PRESIDENCY UNIVERSITY

Private University Estd. in Karnataka State by Act No. 41 of 2013

Itgalpura, Rajankunte, Yelahanka, Bengaluru – 560064

PRESIDENCY SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

Program Regulations and Curriculum

2022-2026

BACHELOR OF TECHNOLOGY (B.Tech.) in MECHANICAL ENGINEERING

based on Choice Based Credit System (CBCS) and outcome Based Education (OBE)

Regulations No.: PU/AC-18.6/MEC15 /MEC /2022-2026

Resolution No. 6 of the 18th Meeting of the Academic Council held on 3rd August 2022, and ratified by the Board of Management in its 19th Meeting held on 4th Aug 2022.

(As amended up to the 26th Academic Council held on 25th July 2025, and ratified by the Board of Management in its 27th Meeting held on 28th July 2025)

AUGUST-2022

Table of Contents

PART A – PROGRAM REGULATIONS

1. Vision & Mission of the University and the School / Department

1.1 Vision of the University

To be a value-driven global university, excelling beyond peers and creating professionals of integrity and character having concern and care for society.

1.2 Mission of the University

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
- Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- To impart globally-applicable skill-sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

1.3 Vision of Presidency School of Engineering

To be a value based, practice-driven School of Engineering and Technology, committed to developing globally-competent Engineers, dedicated to transforming Society.

1.4 Mission of Presidency School of Engineering

- Cultivate a practice-driven environment with a contemporary Learning-pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in Teaching and Research, in the field of Core Engineering.
- Establish state-of-the-art facilities for effective Teaching and Learning-experiences.
- Promote Interdisciplinary Studies to nurture talent and impart relevant skill-sets for global impact.
- Instil Entrepreneurial and Leadership Skills to address Social, Environmental, and Community-needs.

1.5 Vision of Department of Mechanical Engineering

To evolve as a globally recognized Centre of Excellence in mechanical engineering and empowering students to address industrial and societal challenges through innovation, research, and sustainable solutions.

1.6 Mission of Department of Mechanical Engineering

- Impart comprehensive and cutting-edge mechanical engineering education through state-of-the-art laboratory infrastructure, experienced faculty, and an inclusive, dynamic learning environment that fosters technical excellence and innovation.

- Promote research and collaboration with industry and academia to develop practical and sustainable solutions for industrial and societal needs.

- Empower students to become ethical, skilled professionals and responsible global citizens committed to lifelong learning and continuous professional growth.

2. Preamble to the Program Regulations and Curriculum

This is the subset of Academic Regulations and it is to be followed as a requirement for the award of B.Tech degree.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Social Project Based Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations of the University, the Academic Council hereby makes the following Regulations.

3. Short Title and Applicability

a. These Regulations shall be called the Bachelor of Technology Degree Program Regulations and Curriculum 2022-2026.
b. These Regulations are subject to, and pursuant to the Academic Regulations.
c. These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2022-2026 batch, and to all other Bachelor of Technology Degree Programs which may be introduced in future.
d. These Regulations shall supersede all the earlier Bachelor of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.
e. These Regulations shall come into force from the Academic Year 2025-2026.

4. Definitions

In these Regulations, unless the context otherwise requires:

a. "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;
b. "Academic Council" means the Academic Council of the University;
c. "Academic Regulations" means the Academic Regulations, of the University;
d. "Academic Term" means a Semester or Summer Term;
e. "Act" means the Presidency University Act, 2013;
f. "AICTE" means All India Council for Technical Education;
g. "Basket" means a group of courses bundled together based on the nature/type of the course;
h. "BOE" means the Board of Examinations of the University;
i. "BOG" means the Board of Governors of the University;
j. "BOM" means the Board of Management of the University;
k. "BOS" means the Board of Studies of a particular Department/Program of Study of the University;

l. *"CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;*

m. *"Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;*

n. *"COE" means the Controller of Examinations of the University;*

o. *"Course In Charge" means the teacher/faculty member responsible for developing and organising the delivery of the Course;*

p. *"Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;*

q. *"Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;*

r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.*

s. *"DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;*

t. *"Dean" means the Dean / Director of the concerned School;*

u. *"Degree Program" includes all Degree Programs;*

v. *"Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;*

w. *"Discipline" means specialization or branch of B.Tech. Degree Program;*

x. *"HOD" means the Head of the concerned Department;*

y. *"L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;*

z. *"MOOC" means Massive Open Online Courses;*

aa. *"MOU" means the Memorandum of Understanding;*

bb. *"NPTEL" means National Program on Technology Enhanced Learning;*

cc. *"Parent Department" means the department that offers the Degree Program that a student undergoes;*

dd. *"Program Head" means the administrative head of a particular Degree Program/s;*

ee. *"Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2022-2026;*

ff. *"Program" means the Bachelor of Technology (B.Tech.) Degree Program;*

gg. *"PSOE" means the Presidency School of Engineering;*

hh. *"Registrar" means the Registrar of the University;*

ii. *"School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;*

jj. "Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;

kk. "SGPA" means the Semester Grade Point Average as defined in the Academic Regulations;

ll. "Statutes" means the Statutes of Presidency University;

mm. "Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;

nn. "Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;

oo. "SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.

pp. "UGC" means University Grant Commission;

qq. "University" means Presidency University, Bengaluru; and

rr. "Vice Chancellor" means the Vice Chancellor of the University.

5. Program Description

The Bachelor of Technology Degree Program Regulations and Curriculum 2022-2026 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2022-2026 offered by the Presidency School of Engineering (PSOE):

1. Bachelor of Technology in Civil Engineering, abbreviated as B.Tech. (Civil Engineering)
2. Bachelor of Technology in Electronics and Communication Engineering, abbreviated as B.Tech. (Electronics and Communication Engineering)
3. Bachelor of Technology in VLSI, abbreviated as B.Tech. (VLSI)
4. Bachelor of Technology in Electrical and Electronics Engineering, abbreviated as B.Tech. (Electrical and Electronics Engineering)
5. Bachelor of Technology in Mechanical Engineering, abbreviated as B.Tech. (Mechanical Engineering); and
6. Bachelor of Technology in Petroleum Engineering, abbreviated as B.Tech. (Petroleum Engineering)

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations

6. Minimum and Maximum Duration

6.1 Bachelor of Technology Degree Program is a Four-Year, Full-Time Semester based program. The minimum duration of the B.Tech. Program is four (04) years and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the B.Tech. program is eight (08) Semesters.

6.2 A student who for whatever reason is not able to complete the Program within the normal period or the minimum duration (number of years) prescribed for the Program, may be allowed a period of two years beyond the normal period to complete the mandatory minimum credits requirement as prescribed by the concerned Program Regulations and Curriculum. In general, the permissible maximum duration (number of years) for completion of Program is 'N' + 2 years, where 'N' stands for the normal or minimum duration (number of years) for completion of the concerned Program as prescribed by the concerned Program Regulations and Curriculum.

6.3 The time taken by the student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (refer to clause 16.1 of academic regulations) shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and/or treatment, as certified through hospital/medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University/State/India requiring extended time to participate in National/International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer section 19.0 of academic regulations)in the prescribed maximum duration (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7 Program Educational Objectives (PEO)

After four years of successful completion of the program, the graduates shall be to:

PEO1. Demonstrate success as Mechanical Engineer with innovative skills and moral and ethical values.

PEO2. Engage in lifelong learning through research and professional development,

PEO3. Serve as a leader in the profession through consultancy, extension activities or entrepreneurship.

8 Program Outcomes (PO) and Program Specific Outcomes (PSO)

8.1 Program Outcomes (PO)

On successful completion of the Program, the students shall be able to:

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

8.2 Program Specific Outcomes (PSOs):

On successful completion of the Program, the students shall be able to:

PSO1: Employability: Acquire technical and managerial skill that make them an employable graduate.

PSO2: Research: Acquire theoretical background of each course that they are capable of applying it for solving real-time (Physical) problems.

PSO3: Entrepreneurship: Acquire time management, strategic thinking, team work, and network though out their course study and project work enable them to be an entrepreneur.

PSO4: Philanthropist: Get experienced through SIC (Social Immersion Course), social outreach, blood donation and other social activity during their 4 years of stay and enable them to be a philanthropist.

9 Admission Criteria (as per the concerned Statutory Body)

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time**.** The admission criteria to the B.Tech. Program is listed in the following Sub-Clauses:

9.1 An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.

9.2 Provided further, the applicant must have taken Physics and Mathematics as compulsory subjects in the Pre-University / Higher Secondary / (10+2) / (11+1) examination, along with either Chemistry / Biology / Electronics / Computer Science / Biotechnology subject, and, the applicant must have obtained a minimum of 45% of the total marks (40% in case of candidates belonging to the Reserved Category as classified by the Government of Karnataka) in these subjects taken together.

9.3 The applicant must have appeared for Joint Entrance Examinations (JEE) Main / JEE (Advanced) / Karnataka CET / COMED-K, or any other State-level Engineering Entrance Examinations.

9.4 Reservation for the SC / ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.

9.5 Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.

9.6 Candidates must fulfil the medical standards required for admission as prescribed by the University.

9.7 If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.

9.8 The decision of the BOM regarding the admissions is final and binding.

10 Lateral Entry / Transfer Students requirements

10.1 Lateral Entry

The University admits students directly to the second year (3rd Semester) of the B.Tech. Degree program as per the provisions and/or regulations of the Government of Karnataka pertaining to the "Lateral Entry" scheme announced by the Government from time to time. Further, the general conditions and rules governing the provision of Lateral Entry to the B.Tech. Program of the University are listed in the following Sub-Clauses:

10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentage (45%) marks in the final year examination (5th and 6th Semesters of the Diploma Program) in the appropriate branch of Engineering. Provided that, in case of SC / ST and OBC candidates from Karnataka the minimum marks for eligibility shall be forty percent (40%).

10.1.2 Provided further that, candidates seeking Lateral Entry may be required to complete specified bridge Courses as prescribed by the University. Such bridge Courses, if any, shall not be included in the CGPA computations.

10.1.3 All the existing Regulations and Policies of the University shall be binding on all the students admitted to the Program through the provision of Lateral Entry.

10.1.4 The Course requirements prescribed for the 1st Year of the B.Tech. Program shall be waived for the student(s) admitted through Lateral Entry and the duration of the B.Tech. Program for such students is three (03) years, commencing from the 3rd Semester (commencement of the 2nd Year) of the B.Tech. Program and culminating with the 8th Semester (end of the 4th Year) of the B.Tech. Program.

10.1.5 Provided that, if a Lateral Entry student misses any mandatory program specific courses that are typically offered in the 1st year (1st or 2nd semesters), then those courses must be cleared by the students as soon as possible, preferably during the Summer Term.

10.1.6 The existing Program Regulations of the concerned Program to which the student is admitted through the provision of Lateral Entry shall be binding on the student with effect from the 3rd Semester of the Program. i.e., the Program Structure and Curriculum from the 3rd to 8th Semesters of the Program concerned shall be binding on the student admitted through Lateral Entry. Further, any revisions / amendments made to the Program Regulations thereafter, shall be binding on all the students of the concerned Program.

10.1.7 All the Courses (and the corresponding number of Credits) prescribed for the 1st Year of the concerned B.Tech. Program shall be waived for the student(s) admitted to the concerned B.Tech Program through Lateral Entry. Further, the *Minimum Credit Requirements* for the award of the B.Tech. Degree in the concerned Program shall be prescribed / calculated as follows:

The ***Minimum Credit Requirements*** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2022-2026, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Tech. Program.

For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Technology (B.Tech.) Degree as prescribed by the Regulations for B.Tech. (Mechanical Engineering) is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in Mechanical Engineering for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

10.1.8 Further, no other waiver except the Courses prescribed for the 1st year of the B.Tech. Program of the University shall be permissible for students joining the B.Tech. Program through the provision of Lateral Entry.

10.2 Transfer of student(s) from another recognized University to the 2nd year (3rd Semester) of the B.Tech. Program of the University

A student who has completed the 1st Year (i.e., passed in all the Courses / Subjects prescribed for the 1st Year) of the B.Tech. / B.E. / B.S., Four-Year Degree Program from another recognized University, may be permitted to transfer to the 2nd Year

(3rd Semester) of the B.Tech. Program of the University as per the rules and guidelines prescribed in the following Sub-Clauses:

10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 10.1.1, 10.1.2 and 10.1.3.

10.2.2 The student shall submit the Application for Transfer along with a non-refundable Application Fee (as prescribed by the University from time to time) to the University no later than July 10 of the concerned year for admission to the 2nd Year (3rd Semester) B.Tech. Program commencing on August 1 on the year concerned.

10.2.3 The student shall submit copies of the respective Marks Cards / Grade Sheets / Certificates along with the Application for Transfer.

10.2.4 The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the B.Tech. / B.E. / B.S. Four Degree Program from the concerned University, are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor for this purpose. Further, the Equivalence Committee may also prescribe the Courses and Credits the concerned students shall have to mandatorily complete, if admitted to the 2nd Year of the B.Tech. Program of the University.

10.2.5 The Branch / Discipline allotted to the student concerned shall be the decision of the University and binding on the student.

11. Change of Branch / Discipline / Specialization

A student admitted to a particular Branch of the B.Tech. Program will normally continue studying in that Branch till the completion of the program. However, the University reserves the right to provide the option for a change of Branch, or not to provide the option for a change of Branch, at the end of 1st Year of the B.Tech. Program to eligible students in accordance with the following rules and guidelines: framed by the University from time to time.

11.1 Normally, only those students, who have passed all the Courses prescribed for the 1st Year of the B.Tech. Program and obtained a CGPA of not less than 6.50 at the end of the 2nd Semester, shall be eligible for consideration for a change of Branch.

11.2 Change of Branch, if provided, shall be made effective from the commencement of the 3rd Semester of the B.Tech. Program. There shall be no provision for change of Branch thereafter under any circumstances whatsoever.

11.3 The student provided with the change of Branch shall fully adhere to and comply with the Program Regulations of the concerned Branch of the B.Tech. Program, the Fee Policy pertaining to that Branch of the B.Tech. Program, and, all other rules pertaining to the changed Branch existing at the time.

11.4 Change of Branch once made shall be final and binding on the student. No student shall be permitted, under any circumstances, to refuse the change of Branch offered.

11.5 The eligible student may be allowed a change in Branch, strictly in order of *inter se* merit, subject to the conditions given below:

11.5.1 The actual number of students in the 3rd Semester in any particular Branch to which the transfer is to be made, should not exceed the intake fixed by the University for the concerned Branch;

11.5.2 The actual number of students in any Branch from which transfer is being sought does not fall below 75% of the total intake fixed by the University for the concerned Branch.

The process of change of Branch shall be completed within the first five days of Registration for the 3rd Semester of the B.Tech. Program.

12 Specific Regulations regarding Assessment and Evaluation (including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment and End Term Examination for various Course Categories)

12.1 The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

12.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 8.8 of academic regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

12.3 Format of the End-Term examination shall be specified in the Course Plan.

12.4 Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)
- Courses with a class strength less than 30

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (clause 8.10 of academic regulations) shall be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

12.5 Assessment Components and Weightage

Table 1: Assessment Components and Weightage for different category of Courses		
Nature of Course and Structure	**Evaluation Component**	**Weightage**
Lecture-based Course L component in the L-T-P Structure is predominant (more than 1) (Examples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.)	Continuous Assessments	50%
	End Term Examination	50%
Lab/Practice-based Course P component in the L-T-P Structure is predominant (Exam`ples: 0-0-4; 1-0-4; 1-0-2; etc.)	Continuous Assessments	100%
Skill based Courses like Industry Internship, Capstone project, Research Dissertation, Integrative Studio, Interdisciplinary Project, Summer / Short Internship, Social Engagement / Field Projects, Portfolio, and such similar Non-Teaching Credit Courses, where the pedagogy does not lend itself to a typical L-T-P structure	Guidelines for the assessment components for the various types of Courses, with recommended weightages, shall be specified in the concerned Program Regulations and Curriculum / Course Plans, as applicable.	

The exact weightages of Evaluation Components shall be clearly specified in the concerned PRC and respective Course Plan.

Normally, for Practice/Skill based Courses, without a defined credit structure (L–T–P) [NTCC], but with assigned Credits (as defined in clause 5.2 of academic regulations) the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

12.6 Minimum Performance Criteria:

12.6.1 Theory only Course and Lab/Practice Embedded Theory Course

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.

b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

12.6.2 Lab/Practice only Course and Project Based Courses

The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of all assessment components in the concerned Course.

12.6.3 A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per Clause 8.9.1 and 8.9.2 of academic regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

13 Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc. – Note: These are covered in Academic Regulations

The University allows students to acquire credits from other Indian or foreign institutions and/or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

13.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer ANNEXURE B of academic regulations) and approved by the Dean - Academics.

13.2 Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

13.3 Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:

13.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 13.3 (as per academic regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

13.3.2 SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 13.3 (as per academic regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

13.3.3 Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

13.3.4 Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.

13.3.5 A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 13.3.2 above.

13.3.6 SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.

13.3.7 A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall forwarded to the COE for processing of results of the concerned Academic Term.

13.3.8 The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8.11 in the academic regulations.

Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses

Sl. No.	Course Duration	Credit Equivalence
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

13.3.9 The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree.

13.3.10 The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

13.4 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (13.0), shall not be included in the calculation of the CGPA.

PART B– PROGRAM STRUCTURE

14. Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements

The B.Tech. (Mechanical Engineering) Program Structure (2022-2026) totaling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: Summary of Minimum Credit Contribution from various Baskets

Baskets	Credit Contribution
SCHOOL CORE	58
PROGRAM CORE	60
DISCIPLINE ELECTIVE	30
OPEN ELECTIVE	12
TOTAL CREDITS	**160**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 62% out of the total credits of 160 for B.Tech. (Mechanical Engineering) program of four years' duration.

A student will have to complete a minimum of 15 credits of Discipline Electives from a given specialization basket, to earn a specialization certificate in addition to the base degree to which he/she has taken admission.

<table>
<tr><th rowspan="2">Minor Group</th><th colspan="2">Minimum Credits from each minorgroup for various programs</th></tr>
<tr><th>MECHANICAL(MEC)</th><th>MECHATRONICS(MCM)</th></tr>
<tr><td>General</td><td>15</td><td rowspan="5">15</td></tr>
<tr><td>Additive Manufacturing</td><td rowspan="5">15</td></tr>
<tr><td>Thermal and Fluids Engineering</td></tr>
<tr><td>Manufacturing Technology Basket</td></tr>
<tr><td>Mechanical Engineering Design</td></tr>
<tr><td>Mechatronics Basket</td><td>15</td></tr>
<tr><td>Total credits to be earned in discipline elective basket</td><td>30</td><td>30</td></tr>
</table>

15. Minimum Total Credit Requirements of Award of Degree

As per the AICTE guidelines, a minimum of 160 credits is required for the award of a B.Tech. degree.

16. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies,

16.1 The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University.

16.2 A student shall be declared to be eligible for the award of the concerned Degree if she/he:

a. Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

b. Secure a minimum CGPA of 4.50 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-Clause 19.2.1 of Academic Regulations;

c. No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and

d. No disciplinary action is pending against her/him.

PART C – CURRICULUM STRUCTURE

17. Curriculum Structure – Basket Wise Course List

Table 3.1: List of School Core Courses						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	MAT1001	Calculus and Linear Algebra	3	0	2	4
2	MAT1002	Transform Techniques, Partial Differential Equations and their Applications	3	0	0	3
3	MAT1003	Applied Statistics	1	0	2	2
4	MAT2003	Numerical Methods for Engineers	1	0	2	2
5	CSE1001	Problem Solving using JAVA	2	0	2	3
6	CSE2001	Data Structures and Algorithms	3	0	2	4
7	CIV1008	Basic Engineering Sciences	2	0	0	2
8	MEC1006	Engineering Graphics	2	0	0	2
9	CSE1002	Innovation Project - Arduino using Embedded C	0	0	4	2
10	PIP2001	Capstone Project	-	-	-	4
11	PIP4005	Internship	-	-	-	5
12	EEE1001	Fundamentals of Electrical and Electronics Engineering	3	0	2	4
13	PHY1001	Material Physics	2	0	2	3
14	ENG1001 / ENG1002	Fundamental English / Technical English	1	0	2	2
15	ENG1002 / ENG2001	Technical English / Advanced English	1	0	2	2
16	KAN1001 / KAN2001	Kali Kannada / Thili Kannada	1	0	0	1
17	PPS1001	Introduction to Soft Skills	0	0	2	1
18	PPS1002	Soft Skills for Engineers	0	0	2	1

19	PPS4002	Introduction to Aptitude	0	0	2	1
20	CSE1005	Programming in Python	1	0	4	3
21	ECE2011	Innovative Projects Using Raspberry Pi	-	-	-	1
22	CHE1018	Environmental Science	1	0	2	0
23	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1
24	PPS4004	Aptitude Training Intermediate	0	0	2	1
25	CSE3217	Data Structure and Web Development with Python	0	0	2	1
26	PPS4005	Aptitude for Employability	0	0	2	1
27	PPS4006	Logical and Critical Thinking	0	0	2	1
28	PPS3018	Preparedness for Interview	0	0	2	1
					Total No. of Credits	**58**

Table 3.2: List of Program Core Courses

S.No	Course Code	Course Name	L	T	P	C
1	MEC1004	Elements of Mechanical Engineering	1	0	2	2
2	MEC2033	Computer Aided Engineering Drawing	1	0	4	3
3	MEC2010	Fluid Mechanics	2	0	2	3
4	MEC3089	Heat and Mass Transfer	2	0	2	3
5	MEC2011	Mechanics of Solids	3	0	0	3
6	MEC3090	Design of Machine Elements I	3	0	0	3
7	MEC3088	Production Techniques I	2	0	2	3
8	MEC3087	IC Engine and Fuels	2	0	0	2
9	CHE1017	Applied Chemistry	1	0	2	2
10	MEC2015	Metrology and Mechanical Measurements	2	0	2	3
11	MEC2016	Material Science and Metallurgy	2	0	2	3
12	MEC2017	Computer Aided Machine Drawing	0	0	4	2
13	MEC3006	Mechatronics	2	0	2	3
14	MEC3032	Energy Conversion Lab	0	0	2	1
15	MEC3091	Finite Element Analysis	2	0	2	3
16	MEC4005	Production Techniques II	2	0	2	3
17	MEC4003	Applied Thermodynamics	3	0	0	3
18	MEC3068	Production and Operations Management	3	0	0	3
19	MEC3086	Design of Machine Elements II	3	0	0	3
20	MEC4002	Kinematics of Machines	3	0	0	3
21	MEC4001	Basic Thermodynamics	3	0	0	3
22	MEC4008	Mechanisms, Machines and Design Lab	0	0	2	1
23	MEC3085	Dynamics of Machines	2	0	0	2
					Total No. of Credits	**60**

18. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations, 2021, are simply assigned the number of Credits based on the quantum of work / effort required to fulfill the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip B.Tech. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations). The same shall be prescribed in the Course Handout.

18.1 Internship

A student may undergo an Internship for a period of 4-6 weeks in an industry / company or academic / research institution during the Semester Break between 4^{th} and 5^{th} Semesters or 6^{th} and 7^{th} Semesters. Alternatively, he/she may complete a 12- to 14-week internship during a full semester (7th or 8th semester) subject to the following conditions:

18.1.1 The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

18.1.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

18.1.3 The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 18.1.2 above.

18.1.4 A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

18.1.5 A student selected for an Internship in an industry / company or academic

/ research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

18.2 Project Work

A student may opt to do a Project Work for a period of 4-6 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Internship during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters or during the 5th / 6th / 7th Semester as applicable, subject to the following conditions:

18.2.1 The Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

18.2.2 The student may do the project work in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18..2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

18.3 Capstone Project

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 7th / 8th Semester as applicable, subject to the following conditions:

18.3.1 The Capstone Project shall be in conducted in accordance with the Capstone Project Policy prescribed by the University from time to time.

18.3.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

18.3.3 The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 18.3.2 above.

18.3.4 A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the I Capstone Project on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and Capstone project Policy of the University.

18.3.5 A student selected for a Capstone Project in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Capstone Project Policy of the University.

18.4 Research Project / Dissertation

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project, subject to the following conditions:

18.4.1 The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

19. List of Discipline Electives Courses: Minimum Credits to be earned from this basket is 30 Credits

Sl. No.	Course Code	Course Name	L	T	P	C	Type of Skill / Focus	Course Caters to	Pre-requisites / Co-requisites	Anti-requisites	Future Courses that need this as a Pre-requisite
General Basket											
1	MEC2018	Value Engineering	3	0	0	3	EM	ES	-	-	-
2	MEC3008	Design and Analysis of Experiments	3	0	0	3	EM	-	-	-	-
3	MEC3009	Nanotechnology	3	0	0	3	EM	ES	-	-	-
4	MEC3011	Battery and Fuel Cell Technology	3	0	0	3	EM	-	-	-	-
5	MEC3012	Material and Characterization Techniques	3	0	0	3	EM	-	-	-	-
6	MEC3013	Soft Computing Techniques	3	0	0	3	EM	-	MAT1001 MAT1002	-	-
7	MEC3014	Smart Materials	3	0	0	3	EM	-	-	-	-
8	MEC3015	Reliability Engineering	3	0	0	3	EM	-	-	-	-
9	MEC4010	Product Life Cycle Management	2	0	2	3	EM	-	-	-	-
10	MEC3016	Statistics and Quality Control	3	0	0	3	EM	-	-	-	-
11	MEC3095	Advanced Fluid Mechanics	3	0	0	3	EM	-	MEC2010	-	-
12	MEC3081	Quality, Testing and Inspection	3	0	0	3	EM	-	-	-	-
13	MEC3079	Design of Experiments	3	0	0	3	EM	-	-	-	-
14	MEC3097	Plumbing Design	3	0	0	3	EM	-	-	-	-
15	MEC3080	Fundamentals of Plastic Injection Moulding	3	0	0	3	EM	-	-	-	-
16	MEC3077	Flight Mechanics	3	0	0	3	EM	-	-	-	-

Additive Manufacturing Basket										
1	MEC3017	CAD for Additive Manufacturing	3	0	0	3	EM	ES/HP	-	-	-
2	MEC3018	Additive Manufacturing in Medical Applications	3	0	0	3	EM	ES	-	-	-
3	MEC3019	Additive Manufacturing and ItsApplications	3	0	0	3	EM	-	-	-	-
4	MEC3020	Additive Manufacturing Machines and Systems	3	0	0	3	EM	ES	-	-	-
5	MEC3021	Intelligent Machining & Manufacturing	3	0	0	3	EM	-	-	-	-
6	MEC3022	Rapid Prototyping Laboratory	0	0	2	1	EM	-	-	-	-
7	MEC3023	Rapid Tooling and Industrial Applications	3	0	0	3	EM	-	-	-	-
8	MEC3024	Reverse Engineering and Computer Aided Inspection	3	0	0	3	EM	-	-	-	-
9	MEC3002	Introduction To Additive Manufacturing& Its Application	3	0	0	3	EM	-	-	-	-
Thermal and Fluids Engineering Basket										
1	MEC3025	Power Plant Engineering	3	0	0	3	EM	-	MEC4001	-	-
2	MEC3026	Turbomachinery	3	0	0	3	EM	-	MEC2011 MEC4001	-	-
3	MEC3028	Compressible Fluid Flow	3	0	0	3	EM	-	MEC2010	-	-
4	MEC3010	Automotive Engineering	3	0	0	3	EM	-	-	-	-
5	MEC3029	Advanced Heat Transfer	3	0	0	3	EM	-	MEC3089	-	-
6	MEC3030	IC Engines	2	0	2	3	EM	-	-	-	-
7	MEC3031	Computational Fluid Dynamics and Lab	2	0	2	3	EM	-	MEC2010	-	-
8	MEC3033	Alternate fuels	3	0	0	3	EM	ES	-	-	-

9	MEC3027	Refrigeration and Air conditioning(HVAC)	3	0	0	3	EM	-	MEC4001	-	-
10	MEC3082	Elements of Solar Energy Conversion	3	0	0	3	EM	-	-	-	-
11	MEC3095	Advanced Fluid Mechanics	3	0	0	3	EM	-	-	-	-
12	MEC3096	Product Design in RAC	3	0	0	3	EM	-	-	-	-
Manufacturing Technology Basket											
1	MEC3034	Computer Integrated Manufacturing	3	0	0	3	EM	-	-	-	-
2	MEC3035	Production Planning and Control	3	0	0	3	EM	-	-	-	-
3	MEC3036	Flexible Manufacturing Systems	3	0	0	3	EM	-	-	-	-
4	MEC3037	Industrial Engineering Techniques	3	0	0	3	EM	-	-	-	-
5	MEC3038	Smart Manufacturing	3	0	0	3	EM	-	-	-	-
6	MEC3039	Non-Destructive Testing	3	0	0	3	EM	-	-	-	-
7	MEC3040	Modern Manufacturing Processes	3	0	0	3	EM	-	-	-	-
8	MEC3041	CAD/CAM Laboratory	0	0	2	1	EM	-	MEC1006	-	-
9	MEC3042	Powder Metallurgy	3	0	0	3	EM	ES	-	-	-
10	MEC3043	Lasers in Manufacturing Technology	3	0	0	3	EM	ES	-	-	-
11	MEC3044	Modelling and Simulation of Manufacturing Systems	3	0	0	3	EM	-	-	-	-
12	MEC3045	Polymer Engineering	3	0	0	3	EM	ES/HP	-	-	-
13	MEC3046	Micro and Nano Manufacturing	3	0	0	3	EM	ES	-	-	-
14	MEC3047	Metal Forming Simulation	3	0	0	3	EM	-	-	-	-

15	MEC3081	Quality, Testing and Inspection	3	0	0	3	EM	-	-		
16	MEC3080	Fundamentals of Plastic Injection Moulding	3	0	0	3	EM	-	-	-	-
17	MEC3440	Fixed Equipment in Oil and Gas Industry	3	0	0	3	EM	-	-	-	-
18	MEC3441	Reliability and Maintenance in Oil and Gas Industry	3	0	0	3	EM	-	-	-	-
Mechanical Engineering Design Basket											
1	MEC3048	Tribology and Bearing Design	3	0	0	3	EM	-	-	-	-
2	MEC3049	Mechanics of Composite Materials	3	0	0	3	EM	-	-	-	-
3	MEC3050	Experimental Stress Analysis	3	0	0	3	EM	-	MEC2011	-	-
4	MEC3051	Fracture Mechanics	3	0	0	3	EM	-	MEC2011	-	-
5	MEC3052	Machine Tool Design	3	0	0	3	EM	-	-	-	-
6	MEC3053	Theory of Elasticity	3	0	0	3	EM	-	MEC2011	-	-
7	MEC3054	Theory of Plasticity	3	0	0	3	EM	-	-	-	-
8	MEC3055	Product Design for Manufacturing and Assembly	3	0	0	3	EM	ES/HP	-	-	-
9	MEC3056	Product Design and Development	3	0	0	3	EM	-	-	-	-
10	MEC3057	Integrated Product Design and Development	3	0	0	3	EM	-	-	-	-
11	MEC3058	Vehicle dynamics	3	0	0	3	EM	-	-	-	-
12	MEC3075	Automotive Body Design	3	0	0	3	EM	-	-	-	-
13	MEC3097	Plumbing Design	3	0	0	3	EM	-	-	-	-
14	MEC3077	Flight Mechanics	3	0	0	3	EM	-	-	-	-
15	MEC3079	Design of Experiments	3	0	0	3	EM	-	-	-	-
16	MEC3059	Engineering Dynamics	3	0	0	3	EM	-	MEC2011	-	-

17	MEC3007	Mechanical Vibrations & Design	2	0	2	3	EM	-	MEC2011	-	-
Mechatronics Basket											
1	MEC3060	Robotics	3	0	0	3	EM	-	-	-	-
2	MEC3061	Robotics and Automation Lab	0	0	2	1	EM	-	-	-	-
3	MEC3062	Hydraulics and Pneumatics	3	0	0	3	EM	-	-	-	-
4	MEC3063	Control Engineering	3	0	0	3	EM	-	-	-	-
5	MEC3064	Manufacturing Control and Automation	3	0	0	3	EM	-	-	-	-
6	MEC3065	Introduction to Robotics and Automation	3	0	0	3	EM	-	-	-	-
7	MEC3066	Python for Automation	2	0	2	3	EM	-	-	-	-
8	MEC3067	Engineering Instruments and Measurements	3	0	0	3	EM	-	-	-	-
9	MEC3099	Autonomous Mobile Robots	3	0	0	3	EM	-	_	-	-
10	MEC3076	Human Robot Interaction	3	0	0	3	EM	-	-	-	-

20. List of Open Electives Courses: Minimum Credits to be earned from this basket is 12 Credits

Sl. No.	Course Code	Course Name	L	T	P	Credits	Type of Skill / Focus	Course Caters to	Prerequisites/ Corequisites	Anti requisites	Future Courses in that need this Course as Prerequisite
OPEN ELECTIVE											
Chemistry Basket											
1	CHE1003	Fundamentals of Sensors	3	0	0	3	S	ES	-	-	-
2	CHE1004	Smart materials for IOT	3	0	0	3	S	ES	-	-	-
3	CHE1005	Computational Chemistry	2	0	0	2	S	ES	-	-	-
4	CHE1006	Introduction to Nano technology	3	0	0	3	S	ES	-	-	-
5	CHE1007	Biodegradable electronics	2	0	0	2	S	ES	-	-	-
6	CHE1008	Energy and Sustainability	2	0	0	2	S	ES	-	-	-
7	CHE1009	3D printing with Polymers	2	0	0	2	S	ES	-	-	-
8	CHE1010	Bioinformatics and Healthcare IT	2	0	0	2	S	ES	-	-	-
9	CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	S	ES	-	-	-
10	CHE1012	Introduction to Composite materials	2	0	0	2	S	ES	-	-	-
11	CHE1013	Chemistry for Engineers	3	0	0	3	S	ES	-	-	-
12	CHE1014	Surface and Coatings technology	3	0	0	3	S	ES	-	-	-
13	CHE1015	Waste to Fuels	2	0	0	2	S	ES	-	-	-
14	CHE1016	Forensic Science	3	0	0	3	S	ES	-	-	-
Civil Engineering Basket											
1	CIV1001	Disaster mitigation and management	3	0	0	3	S	ES / HP	-	-	-
2	CIV1002	Environment Science and Disaster Management	3	0	0	3	F	ES	-	-	-

3	CIV2001	Sustainablility Concepts in Engineering	3	0	0	3	S	ES	-	-	-
4	CIV2002	Occupational Health and Safety	3	0	0	3	S		-	-	-
5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	ES	-	-	-
6	CIV2004	Integrated Project Management	3	0	0	3	EN	HP/ GS	-	-	-
7	CIV2005	Enviornmental Impact Assessment	3	0	0	3	EN	ES	-	-	-
8	CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	ES	-	-	-
9	CIV2044	Geospatial Applications for Engineers	2	0	2	3	EM	ES	-	-	-
10	CIV2045	Environmental Meteorology	3	0	0	3	S	ES	-	-	-
11	CIV3046	Project Problem Based Learning	3	0	0	3	S	ES	-	-	-
12	CIV3059	Sustainability for Professional Practice	3	0	0	3	S	ES	-	-	-
Commerce Basket											
1	COM2001	Introduction to Human Resource Management	2	0	0	2	F	HP/ GS	-	-	-
2	COM2002	Finance for Non Finance	2	0	0	2	S	-	-	-	-
3	COM2003	Contemporay Management	2	0	0	2	F	-	-	-	-
4	COM2004	Introduction to Banking	2	0	0	2	F	-	-	-	-
5	COM2005	Introduction to Insurance	2	0	0	2	F	-	-	-	-
6	COM2006	Fundamentals of Management	2	0	0	2	F	-	-	-	-
7	COM2007	Basics of Accounting	3	0	0	3	F	-	-	-	-
Computer Science Basket											
1	CSE2002	Programming in Java	2	0	2	3	S/E M	-	-	-	-
2	CSE2003	Social Network Analytics	3	0	0	3	S	GS	-	-	-
3	CSE2004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
4	CSE2005	Web design	2	0	2	3	S/	-	-	-	-

		fundamentals					EM/ EN				
5	CSE3111	Artificial Intelligence : Search Methods For Problem Solving	3	0	0	3	S/ EM/ EN	-	-	-	-
6	CSE3112	Privacy And Security In Online Social Media	3	0	0	3	S/ EM/ EN	-	-	-	-
7	CSE3113	Computational Complexity	3	0	0	3	S/ EM/ EN	-	-	-	-
8	CSE3114	Deep Learning for Computer Vision	3	0	0	3	S/ EM/ EN	-	-	-	-
9	CSE3115	Learning Analytics Tools	3	0	0	3	S/ EM/ EN	-	-	-	-
Design Basket												
1	DES1001	Sketching and Painting	0	0	2	1	S	-	-	-	-
2	DES1002	Innovation and Creativity	2	0	0	2	F	-	-	-	-
3	DES1121	Introduction to UX design	1	0	2	2	S	-	-	-	-
4	DES1122	Introduction to Jewellery Making	1	0	2	2	S	-	-	-	-
5	DES1124	Spatial Stories	1	0	2	2	S	-	-	-	-
6	DES1125	Polymer Clay	1	0	2	2	S	-	-	-	-
7	DES2001	Design Thinking	3	0	0	3	S	-	-	-	-
8	DES1003	Servicability of Fashion Products	1	0	2	2	F	ES	-	-	-
9	DES1004	Choices in Virtual Fashion	1	0	2	2	F	ES, GS, HP	-	-	-
10	DES1005	Fashion Lifestyle and Product Diversity	1	0	2	2	F	ES, GS, HP	-	-	-
11	DES1006	Colour in Everyday Life	1	0	2	2	F	ES	-	-	-
12	DES2080	Art of Design Language	3	0	0	3	S	-	-	-	-
13	DES2081	Brand Building in Design	3	0	0	3	S	-	-	-	-
14	DES2085	Web Design Techniques	3	0	0	3	S	-	-	-	-
15	DES2089	3D Modeling for Professionals	1	0	4	3	S	-	-	-	-
16	DES2090	Creative Thinking for Professionals	3	0	0	3	S	-	-	-	-

17	DES2091	Idea Formulation	3	0	0	3	S	-	-	-	-
Electrical and Electronics Engineering Basket												
1	EEE1002	IoT based Smart Building Technology	3	0	0	3	S	-	-	-	-
2	EEE1003	Basic Circuit Analysis	3	0	0	3	S	-	-	-	-
3	EEE1004	Fundamentals of Industrial Automation	3	0	0	3	S	-	-	-	-
4	EEE1005	Electric Vehicles & Battery Technology	3	0	0	3	S	-	-	-	-
5	EEE1006	Smart Sensors for Engineering Applications	3	0	0	3	S	-	-	-	-
Electronics and Communication Engineering Basket												
1	ECE1003	Fundamentals of Electronics	3	0	0	3	F	-	-	-	-
2	ECE1004	Microprocessor based systems	3	0	0	3	F	-	-	-	-
3	ECE1005	Journey of Communication Systems	3	0	0	3	F	-	-	-	-
4	ECE3089	Artificial Neural Networks	3	0	0	3	S	-	-	-	-
5	ECE3090	Digital System Design using VERILOG	3	0	0	3	F/EM	-	-	-	-
6	ECE3091	Mathematical Physics	3	0	0	3	F	-	-	-	-
7	ECE3092	Photonic Integrated Circuits	3	0	0	3	F	-	-	-	-
8	ECE3093	Machine learning for Music Information Retrieval	3	0	0	3	F/EM	-	-	-	-
9	ECE3094	Video Processing and Computer Vision	3	0	0	3	F/EM	-	-	-	-
10	ECE3095	Blockchain and Cryptocurrency Technologies	3	0	0	3	S / EM / EN	-	-	-	-
11	ECE3096	Natural Language Processing	3	0	0	3	F/ EM / EN	-	-	-	-
12	ECE3097	Smart Electronics in Agriculture	3	0	0	3	F/EM	-	-	-	-
13	ECE3098	Environment Monitoring Systems	3	0	0	3	F/EM	-	-	-	-
14	ECE3099	Modern Wireless Communication	3	0	0	3	F/ EM /	-	-	-	-

		with 5G					EN				
15	ECE3100	Underwater Communication	3	0	0	3	F/ EM / EN	-	-	-	-
16	ECE3101	Printed Circuit Board Design	3	0	0	3	S/F/ EM	-	-	-	-
17	ECE3102	Consumer Electronics	3	0	0	3	F/EM	-	-	-	-
18	ECE3103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN	-	-	-	-
19	ECE3104	Vehicle to Vehicle Communication	3	0	0	3	F/ EM / EN	-	-	-	-
20	ECE3105	Wavelets and Filter Banks	3	0	0	3	F/EM	-	-	-	-
21	ECE3106	Introduction to Data Analytics	3	0	0	3	F/EM	-	-	-	-
22	ECE3107	Machine Vision for Robotics	3	0	0	3	F/EM	-	-	-	-
English Basket											
1	ENG1008	Indian Literature	2	0	0	2	-	GS/ HP	-	-	-
2	ENG1009	Reading Advertisement	3	0	0	3	S	-	-	-	-
3	ENG1010	Verbal Aptitude for Placement	2	0	2	3	S	-	-	-	-
4	ENG1011	English for Career Development	3	0	0	3	S	-	-	-	-
5	ENG1012	Gender and Society in India	2	0	0	2	-	GS/ HP	-	-	-
6	ENG1013	Indian English Drama	3	0	0	3	-	-	-	-	-
7	ENG1014	Logic and Art of Negotiation	2	0	2	3	-	-	-	-	-
8	ENG1015	Professional Commuication Skills for Engineers	1	0	0	1	-	-	-	-	-
Fitness and Wellness Basket											
1	DSA2001	Spirituality for Health	2	0	0	2	F	HP	-	-	-
2	DSA2002	Yoga for Health	2	0	0	2	S	HP	-	-	-
3	DSA2003	Stress Management and Well Being	2	0	0	2	F	-	-	-	-
Kannada Basket											
1	KAN1003	Kannada Kaipidi	3	0	0	3	S	-	-	-	-
2	KAN2003	Pradharshana Kale	1	0	2	2	S	-	-	-	-
3	KAN2004	Sahithya	2	0	0	2	S	-	-	-	-

		Vimarshe									
4	KAN2005	Anuvadha Kala Sahithya	3	0	0	3	S	-	-	-	-
5	KAN2006	Vichara Manthana	3	0	0	3	S	-	-	-	-
6	KAN2007	Katha Sahithya Sampada	3	0	0	3	S	-	-	-	-
7	KAN2008	Ranga Pradarshana Kala	3	0	0	3	S	-	-	-	-
Foreign Language Basket											
1	FRL1004	Introduction of French Language	2	0	0	2	S	-	-	-	-
2	FRL1005	Fundamentals of French	2	0	0	2	S	-	-	-	-
3	FRL1009	Mandarin Chinese for Beginners	3	0	0	3	S	-	-	-	-
Law Basket											
1	LAW1001	Introduction to Sociology	2	0	0	2	F	HP	-	-	-
2	LAW2001	Indian Heritage and Culture	2	0	0	2	F	HP/ GS	-	-	-
3	LAW2002	Introdcution to Law of Succession	2	0	0	2	F	HP/ GS	-	-	-
4	LAW2003	Introduction to Company Law	2	0	0	2	F	HP	-	-	-
5	LAW2004	Introduction to Contracts	2	0	0	2	F	HP	-	-	-
6	LAW2005	Introduction to Copy Rights Law	2	0	0	2	F	HP	-	-	-
7	LAW2006	Introduction to Criminal Law	2	0	0	2	F	HP	-	-	-
8	LAW2007	Introduction to Insurance Law	2	0	0	2	F	HP	-	-	-
9	LAW2008	Introduction to Labour Law	2	0	0	2	F	HP	-	-	-
10	LAW2009	Introduction to Law of Marriages	2	0	0	2	F	HP/ GS	-	-	-
11	LAW2010	Introduction to Patent Law	2	0	0	2	F	HP	-	-	-
12	LAW2011	Introduction to Personal Income Tax	2	0	0	2	F	HP	-	-	-
13	LAW2012	Introduction to Real Estate Law	2	0	0	2	F	HP	-	-	-
14	LAW2013	Introduction to Trademark Law	2	0	0	2	F	HP	-	-	-
15	LAW2014	Introduction to Competition Law	3	0	0	3	F	HP	-	-	-
16	LAW2015	Cyber Law	3	0	0	3	F	HP	-	-	-
17	LAW2016	Law on Sexual Harrassment	2	0	0	2	F	HP/ GS	-	-	-
18	LAW2017	Media Laws and	2	0	0	2	F	HP/	-	-	-

		Ethics						GS				
Mathematics Basket												
1	MAT2008	Mathematical Reasoning	3	0	0	3	S	-	-	-	-	
2	MAT2014	Advanced Business Mathematics	3	0	0	3	S	-	-	-	-	
3	MAT2041	Functions of Complex Variables	3	0	0	3	S	-	-	-	-	
4	MAT2042	Probability and Random Processes	3	0	0	3	S	-	-	-	-	
5	MAT2043	Elements of Number Theory	3	0	0	3	S	-	-	-	-	
6	MAT2044	Mathematical Modelling and Applications	3	0	0	3	S	-	-	-	-	
7	MAT2029	Optimization technique	3	0	0	3	S	-	-	-	-	
Mechanical Engineering Basket												
1	MEC1001	Fundamentals of Automobile Engineering	3	0	0	3	F	-	-	-	-	
2	MEC1002	Introduction to Matlab and Simulink	3	0	0	3	S/EM	-	-	-	-	
3	MEC1003	Engineering Drawing	1	0	4	3	S	-	-	-	-	
4	MEC2001	Renewable Energy Systems	3	0	0	3	F	ES	-	-	-	
5	MEC2002	Operations Research & Management	3	0	0	3	F	-	-	-	-	
6	MEC2003	Supply Chain Management	3	0	0	3	S/ EM/ EN	-	-	-	-	
7	MEC2004	Six Sigma for Professionals	3	0	0	3	S/EM	-	-	-	-	
8	MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-	
9	MEC2006	Safety Engineering	3	0	0	3	S/EM	ES	-	-	-	
10	MEC2007	Additive Manufacturing	3	0	0	3	F/EM		-	-	-	
11	MEC3069	Engineering Optimisation	3	0	0	3	S/EM		MAT1001 MAT1002			
12	MEC3070	Electronics Waste Management	3	0	0	3	F/S	ES	-	-	-	
13	MEC3071	Hybrid Electric Vehicle Design	3	0	0	3	S/EM	ES	-	-	-	
14	MEC3072	Thermal	3	0	0	3	S/E					

		Management of Electronic Appliances					M	-	-	-	-
15	MEC3200	Sustainable Technologies and Practices	3	0	0	3	S/EM	-	-	-	-
16	MEC3201	Industry 4.0	3	0	0	3	S/EM	-	-	-	-
Petroleum Engineering Basket											
1	PET1005	Geology for Engineers	2	0	0	2	S		-	-	-
2	PET1006	Overview of Energy Industry	2	0	0	2	S	ES / HP	-	-	-
3	PET1007	Introduction to Energy Trading and Future Options	2	0	0	2	S	ES / HP	-	-	-
4	PET1008	Sustainable Energy Management	2	0	0	2	S	ES / HP	-	-	-
5	PET2026	Introduction to Computational Fluids Dynamics	3	0	0	3	S	HP	-	-	-
6	PET2028	Polymer Science and Technology	3	0	0	3	E	ES / HP	-	-	-
7	PET2031	Overview of Material Science	3	0	0	3	E	ES / HP	-	-	-
8	PET2032	Petroleum Economics	3	0	0	3	E	HP	-	-	-
Physics Basket											
1	PHY1003	Mechanics and Physics of Materials	3	0	0	3	F/S	-	-	-	-
2	PHY1004	Astronomy	3	0	0	3	F	-	-	-	-
3	PHY1005	Game Physics	2	0	2	3	F/S	-	-	-	-
4	PHY1006	Statistical Mechanics	2	0	0	2	F	-	-	-	-
5	PHY1007	Physics of Nanomaterials	3	0	0	3	F	-	-	-	-
6	PHY1008	Adventures in nanoworld	2	0	0	2	F		-	-	-
7	PHY2001	Medical Physics	2	0	0	2	F	ES	-	-	-
8	PHY2002	Sensor Physics	1	0	2	2	F/S		-	-	-
9	PHY2003	Computational Physics	1	0	2	2	F		-	-	-
10	PHY2004	Laser Physics	3	0	0	3	F	ES	-	-	-
11	PHY2005	Science and Technology of Energy	3	0	0	3	F	ES	-	-	-
12	PHY2009	Essentials of Physics	2	0	0	2			-	-	-
Management Basket											
1	MGT1001	Introduction to	3	0	0	3	F	HP	-	-	-

		Psychology									
2	MGT1002	Business Intelligence	3	0	0	3	EN		-	-	-
3	MGT1003	NGO Management	3	0	0	3	S		-	-	-
4	MGT1004	Essentials of Leadership	3	0	0	3	EM/ EN	GS/ HP	-	-	-
5	MGT1005	Cross Cultural Communication	3	0	0	3	S/E M/ EN	HP	-	-	-
6	MGT2001	Business Analytics	3	0	0	3	S/ EM/ EN		-	-	-
7	MGT2002	Organizational Behaviour	3	0	0	3	F	HP	-	-	-
8	MGT2003	Competitive Intelligence	3	0	0	3	S		-	-	-
9	MGT2004	Development of Enterprises	3	0	0	3	S/E M/E N		-	-	-
10	MGT2005	Economics and Cost Estimation	3	0	0	3	S/E M		-	-	-
11	MGT2006	Decision Making Under Uncertainty	3	0	0	3	S		-	-	-
12	MGT2007	Digital Entrepreneurship	3	0	0	3	S/E M/E N		-	-	-
13	MGT2008	Econometrics for Managers	3	0	0	3	S		-	-	-
14	MGT2009	Management Consulting	3	0	0	3	S/E M/E N		-	-	-
15	MGT2010	Managing People and Performance	3	0	0	3	S/E M/E N	HP/ GS	-	-	-
16	MGT2011	Personal Finance	3	0	0	3	F	-	-	-	-
17	MGT2012	E Business for Management	3	0	0	3	S/E M	-	-	-	-
18	MGT2013	Project Management	3	0	0	3	EN / EM	GS/ HP/E S	-	-	-
19	MGT2014	Project Finance	3	0	0	3	EN / EM	HP			
20	MGT2015	Engineering Economics	3	0	0	3	S	-	-	-	-
21	MGT2016	Business of Entertainment	3	0	0	3	EM/ EN	-	-	-	-
22	MGT2017	Principles of Management	3	0	0	3	S/E M/ EN	-	-	-	-
23	MGT2018	Professional and Business Ethics	3	0	0	3	S/E M/ EN	HP	-	-	-
24	MGT2019	Sales Techniques	3	0	0	3	S/E M/	HP	-	-	-

							EN				
25	MGT2020	Marketing for Engineers	3	0	0	3	S/EM/EN	HP	-	-	-
26	MGT2021	Finance for Engineers	3	0	0	3	S/EM/EN	HP	-	-	-
27	MGT2022	Customer Relationship Management	3	0	0	3	S/EM/EN	HP	-	-	-
28	MGT2023	People Management	3	0	0	3	S/EM/EN	HP	-	-	-
Media Studies Basket											
1	BAJ3050	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP	-	-	-
2	BAJ3051	Digital Photography	2	0	2	3	EM	HP	-	-	-
3	BAJ3055	Introduction to New Anchoring and News Management	0	0	2	1		-	-	-	-
Research URE Basket											
1	URE2001	University Research Experience	-	0	-	3	S/EM/EN	-	-	-	-
2	URE2002	University Research Experience	-	0	-	0	S/EM/EN	-	-	-	-

21.List of MOOC (NPTEL) Courses

21.1 NPTEL - Discipline Elective Courses for B. Tech. (Mechanical Engineering)

Sl. No.	Course ID	Course Name	Duration
1	noc25-ge54	Sustainable Power Generation Systems	12 Weeks
2	noc25-me162	Microfluidics and Nanofluidics	12 Weeks
3	noc25-me167	Energy Conservation and Waste Heat Recovery	12 Weeks
4	noc25-me177	Microrobotics	12 Weeks
5	noc25-me180	Design of Precision Machines	12 Weeks
6	MEC3442	Fundamentals of Additive Manufacturing Technologies	12 Weeks
7	MEC3443	Electric Vehicles	12 Weeks

21.2 NPTEL - Open Elective Courses for B. Tech. (Mechanical Engineering)

Sl. No.	Course ID	Course Name	Duration
1	MEC3444	Engineering Aspects of Biofuels and Biomass Conversion Technologies	12 Weeks
2	noc25-me110	Explosions and Safety	12 Weeks
3	noc25-me125	Rapid Manufacturing	12 Weeks
4	noc25-me133	Compliant Mechanisms: Principles and Design	12 Weeks
5	noc25-me142	Mathematical Modeling of Manufacturing Processes	12 Weeks

22. Semester Wise Course Tables/ Grids:

Semester 1										
S. NO.	COURSE CODE	BASKET	COURSE NAME	CREDIT STRUCTURE					TYPE OF SKILL	COURSE ADDRESSESTO
				L	T	P	C	CONTACTHOURS		
1	MAT1001	SC	Calculus and Linear Algebra	3	0	2	4	5	F	-
2	PHY1001	SC	Material Physics	2	0	2	3	4	F	-
3	EEE1001	SC	Fundamentals of Electrical and Electronics Engineering	3	0	2	4	5	S	-
4	ENG1001/ ENG1002	SC	Foundation English/ Technical English	1	0	2	2	3	S	-
5	MEC1004	PC	Elements of Mechanical Engineering	1	0	2	2	3	F	ES
6	PPS1001	SC	Introduction to soft skills	0	0	2	1	2	S	-
7	CHE1018	SC	Environmental Science	1	0	2	0	3	F	ES
TOTAL				11	0	14	16	25	-	-
SC = School Core, PC = Program Core, DE = Discipline Elective, OE = Open Elective Foundation Course = FC, Skill Development = SD, Employability = EM, Entrepreneurship = EN Gender Sensitization = GS, Environment and Sustainability = ES, Human Values and Professional Ethics = HP,CH=Contact Hours										

Semester 2										
S. NO.	COURSE CODE	BASKET	COURSE NAME	CREDIT STRUCTURE					TYPE OF SKILL	COURSE ADDRESSES TO
				L	T	P	C	CONTACT HOURS		
1	MAT1003	SC	Applied Statistics	1	0	2	2	3	F	-
2	CSE1001	SC	Problem Solving using JAVA	2	0	2	3	4	S	-
3	CHE1017	PC	Applied Chemistry	1	0	2	2	3	S	-
4	CIV1008	SC	Basic Engineering Sciences	2	0	0	2	2	S	-
5	MEC1006	SC	Engineering Graphics	2	0	0	2	2	S	EN
6	ENG1002/ ENG2001	SC	Technical English/ Advanced English	1	0	2	2	3	S	-
7	KAN1001/ KAN2001	SC	Kali Kannada / Thili Kannada	1	0	0	1	1	S	-
8	PPS1002	SC	Soft Skills for Engineers	0	0	2	1	2	S	EN
9	MEC2016	PC	Material Science and Metallurgy	2	0	2	3	4	S	EM
10	CSE1002	SC	Innovative Projects-Arduino using Embedded ‘C’	0	0	4	2	4	S	-
TOTAL				12	0	16	20	28		

Semester 3										
S. NO.	**COURSE CODE**	**BASKET**	**COURSE NAME**	**CREDIT STRUCTURE**					**TYPE OF SKILL**	**COURSE ADDRESSES TO**
				L	**T**	**P**	**C**	**CONTACTHOURS**		
1	MAT1002	SC	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	3	F	-
2	CSE2001	SC	Data Structures and Algorithms	3	0	2	4	5	F	-
3	MEC4001	PC	Basic Thermodynamics	3	0	0	3	3	S	-
4	MEC2011	PC	Mechanics of Solids	3	0	0	3	3	S	-
5	MEC2033	PC	Computer Aided Engineering Drawing	1	0	4	3	5	S	-
6	MEC2010	PC	Fluid Mechanics	2	0	2	3	4	S	-
7	MECXXXX	DE	Discipline Elective - I	3	0	0	3	3	EM	-
8	PPS4002	SC	Introduction to Aptitude	0	0	2	1	2	S	-
9	CSE1005	SC	Programming in Python	1	0	4	3	5	S	-
TOTAL				19	0	14	26	33		

Semester 4										
S. NO.	**COURSE CODE**	**BASKET**	**COURSE NAME**	**CREDIT STRUCTURE**					**TYPE OF SKILL**	**COURSE ADDRESSESTO**
				L	**T**	**P**	**C**	**CONTACT HOURS**		
1	MAT2003	SC	Numerical Methods for Engineers	1	0	2	2	3	F	-
2	MEC4003	PC	Applied Thermodynamics	3	0	0	3	3	S	-
3	MEC4002	PC	Kinematics of Machines	3	0	0	3	3	S	-
4	MEC3088	PC	Production Techniques-I	2	0	2	3	4	S	-
5	MEC2015	PC	Metrology and Mechanical Measurements	2	0	2	3	4	F	-
6	MEC2017	PC	Computer Aided Machine Drawing	0	0	4	2	3	S	-
7	MEC3006	PC	Mechatronics	2	0	2	3	4	S	-
8	MECXXXX	DE	Discipline Elective - II	3	0	0	3	3	EM	-
9	XXXXXXX	OE	Open Elective – I (Course from Management Basket)	3	0	0	3	3	EN	-
10	PPS4004	SC	Aptitude Training Intermediate	0	0	2	1	2	EM	-
11	ECE2011	SC	Innovative Projects Using Raspberry Pi	-	-	-	1	1	S	
TOTAL				20	0	12	27	33		

Semester 5										
S. NO.	**COURSE CODE**	**BASKET**	**COURSE NAME**	**CREDIT STRUCTURE**					**TYPE OF SKILL**	**COURSE ADDRESSESTO**
				L	**T**	**P**	**C**	**CONTACT HOURS**		
1	MEC3085	PC	Dynamics of Machines	2	0	0	2	2	S	-
2	MEC4005	PC	Production Techniques-II	2	0	2	3	4	S	-
3	MEC3090	PC	Design of Machine Elements-I	3	0	0	3	3	S	-
4	MEC3091	PC	Finite Element Analysis	2	0	2	3	4	S	-
5	MECXXXX	DE	Discipline Elective - III	3	0	0	3	3	EM	-
6	CSE3216	SC	Mastering Object-Oriented Concepts in Python	0	0	2	1	2	SC	-
7	MECXXXX	DE	Discipline Elective - IV	3	0	0	3	3	EM	-
8	MECXXXX	DE	Discipline Elective - V	3	0	0	3	3	EM	-
9	XXXXXXX	OE	Open Elective - II	3	0	0	3	3	EN	-
10	PPS4006	SC	Logical and Critical Thinking	0	0	2	1	2	S	-
TOTAL				21	0	6	25	29		

Semester 6										
S. NO.	**COURSE CODE**	**BASKET**	**COURSE NAME**	**CREDIT STRUCTURE**					**TYPE OF SKILL**	**COURSE ADDRESSESTO**
				L	**T**	**P**	**C**	**CONTACTHOURS**		
1	MEC3089	PC	Heat and Mass Transfer	2	0	2	3	4	S	-
2	MEC3068	PC	Production and Operations Management	3	0	0	3	3	S	-
3	MEC3086	PC	Design of Machine Elements-II	3	0	0	3	3	S	-
4	MEC3032	PC	Energy Conversion Lab	0	0	2	1	2	S	-
5	CSE3217	SC	Data Structure and Web Development with Python	0	0	2	1	2	S	-
6	MEC4008	PC	Mechanisms, Machines and Design Lab	0	0	2	1	2	S	-
7	MECXXXX	DE	Discipline Elective - VI	3	0	0	3	3	EM	-
8	MECXXXX	DE	Discipline Elective - VII	3	0	0	3	3	EM	-
9	MEC3087	PC	I. C. Engine and Fuels	2	0	0	2	2	S	-
10	XXXXXXX	OE	Open Elective - III (Course from Management Basket)	3	0	0	3	3	EN	-
11	PPS4005	SC	Aptitude for Employability	0	0	2	1	2	S	-
TOTAL				19	0	8	24	29		

Semester 7										
S. NO.	COURSE CODE	BASKET	COURSE NAME	CREDIT STRUCTURE					TYPE OF SKILL	COURSE ADDRESSES TO
				L	T	P	C	CONTACT HOURS		
1	MECXXXX	DE	Discipline Elective - VIII	3	0	0	3	3	EM	-
2	MECXXXX	DE	Discipline Elective - IX	3	0	0	3	3	EM	-
3	MECXXXX	DE	Discipline Elective - X	3	0	0	3	3	EM	-
4	PPS3018	SC	Preparedness for Interview	0	0	2	1	2	S	-
5	XXXXXXX	OE	Open Elective - IV	3	0	0	3	3	EN	-
6	PIP2001	SC	Capstone Project	-	-	-	4	-	EM	-
TOTAL				12		0	17	14	-	-

Semester 8										
S. NO.	COURSE CODE	BASKET	COURSE NAME	CREDIT STRUCTURE					TYPE OF SKILL	COURSE ADDRESSES TO
				L	T	P	C	CONTACT HOURS		
1	PIP4005	SC	Internship	-	-	-	5	0	EM	-
TOTAL							5			

23. Course catalogues

Course Code: **MEC1004**	**Course Title: Elements of Mechanical Engineering** **Type of Course: Program core Theory & Laboratory Integrated**	**L-T-P-C**	**1**	**0**	**2**	**2**
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This basic course in mechanical engineering is designed to acquaint students with an exposure to fundamentals of mechanical engineering. The very purpose of this course is to introduce the field of mechanical engineering through an exposition of its broader areas. This course provides insights into fundamental aspects of mechanical engineering. It also introduces the field of mechanical engineering through an exposition of its broader areas such as thermal energy, power transmission drives, manufacturing processes etc.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Elements of Mechanical Engineering**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: Describe different types of energy resources, prime movers, refrigeration and air-conditioning system. CO2: Explain various power transmission systems used in Mechanical Engineering. CO3: Classify different metal cutting processes and machine tools used in industries. CO4: Identify the different metal joining processes like Welding.					
Course Content:						

Module 1	Thermal Engineering	Assignment	Data Collection/any other such associated activity	4 sessions
Topics: Steam formation and its properties, laws of thermodynamics (Numerical based on First Law), Types of Systems, Introduction to refrigerators and room air conditioning system.				
Module 2	Prime Movers	Assignment	Data Collection/any other such associated activity	6 Sessions
Topics: Introduction to different types of prime movers like IC engines (4-stroke) and Turbines (Water).				
Module 3	Mechanical Power Transmission Drives	Assignment- Quiz	Data Collection/any other such associated activity	4 Sessions
Topics: Classification of different power transmission systems.				
Module 4	Manufacturing Processes	Assignment -Quiz	Data Collection/any other such associated activity	4 Sessions

Topics: Introduction to Manufacturing processes deals with machines tools, welding (arc)
List of Laboratory Tasks: Experiment N0 1: Demonstration of working of IC engines, and To compute the power losses in IC engines. Level 1: For the data provided for a 5 kW IC engine, compute various power loses using C program Level 2: For the data provided for a 5kW IC engine, compute various power loses using C program Experiment No. 2: Demonstrate the working of different types of turbines. Level 1: Working of Pelton Turbine and plotting its characteristic curves. Level 2: Working of Kaplan & Francis Turbines, and plotting their characteristic curves. Experiment No. 3: Demonstrate the performance of various welding Operations Level 1: Performance of Spot welding Level 2: Performance of Gas welding Experiment No. 4: Demonstration of working of machine tools Level 1: Working of Lathe Machine tool Level 2: Performing Milling Operations
Targeted Application & Tools that can be used: Application Area is Alternate energy resources – data collection related to renewable energy resources. IC engines. And Electric vehicles Professionally Used Software: C programming/ Python/ MATLAB
Textook: 1. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and Publishers Pvt Ltd, Mumbai. 2. D.S. Kumar, "Elements of Mechanical Engineering", S.K. Kataria & Sons. **Reference:** 3. VERSION 0.1, BEGINNER'S GUIDE TO 3D PRINTING, THINK3D TEAM, https://www.think3d.in/landing-pages/beginners-guide-to-3d-printing 4. Daan Bakker, August 2010 Battery Electric Vehicles, 5. Mechatronics-Electronic control systems in mechanical and electrical engineering, Sixth Edition, William Bolton, Pearson Education Limited 2015. 6. Web Resources: https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433
Topics relevant to "SKILL DEVELOPMENT": Manufacturing processes with machines tools, welding types and process for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Mr. Narender Singh
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: **MEC1006**	**Course Title: Engineering Graphics** **Type of Course: School Core & Theory Only**		**L-T-P-C**	2	0	0	2
Version No.	1.2					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course is designed with the objective of giving an overview of engineering drawing with the help of software tools. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings with computerized drafting tools. Computerized drafting provides accurate and easily modifiable graphic entities, easy data storage, easy retrieval facility and it enhances creativity. It will expose students to the concept of engineering drawing and teach them to draw different views of planes and solids in different orientations. The course will teach students to use AutoCAD to produce engineering drawings. They will learn to create drawing layouts, dimensioning, the theory of projection, orthographic projection of points, lines, planes and solids, isometric projection and be introduced to the development of surfaces.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Engineering Graphics**" and attain **SKILL DEVELOPMENT** through Problem solving methodologies.					
Course Outcomes	**On successful completion of this course the students shall be able to:** (1) Demonstrate competency using AutoCAD graphics software as per BIS conventions and standards. (2) Comprehend the theory of projection for drawing projections of Points, Lines and Planes under different conditions. (3) Prepare multiview orthographic projections of Solids by visualizing them in different positions. (4) Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions.					

Course Content

Module 1	Introduction to Drawing	Assignment	Standard technical drawing	02 Sessions

Topics:
Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Line conventions, dimensioning, Selection of drawing sheet size and scale.

[02 Hours: Comprehension Level]

Module 2	Orthographic projections of Points, Straight Lines and Plane Surfaces	Assignment	Projection methods Analysis	10 Sessions

Topics:
Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points in all 4 quadrants.
Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No

application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only. [10 Hours: Application Level]				
Module 3	Orthographic Projections of Solids	Assignment	Multi-view drawing Analysis	10 Sessions
Topics: Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection). [10 Hours: Application Level]				
Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	8 Sessions
Topics: Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects. [8 Hours: Application Level]				
Targeted Application & Tools that can be used: Application Area is in understanding and interpreting an object in various positions and converting it into a technical drawing which can be universally accepted. Professionally Used Software: AutoCAD				
Text Book: 1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd**.**				
References: 1. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore. 2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall. 3. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill. 4. Engineering Graphics Manual provided by Instructor incharge. **Webresources :** Knimbus - Your Library. Anywhere, Anytime.				
Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.				
Catalogue prepared by	Mr. Yeshwanth D			
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 27/8/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

<table>
<tr><td>Course Code:
MEC2016</td><td colspan="2">Course Title: Material Science and Metallurgy
Type of Course:
1] Program Core
2]Laboratory integrated</td><td>L-T-P-C</td><td>2-0-2-3</td></tr>
<tr><td>Version No.</td><td colspan="4">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="4">MEC1004</td></tr>
<tr><td>Anti-requisites</td><td colspan="4">NIL</td></tr>
<tr><td>Course Description</td><td colspan="4">Material Science and Metallurgy Course provides basic concepts in materials structure and its relation to properties and application to engineering problems. The Course includes structure of metallic, ceramic, and polymeric materials. The Course discusses the type of bonding and crystal structure their effect on the mechanical, electrical, and chemical properties of materials.
MMT Lab course aims at learning the practical concepts in material testing, which includes destructive testing like Tensile, Compressive, Hardness, Impact and non-destructive testing like Ultrasonic, Dye penetration test and Magnetic test.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of “Material Science and Metallurgy & MMT Lab” and attain SKILL DEVELOPMENT through Experiential learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:
CO1] Describe the crystal structure, crystal imperfections and diffusion process in solids
CO2] Explain phase diagrams and various heat treatment processes.
CO3] Classify various engineering materials and their applications.
CO4] Conduct Hardness, tensile, shear and compression tests of metallic specimens.
CO5] Identify the defects inside the body by using Non-Destructive testing methods.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction To Crystal Structures And Diffusion:</td><td>Project</td><td>Knowledge level</td><td>07 Sessions</td></tr>
<tr><td colspan="5">Topics:
Fundamental concepts, atomic structure, atomic bonding, crystal structure, defects and diffusion</td></tr>
<tr><td>Module 2</td><td>Phase Diagram</td><td>Assignment</td><td>Understanding level</td><td>07 Sessions</td></tr>
<tr><td colspan="5">Topics:
Solidification, Phase Equilibria, Phase transformation, Iron carbon system, Numericals</td></tr>
<tr><td>Module 3</td><td>Heat Treatment</td><td>Case study</td><td>Understand level</td><td>08 Sessions</td></tr>
<tr><td colspan="5">Topics:
TTT diagram, CC curve, Microstructures developed, Different HT processes.</td></tr>
<tr><td>Module 4</td><td>Engineering Materials</td><td>Assignment</td><td>Knowledge level</td><td>08 Sessions</td></tr>
</table>

Topics:
Properties and applications of alloy steels, tool steels, cast iron, copper and Al base alloy, Ni base alloys, Composites, ceramics, Polymers.

List of Laboratory Tasks:

Experiment N0 1: Study of Hardness of a given specimen using Rockwell Hardness Testing machine. [Level 1]

Experiment No. 2: Study of Hardness of a given specimen using Brinnel Hardness Testing machine.[Level 1]

Experiment No. 3: Study of Hardness of a given specimen using Vickers Hardness Testing machine. [Level 1]

Experiment No. 4: Izod and Charpy tests on Mild steel, Copper and Brass Specimen. [Level 1]

Experiment No. 5: Preparation of specimen for Metallographic examination of different Engineering materials. Identification of microstructures of plain carbon Steel, tool steel, Gray cast Iron, SG (Spheroidal Graphite) iron, Brass, Bronze & composites. [Level 1]

Experiment No. 6: Non-Destructive Test experiments like,

a) Ultrasonic flaw detection.

b) Magnetic crack detection.

c) Dye penetration testing

to study the defects of casted and welded specimens [Level 1]

Experiment No. 7: Tensile test on metallic (Mild steel) specimens using a Universal testing machine. [Level 2]

Experiment No. 8: Compression test on metallic (Mild steel) specimens using a Universal testingmachine. [Level 2]

Experiment No. 9: Shear test on metallic (Mild steel) specimens using a Universal testing machine. [Level 2]

Experiment No. 10: Bending test on metallic (Mild steel) specimens using a Universal testing machine. [Level 2]

Experiment No. 11: Torsion test on metallic (Mild steel) specimens using a Torsion testing machine.
[Level 2]

Experiment No. 12: Fatigue Test on metallic (Mild steel) specimens using a fatigue testing machine. [Level 2]

Targeted Application & Tools that can be used:

Materials scientists work with diverse types of materials (e.g., metals, polymers, ceramics, liquid crystals, composites) for a broad range of applications (e.g., energy, construction, electronics, biotechnology, nanotechnology) employing modern processing and discovery principles (e.g., casting, additive manufacturing, coating, evaporation, plasma and radiation processing, artificial intelligence, and computer simulations).
Destructive testing is undertaken in order to understand a specimen's performance or material behaviour, these procedures are carried out to the test specimen's failure. Destructive testing procedures can either follow specific standards or can be tailored to reproduce set service conditions in automobile, aerospace, construction industries etc. The standardized Nondestructive test methods are used in almost all industrial sectors, whether it concerns motor vehicles, airplanes, ships, machines or the quality assurance of buildings.

Text Book

1. G.E. Dieter, "Mechanical Metallurgy", G. E. Dieter. Mechanical Metallurgy, Mc Graw Hill Book Co., New York 1986.
2. "Metallography and Materials Testing Lab Manual", Presidency University

References 1. W. D. Callister, "Material Science and Engineering: An Introduction", Wiley. 2. V. Raghavan, "Materials Science and Engineering", Fifth Edition (Kindle Edition), PHI.
Topics relevant to "SKILL DEVELOPMENT": Atomic structure, atomic bonding, crystal structure and test on specimen for Fatigue, Bending, compression and shear for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.
Web Resources 1. W. D. Callister, "Material Science and Engineering https://ftp.idu.ac.id/wp-content/uploads/ebook/tdg/TEKNOLOGI%20REKAYASA%20MATERIAL%20PERTAHANAN/Materials%20Science%20and%20Engineering%20An%20Introduction%20by%20William%20D.%20Callister,%20Jr.,%20David%20G.%20Rethwish%20(z-lib.org).pdf 2. G.E. Dieter, "Mechanical Metallurgy" https://stu.westga.edu/~bthibau1/MEDT%207477-Cooper/Calibre%20Library/Dieter_%20George%20Ellwood/Mechanical%20metallurgy%20(13)/Mechanical%20metallurgy%20-%20Dieter_%20George%20Ellwood.pdf 3. NPTEL Course https://www.digimat.in/nptel/courses/video/113102080/L01.html 4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=ELSEVIER1_20983

Catalogue prepared by	Priyanka S Umarji Asst.Professor
Recommended by the Board of Studies on	12th. BOS held on 21/4/21
Date of Approval by the Academic Council	14th. Academic Council held on 3/5/21.

<table>
<tr><td>Course Code: MEC4001</td><td>Course Title: Basic Thermodynamics
Type of Course: Program Core Theory</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">MAT1001</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The course aims at learning the practical concepts in different working cycles and operation of two stroke, four stroke SI and CI Engine cycles. Ignition, combustion, alternative fuels, emission and their control. The course is both conceptual and analytical in nature and needs basic knowledge of Mathematics. The course develops the critical thinking and analytical skills.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "Basic Thermodynamics" and attain SKILL DEVELOPMENT through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">On successful completion of this course the students shall be able to:
CO1] Summarize the basic concepts of thermodynamics.
CO2] Compute the properties of pure substance with the help of steam tables.
CO3] Apply the first & second laws of thermodynamics to control mass and steady flow control volume system.
CO4] Predict feasibility of thermodynamic process and availability of maximum work.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Introduction to Thermodynamics</td><td>Case Study</td><td colspan="2">Data Analysis</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="7">Topics:
Role of Thermodynamics in Engineering and Science, Applications of Thermodynamics: Power Generation, Thermal Environment Control, Cooling of Electrical Systems and Electronic Devices, Surroundings, Macroscopic and Microscopic Analysis, Definition of Substance, Properties of Substance: Intensive and Extensive, Thermodynamic Equilibrium, Concept of Quasi-Equilibrium, Process and Cycle, Fundamental Units, The Zeroth Law of Thermodynamics.</td></tr>
<tr><td>Module 2</td><td>Application of First Law</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="7">Topics:
Definition of Thermodynamic Work, Forms of Work, Definition of Heat, Statement of First Law of Thermodynamics: First Law for Cyclic Process, First Law for Change of State of a System: Internal Energy, First Law as a Rate Equation, First Law Applied to a Control Volume.</td></tr>
<tr><td>Module 3</td><td>Second Law of thermodyn</td><td>Assignment</td><td colspan="2">Data Analysis through Programming</td><td colspan="2">12 Sessions</td></tr>
</table>

<table>
<tr><td></td><td>amics and entropy:</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Topics:
Definition of Heat Engine and Reservoirs, Kelvin-Planck and Clausius Statements of the Second Law, Reversible and Irreversible Engines and processes, Internal and External Irreversibility, The Efficiency of a Carnot Cycle, The Ideal Gas Temperature Scale. Clausius Inequality, Entropy a Property of a System, Pure Substance, The Thermodynamic Property Relation, Calculation of Change in Entropy, Second Law Analysis of a Control Volume, Principle of Increase of Entropy, Definition of Exergy, Exergy Analysis of System and Control volume</td></tr>
<tr><td>Module 4</td><td>Properties of Pure Substances</td><td>Assign ment</td><td>Simulation & Data Analysis</td><td>11 Sessions</td></tr>
<tr><td colspan="5">Topics:
Definition of Pure Substance, Facts about Pure Substances, Vapor, liquid, solid Phase Equilibrium, Equation of State for the Vapor Phase: Simple substance, Ideal Gases Characterization, Ideal Gas Equation, Real Gases.
Internal Energy, First Law as a Rate Equation, First Law Applied to a Control Volume, The SSSF processes</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Application area includes Power Plants (NTPC /BARC/NPCIL/BHEL), Automobile sector (Design – TATA/Hyundai/Bajaj etc.), Manufacturing Industries (Bosch/Irwin Tools/Casting Industries).
Tools used: Matlab, Ansys</td></tr>
<tr><td colspan="5">Text Books:
T1. Yunus A Cengel, Michael A, Boles, “Thermodynamics”, McGraw Hill Education (India) Pvt Ltd.,5th edition, 2017</td></tr>
<tr><td colspan="5">References:
R1. Nag P.K, “Engineering Thermodynamics”, Tata Mc Graw-Hill Publishers.
R2. Sonntag, Borgnakke, Van Wylen, “Fundamentals of Thermodynamics”, John Wiley and Sons, New York.
R3. Michael J Moran, Howard N Shapiro, Daisie D Boettner, Margaret B Bailey, “Principles of Engineering Thermodynamics” Wiley India Pvt. Ltd.
Web Resources: William D Ennis, “Applied Thermodynamics for Engineers”, 5th Edition. Link:
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=BOOKYARDS_1_5255</td></tr>
<tr><td colspan="5">Topics relevant to “SKILL DEVELOPMENT”: Thermodynamics laws, Refrigeration numerical for SKILL DEVELOPMENT through Problem Solving methodologies. This is attained through the assessment component mentioned in the course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Mr. Narender Singh and Mr. Neeraj Singh</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td colspan="4">BOS NO: 15th BOS held on 29/7/2022</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td colspan="4">Academic Council Meeting No. 18, Dated 03/08/2022.</td></tr>
</table>

<table>
<tr><td>Course Code:
MEC2011</td><td colspan="2">Course Title: Mechanics of Solids
Type of Course: Program Core & Theory</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">MAT 1001</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course is designed with the objective of providing a fundamental understanding of the behavior of structural components commonly used in engineering structures and machines. It focuses on developing the skills to model and analyze the behavior of structural and machine components subjected to various loading and support conditions based on the principles of equilibrium and material constitutional relationships. It includes mechanics of rigid and deformable bodies in equilibrium and extends the depth of meaning contained in the basic principles of equilibrium to three dimensional continuous media including torsion, bending stresses and deflections.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Mechanics of Solids” and attain SKILL DEVELOPMENT through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">CO1 Compute the Normal Stress and Strain in Mechanical components
CO2 Compute the Bending Stress and Deflections of Beams
CO3 Compute Torsional Shear Stress and Strain in Shafts
CO4 Explain the concepts of Principle Stress and Strain Transformations</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Stress and Strain</td><td>Assignment</td><td colspan="4">Data collection</td><td>15 Sessions</td></tr>
<tr><td colspan="8">Topics:
Brief Introduction, Stress and strain graphs and concepts, elastic constants, axial loads, statically indeterminate axially loaded members, thermal strain.</td></tr>
<tr><td>Module 2</td><td>Shear Stress and Deflection of Beams</td><td>Assignment</td><td colspan="4">Mathematical</td><td>10 Sessions</td></tr>
<tr><td colspan="8">Topics:
Transverse shear, shear flow in built-up members, combined loadings, Deflection of beams by the method of integration and Moment area method.</td></tr>
<tr><td>Module 3</td><td>Torsion and Bending</td><td>Assignment</td><td colspan="4">Mathematical</td><td>10 Sessions</td></tr>
<tr><td colspan="8">Topics:
Torsion, angle of twist, statically indeterminate torque-loaded members, bending, eccentric axial loading of beams.</td></tr>
<tr><td>Module 4</td><td>Stress and Strain Transformation</td><td>Assignment</td><td colspan="4">Mathematical</td><td>10 Sessions</td></tr>
<tr><td colspan="8">Topics:</td></tr>
</table>

Stress at a point on different planes in 2-D, transformation of stresses, principal and maximum shear stresses, Mohr's Circle.
Targeted Application & Tools that can be used: Application Area is Geophysical phenomenon, Hydrology, Aerospace, Aerodynamics, Microfluidics, Pipe network, Turbo-machinery. Industries using above applications and tools – Siemens, Quest Global, Simulent consulting, Triveni Engineering, TATA, GE etc
TEXTBOOKS: E. P. Popov, "Engineering Mechanics of Solids", Prentice Hall, **Reference Book(s):** 1. F. P. Beer, E. R. Johnston (Jr.), and J. T. De Wolf, "Mechanics of Materials", Tata McGraw-Hill, 2. S. P. Timoshenko, "Strength of Materials", Volumes 1 and 2, CBS Publishers. **Web links:** 1. https://www-sciencedirect-com-presiuniv.knimbus.com/journals 2. https://presiuniv.knimbus.com/user#/searchresult?searchId=mechatronics&_t=1655961642518
Topics relevant to "SKILL DEVELOPMENT": Stress and strain in beams and columns for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Mr. Wasim Akram
Recommended by the Board of Studies on	BOS NO: 11th BoS held on 05/09/2020
Date of Approval by the Academic Council	14th Meeting of the Academic Council held on 24/12/2020

Course Code: **MEC2033**	**Course Title: Computer Aided Engineering Drawing** **Type of Course: Program Core/ Laboratory only**	**L-T-P-C**	1	0	4	3
Version No.	1.0					
Course Pre-requisites	MEC1006					
Anti-requisites	NIL					
Course Description	Technical Graphics is used to communicate the necessary technical information required for manufacture and assembly of machine components. These drawings follow rules laid down in national and International Organizations for Standards (ISO). Hence the knowledge of the different standards is very essential. The following topics have been covered to fulfill the above objectives. Classification of Machine Drawings, Principles of Drawings, Sectioning, Dimensioning, Limits, Fits and Tolerance, Symbols and Conventional Representation, Screw Fasteners, Key Joints, Coupling and its Types, Riveted Joints, Welded Joints, Structural Applications, Assembly Drawings, Production Drawings, Reproduction of Drawing, Introduction of Computer Aided Drafting, Introduction of Solid 3D Modeling.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Computer Aided Engineering Drawing**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1. Draw different fasteners, joints and sections of parts as per B.I.S & Practices CO2. Distinguish between cut sections of components and assembly by using knowledge of limits, fits and tolerances through drawings. CO3. Demonstrate 3-D models of machine parts and assembly using CAD software enabling 2-D drawings. CO4. Demonstrate the knowledge of surface modeling of 3-D components/parts					
Course Content	**Task 01: Sections of solids** Level No 01: Analyzing the views of the component Level No. 02: construction of machine component using solid works **Task 02: Iso to ortho conversions** Level No 01: Detailed geometrical study of machine components Level No. 02: construction of machine component using solid works **Task 03: to ortho to Iso conversions** Level No 01: Detailed geometrical study of machine components Level No. 02: construction of machine component using solid works **Task 04: Riveting and Couplings** Level No 01: Types of riveted joints Level No. 02: Types of joints and couplings **Task 05: Assembly of machine components- Screw Jack** Level No 01: Detailed studying of parts of screw jack Level No 02: construction of all the parts using solid works **Task 06: Assembly of machine components- Plummer Block** Level No 01: Detailed studying of parts of Plummer Block Level No 02: construction of all the parts using solid works **Task 07: Assembly of machine components- Machine vise** Level No 01: Detailed studying of parts of Machine vise Level No 02: construction of all the parts using solid works					

	Task 08: Assembly of machine components- Knuckle joint Level No 01: Detailed studying of parts of Knuckle joint Level No 02: construction of all the parts using solid works **Task 09: Assembly of machine components- Fuel Injector** Level No 01: Detailed studying of parts of Fuel injector Level No 02: construction of all the parts using solid works **Task 10: Assembly of machine components- Tailstock** Level No 01: Detailed studying of parts of Tailstock Level No 02: construction of all the parts using solid works
Targeted Application & Tools that can be used: Design engineer, draftsmen and Solid works	
Text Book N.D. Bhatt, Machine Drawing, Charotar Book Stall, Anand, 1996 K L Narayana, P kannaiah, K Venkata Reddy, "Machine Drawing" third edition, 2006 K.L.Narayana, Production drawing, New Age International Pvt. Ltd. New Delhi, 2003**.**	
References S Trayambak Murthy, "Text book of Computer Aided Machine Drawing", CBS K.R.Gopalakrishna, Machine Drawing, Subhas Stores, Bangalore, 2002 **Web Resources:** https://presiuniv.knimbus.com/openFullText.html?DP=https://search-ebscohost-com-presiuniv.knimbus.com/login.aspx?direct=true&db=iih&jid=0MA	
Topics relevant to "SKILL DEVELOPMENT": Analyzing the views of the component and Assembly of machine components for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Madhusudhan M
Recommended by the Board of Studies on	BOS NO: 15^{th} BOS held on 29/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

<table>
<tr><td>Course Code:
MEC2010</td><td>Course Title: Fluid Mechanics
Type of Course: Program Core
Theory &Integrated Laboratory</td><td>L-T- P- C</td><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">MAT1001</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">This Course is designed to present the fundamental laws relating to the static and dynamic behavior of fluids. It provides a basic knowledge in fluid properties and statics utilizing the principles developed in previous mechanics Courses and illustrates the basic fluid properties and fluid statics. Introduction to the fundamentals governing laws. The Course also discusses the basic concepts about Fundamentals of fluid kinematics, dimensional Analysis and flow through pipes and external surfaces.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "Fluid Mechanics" and attain SKILL DEVELOPMENT through Experiential learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">CO1 Calculate pressure using various kinds of manometers
CO2 Examine simple fluid flow problem by using Bernoulli equation
CO3 Apply the control volume formulation of the basic laws to model physical systems
CO4 Examine certain types of flows using the Navier–Stokes equations</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Introduction and Fluid statics</td><td>Assignment</td><td colspan="3">Data collection</td><td>6 Sessions</td></tr>
<tr><td colspan="7">Topics:
Introduction: definition of fluid, liquids and gases, continuum hypothesis, compressible and incompressible fluid/flow, viscosity, stress field, Newtonian and non-Newtonian fluids Introduction, Fluid properties,
Fluid Statics: Pressure distribution in a fluid, Manometry, Buoyancy.</td></tr>
<tr><td>Module 2</td><td>Fluid Dynamics and Fluid Kinematics</td><td>Assignment</td><td colspan="3">Mathematical</td><td>8 Sessions</td></tr>
<tr><td colspan="7">Topics:
Newton's second law to fluid flow, Physical interpretations of Bernoulli equation, Static, stagnation, Dynamics and total pressure head, Venturi-meter, vertical orifice & orifice meter, Pitot tube
Fluid flow fields: Eulerian vs. Lagrangian descriptions, Velocity fields, Acceleration field, Control volume and system representation, Reynolds transport theorem.</td></tr>
<tr><td>Module 3</td><td>Control volume analysis</td><td>Assignment</td><td colspan="3">Mathematical</td><td>8 Sessions</td></tr>
<tr><td colspan="7">Topics:
Control-volume analysis: Mass balance, Momentum balance, Energy balance</td></tr>
<tr><td>Module 4</td><td>Differential analysis of</td><td>Assignment</td><td colspan="3">Mathematical</td><td>8 Sessions</td></tr>
</table>

	fluid flow			

Topics:
Fluid Element of Kinematics, Conservation of Mass, Linear momentum equation, Inviscid flow, Viscous flow

List of Laboratory Tasks:

Experiment No. 1: Verification of Bernoulli's Theorem.

Level 1: To calculate the total energy at different cross section of pipe.
Level 2: To plot the graph between total energy vs distance and prove the Theorem.

Experiment No. 2: Discharge through Venturimeter and orifice meter to study the variation of coefficient of discharge with the Reynolds number.
Level 1: To demonstrate the use of Venturimeter for fluid flow measurement
Level 2: To determine the coefficient of discharge for a given input.

Experiment No. 3: Calibration and to Calculate the rate of flow using liquid Rotameter.
Level 1: To demonstrate and calibrate the device.
Level 2: To determine the coefficient of discharge for a given input.

Experiment No. 4: To measure the force developed by impact of jet of water on plates of different configurations and compare with the theoretical value.
Level 1: To determine the impact forces of jet on flat vane.
Level 2: To plot the performance characteristics.

Experiment No. 5: To determine flow regime using Reynolds apparatus.
Level 1: To determine the Reynold's Number & hence the type of flow.
Level 2: To study transition zone.

Experiment No. 6: Determination of loss of head due to bend, enlargement & contraction in pipes.
Level 1: To determine loss of head due to bend, enlargement & contraction in pipes
Level 2: To determine the reason for friction loss

Experiment No. 7: To evaluate the friction losses in pipes.
Level 1: To determine the friction factor for Darcy - Weisbach equation.
Level 2: To determine the reason for friction loss.

Targeted Application & Tools that can be used:
Application Area is Geophysical phenomenon, Hydrology, Aerospace, Aerodynamics, Microfluidics, Pipe network, Turbo-machinery.
Industries using above applications and tools – Siemens, Quest Global, Simulent consulting, Triveni Engineering, TATA, GE etc

Textbook

T1 Bruce R. Munson, Theodore H. Okiishi, Wade W. Huebsch, and Alric P. Rothmayer, Fundamentals of Fluid Mechanics, 7th Edition, John Wiley and Sons, 2013.
T2. Çengel, Yunus A., and John M. Cimbala. *Fluid mechanics: Fundamentals and applications*. Boston: McGraw-Hill Higher Education, 15th edition. 2006.

References

R1. White, Frank M., "Fluid Mechanics," McGraw Hill Education (India). 2011 7th Edition
R2. Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, John W. Mitchell, "Fluid Mechanics: SI Version," Wiley India.

Lab
Suggested Book / Study Materials:

(i) Course Material
Fluid Mechanics Lab Manual 2021-2022, Presidency University.

(ii) Text book(s)

P. N Modi and S. M. Seth, "Hydraulics and Fluid Mechanics, "Rajsons Publications Pvt. Limited.

(iii)Reference book(s)

1. White, Frank M., "Fluid Mechanics" McGraw Hill Education (India).
2. Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, John W. Mitchell, "Fluid Mechanics: SI Version" Wiley India.
3. Fluid Mechanics and Hydraulic Machines by RK Bansal, Laxmi Publications Pvt Ltd.

Topics for Technology Enabled Learning:

Fluid Mechanics on NPTEL By Prof. Suman Chakravarti
NPTEL :: Mechanical Engineering - Introduction to Fluid Mechanics and Fluid Engineering
Knimbus - Your Library. Anywhere, Anytime.

Topics relevant to "SKILL DEVELOPMENT": Newton's second law to fluid flow, Physical interpretations of Bernoulli equation, Static, stagnation, Dynamics and total pressure head, Venturi-meter, vertical orifice & orifice meter, Pitot tube Fluid flow fields for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Devendra Singh Dandotiya
Recommended by the Board of Studies on	12th BoS held on 06/08/2021
Date of Approval by the Academic Council	16th Meeting of the Academic Council held on 23rd October, 2021

<table>
<tr><td>Course Code:
MEC4003</td><td>Course Title: Applied Thermodynamics
Type of Course: Program Core & Theory Only</td><td colspan="2">L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">MEC4001</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course deals with the application of Thermodynamics - the science of applications of thermodynamics laws for different equipment. Different tools will be introduced to analyse energy systems from engines, power plants etc. The course is both conceptual and analytical in nature and needs basic knowledge of Mathematics. The course develops the critical thinking and analytical skills.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Applied Thermodynamics” and attain SKILL DEVELOPMENT through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1. Apply the first law and second law of thermodynamics to analyses the reciprocating internal combustion engine.
CO2. Apply the first law and second law of thermodynamics to analyses the gas turbine and Jet propulsion.
CO3. Apply the first law and second law of thermodynamics to analyses the vapor power cycle.
CO4. Apply the first law and second law of thermodynamics to analyses the refrigeration cycle.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Reciprocating Internal Combustion Engine:</td><td>Assignment</td><td colspan="2">Data Collection/any other such associated activity</td><td colspan="3">15 sessions</td></tr>
<tr><td colspan="8">Topics:
Air Standard cycles: Carnot, Otto, Diesel, Dual, P-V and T-S diagrams, Efficiencies and mean effective pressures, Comparison of Otto, Diesel and Dual cycles.</td></tr>
<tr><td>Module 2</td><td>Gas turbine and Jet propulsion</td><td>Assignment</td><td colspan="2">Data Collection/any other such associated activity</td><td colspan="3">10 Sessions</td></tr>
<tr><td colspan="8">Topics:
Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency.</td></tr>
<tr><td>Module 3</td><td>Vapour Power Cycles</td><td>Assignment- Quiz</td><td colspan="2">Data Collection/any other such</td><td colspan="3">10 Sessions</td></tr>
</table>

			associated activity	
Topics: Carnot cycle, Rankine cycle, reheat cycle, regenerative cycle, steam cycles for nuclear power plant, back-pressure and extraction turbines and cogeneration.				
Module 4	Refrigeration Cycle	Assignment -Quiz	Data Collection/any other such associated activity	10 Sessions
Topics: Reversed Carnot cycle, Vapor compression refrigeration system; description, analysis, refrigerating effect, capacity, power required, units of refrigeration, COP, Refrigerants and their desirable properties, Air cycle refrigeration; Reversed Brayton cycle, Pyschrometry.				
Targeted Application & Tools that can be used: Application Area is Alternate energy resources – data collection related to IC engines and Electric vehicles. Professionally Used Software: C programming/ Python/ MATLAB				
Textook: 1. T. D. Eastop, "Applied Thermodynamics for Engineering Technologists", 5th Edition, Pearson Education (India), 2002. 2. Michael J Moran, Howard N Shapiro, Daisie D Boettner, Margaret B Bailey, "Principles of Engineering Thermodynamics" Wiley India Pvt. Ltd. **Reference:** 1. Michael J. Moran and Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition, John Wiley & Sons, 2014. 2. P.K. Nag, "Engineering Thermodynamics" 5th Edition, McGraw-Hill Education, 2013. **Web Resources:** William D Ennis, "Applied Thermodynamics for Engineers", 5th Edition. Link: https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=BOOKYARDS_1_5255				
Topics relevant to "SKILL DEVELOPMENT": Reversed Carnot cycle, Vapour compression refrigeration system, analysis, capacity and power required for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout				
Catalogue prepared by	Mr. Narender Singh			
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/7/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

Course Code: MEC4002	Course Title: Kinematics of Machines Type of Course: Program Core		L-T-P-C	3	0	0	3
Version No.	2.0						
Course Pre-requisites	MAT1001, MAT1002						
Anti-requisites	NIL						
Course Description	The course is designed with an objective of giving an overview of the methods for analyzing the motion of mechanisms used in engineering applications. It includes the concepts and methods for determining the mobility and performing kinematic analysis of planar mechanisms. The course emphasizes on Kinematic links, Kinematic pairs, Degree of Freedom of simple mechanisms, Kinematic chain, basic mechanisms and their Inversions. The velocity and acceleration analysis of basic mechanisms such as four bar mechanism, Slider – crank mechanism and their inversions are discussed using graphical methods. The course also discusses the concepts involved in the design and kinematic analysis of cam and follower pair, gears and gear trains.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Kinematics of Machines**" and attain **SKILL DEVELOPMENT** through Problem solving methodologies.						
Course Outcomes	On successful completion of this course the students shall be able to: CO1) Describe the mobility analysis on planar mechanisms. CO2) Explain the inversions of basic mechanisms. CO3) Construct the velocity and acceleration profile of kinematic analysis on planar mechanisms CO4) Outline the profile of the cam to get desired performance.						
Course Content:							
Module 1	Introduction to Kinematics	Assignment	Programming Task, Data Analysis task			10 sessions	
Topics: Machines and mechanisms, Types of constrained motions, Kinematic links, Kinematic pairs, Types of joints, Degrees of Freedom of simple mechanisms, Kinematic chain, Mobility of Mechanisms, Kutzback's criterion, Gruebler's criterion.							
Module 2	Basic Mechanisms and Their Inversions	Quiz	Analytical thinking			12 Sessions	
Topics: Four bar chain mechanism, Inversions of four bar chain mechanism, Grashof's law, Parallel crank four bar linkage, Deltoid linkage, Mechanical advantage, Transmission angle, Slider crank chain, Inversions of slider crank chain, Double slider crank chain, Inversions of double slider crank chain.							
Module 3	Velocity and Acceleration Analysis	Assignment	Data Collection and Analysis			11 Sessions	
Topics: Basics of Vectors, Motion of a link, Velocity and acceleration analysis of four bar mechanism and							

inversions, Velocity of rubbing, Velocity and acceleration analysis of slider crank mechanism and inversions, Coriolis acceleration.				
Module 4	Cams and Gears	Assignment	Data Collection and Analysis	12 Sessions
Topics: Types of Cams, Types of Followers, Basic definitions, Follower displacement programming, High speed cams, Undercutting, Motions of the follower, Layout of cam profiles. Classification of gears, Gear terminology, Law of Gearing, Forms of gear teeth – cycloidal and involute, Interchangeable gears, Path of Contact, Arc of Contact, Contact ratio, Interference in Involute Gears, Undercutting				
Targeted Application & Tools that can be used: Application Area is collision of vehicles, aerospace, automobile kinematics and dynamics, vibration of machines. Professionally Used Software: MATLAB				
Text Books 1. Meriam, J. L., and L. G. Kraige. *Engineering Mechanics: Dynamics*. 6th ed. New York,NY: Wiley, 2006. ISBN: 9780471739319. 2. J. R. Taylor, *Classical mechanics*, University Science Books, 2005. 3. S. S. Rattan, "Theory of Machines", Tata McGraw Hill,2019				
References 1.A. Ghosh and A. K. Mallik, "*Theory of Mechanisms, and Machines"*, East West Press Pvt Ltd.. 2. K. J. Waldron and G. L Kinzel, "*Kinematics, Dynamics and Design of Machinery"*, Wiley Student Edition. 3.The resources from the Engineering Kinematics Course from MIT Open Course Ware from Fall, 2011, are available here: Link. 4.The resources from the Kinematics of Machines Course from SWAYAM-NPTEL from December, 2009 are available here: Link. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609				
Topics relevant to "SKILL DEVELOPMENT": Cams design, Velocity, acceleration diagram for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.				
Catalogue prepared by	Mr. Kunwar Chandra Singh			
Recommended by the Board of Studies on	15th BOS held on 29/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022			

Course Code: **MEC3088**	**Course Title:** **Production Techniques I** **Type of Course:** **1] Program Core** **2] Laboratory integrated**		**L-T-P-C**	**2**	**0**	**2**	**3**
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	The cost and quality of end product used by consumer is largely depends on the manufacturing process. A significant advancement in the manufacturing process has taken in the last decade, thus proper selection of manufacturing process needs a clear understanding of the various manufacturing process including its advantage, disadvantage, material that can be processed etc. This course help students to develop the understanding of various manufacturing process like casting, welding, metal forming and machining.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Production Techniques I**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.						
Course Out Comes	On successful completion of the course the students shall be able to: CO1 Classify metal casting process and its types, CO2 Elucidate Metal joining process and its types. CO3 Explain various metal forming and extrusion process. CO4 Discuss different machining operations using diverse machine tools						
Course Content:							

Module 1	Casting and joining process	Case Study	Compare and analyze the microstructure obtained in different casting process through matlab.	12 Sessions

Topics:

Casting Process: Sand Casting : Sand Mold – Type of patterns - Pattern Materials – Pattern allowances –Molding sand Properties and testing – Elements of Gating system- Principle of special casting processes : Shell - investment – Pressure die casting - Centrifugal Casting – Stir casting; Defects in Sand casting.

Joining Process:

Classification of Welding process, Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding- Gas metal arc welding – Submerged arc welding –Electron beam welding: Operating principle and applications of Solid state welding: Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.

Module 2	Metal working and sheet metal process.	Assignment	Simulate the open die forging process using Deform software.	12 Sessions

Topics:

Metal working process: Hot working and cold working of metals – Forging processes – Open, impression and closed die Forging – forging operations. Rolling of metals–

Types of Rolling – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and cold extrusion. **Sheet metal process:** Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations– Formability of sheet metal – Special forming processes-Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming, magnetic pulse forming, peen forming.				
Module 3	Introduction to Machine Tools	Assignment	Programming to calculate machining time on various machine tool in Python.	6 Sessions
Topics: Lathe machine and its principle, drilling machine and its principle, Milling machine and its principle, shaper machine and its principle.				
List of Laboratory Tasks:				
Experiment N0 1: Preparation of Sand Mold With Single Patterns **Level 1:** Enable students to learn about different tools used in making of mold with single pattern. **Level 2:** Enables students to prepare simple sand mold using single pattern.				
Experiment No. 2: Preparation of Sand Mold With Split Patterns **Level 1:** Enable student to learn the relative advantage of split pattern over single pattern. **Level 2:** Enables students to prepare simple sand mold using split pattern.				
Experiment No. 3: Preparation of Sand Mold Without Pattern **Level 1:** Enable student to learn the relative advantage and disadvantage of making sand mold without pattern over single and split pattern. **Level 2:** Enables students to prepare sand mold without pattern.				
Experiment No. 4: Moisture Content Test **Level 1:** Enable student to learn the importance of moisture content in sand mold. **Level 2:** Enables students to calculate the percentage moisture present in the given sand sample.				
Experiment No. 5: Clay Content Test **Level 1:** Enable student to learn the effect of clay content on the properties of the sand mold. **Level 2:** Enables students to learn the technique and device used in calculation of clay content in the given sand specimen.				
Experiment No. 6: Permeability Test **Level 1:** Student will learn about the importance of permeability in the sand mold. It also help student to learn how to minimize the defect such as gas holes by incorporating optimized permeability in the sand mold.				

Level 2: Student will learn about the device, its principle and the steps used in the calculation of permeability of the given sand mold. They also exposed to the actual problems encounted during the execution of the test.
Experiment No. 7: Grain Fineness Number Test (Sieve Analysis) **Level 1:** Student will learn about the properties of the sand mold which is significantly affected by the size of the base sand and thus will learn the importance of grain fineness test in the sand mold preparation. **Level 2:** Student will learn about the device, its principle and the steps used in the calculation of Grain Fineness Number of the given sand. They also exposed to the real problems encountered during the execution of the test.
Experiment No. 8: Compression, tensile, green shear and transverse test of molding sand using **universal sand testing machine.** **Level 1:** Enable student to learn the role of compression strength, tensile strength, shear and transverse strength of the sand mold during casting process. **Level 2:** Student will learn about the universal sand testing machine, its principle and the steps used in determining the different strength of the given sand mold. They also expose to hand on experience in handling the sand testing machine for determining the different Strength.
Experiment No. 9: Forging of given round bar into square bar and square nail. **Level 1:** Enable student to learn how plastic based deformation helps in converting given shapes into desired shape. **Level 2:** Student will learn about the steps and also exposed to hand on experience used in forging a given shape into required shape.
Experiment No. 10: To perform different welding process(Gas welding, TIG welding, MIG **welding and spot welding process)** **Level 1:** Enable student to learn about different welding process, handling of various tools and surface preparation for different welding process. **Level 2:** Student will expose to hand on experience in joining of material using different welding process.
Targeted Application & Tools that can be used: Casting is used in producing automobile engine, aircraft engine and other parts where higher order complexity is involved. Joining is find its use in small products like electronic items to fabrication of large bridge structure. Plastic deformation based is significantly used when small components is to be made in

large numbers such as toys. Sheet metal process is largely used in automobile and aerospace industry to make outer structure. **Professionally Used Software:** Deform, ANSYS
Text Book: **T1.** Hajra Chouldhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", Volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997 **T2.** Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition.
References: **(A) Books:** **R1.** Gowri P. Hariharan, A.Suresh Babu, "Manufacturing Technology I", Pearson Education. **R2.**Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education. **R3.**Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" Eight Editions, Prentice – Hall of India, 1997. **R4.**Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 2ndEdition, TMH-2003. **R5.**Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2004. **(B) Digital resources:** **D1.** NPTEL - http://nptel.ac.in/courses/113105024
Topics relevant to "SKILL DEVELOPMENT": Gas Tungsten arc welding, Gas metal arc welding, Submerged arc welding, Electron beam welding and Friction welding for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Madhusudhan M
Recommended by the Board of Studies on	15th BOS held on : 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

<table>
<tr><td>Course Code: MEC2015</td><td colspan="2">Course Title: Metrology and Mechanical Measurement
Type of Course: Program Core and Laboratory integrated</td><td>L-T-P-C</td><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">MAT1001</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The Course is designed with an objective of giving an overview of science of measurement and its applications. This Course is aimed at teaching basic concepts of measurement sciences for mechanical engineering students.

The student can learn the art of measurement and calibration of instruments. The lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Metrology And Mechanical Measurement” and attain SKILL DEVELOPMENT through Experiential learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7">On successful completion of the course the students shall be able to:
CO1]Explain different measuring instruments to measure the qualitative and quantitative characteristics of different mechanical components and identify the measuring instruments suitable for Tool room applications
CO2] Evaluate quality of fit and their tolerance in machines and instruments.
CO3] Brief the terminologies of gears and screw thread.
CO] Discuss the basics of mechanical measurement system.
CO5]Classify measurement of field variables like force, torque, pressure and
Temperature.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction to Metrology and Measuring Instruments</td><td colspan="2">Assignment</td><td colspan="2">Data Collection</td><td colspan="2">8 sessions</td></tr>
<tr><td colspan="8">Topics:
Definition and concept of metrology, Need of inspection, Principles of measurement, Process of measurement, Methods of Measurement, Classification of measuring instruments, Selection of measuring instruments, Measuring systems and accuracy of measurement, Precision and accuracy, errors in measurement.
Standards of Measurement: Classification of standards, conversion of line standard. Usage of Calipers.
Interferometry: Principle and uses of interferometry, optical flat and interferometers.
Angular Measurement: Construction, working principle, measurement procedure of sine bar, Taper measurement, application of angle gauge.</td></tr>
</table>

Comparators: Classification, Mechanical comparators- Dial indicator, Sigma Comparator, Electrical-Comparators-principles, LVDT, Pneumatic- back pressure gauge. Assignment on development of different standardization methods.				
Module 2	Limits, Fits, Tolerances and Gauging	Case Study	Lab based activity	07 sessions
Topics: Introduction of limits and fits, Definitions of various parameters and terminologies. Types of fits and its designations with suitable applications, Tolerance systems and Geometrical tolerance notations with examples, Terms and symbols used, IT grades and simple formulae used, Numerical. Types of Limit gauges, Taylor's principle of gauge design, Present British System of Gauge & Wear Tolerance. Case study on geometrical tolerance on industrial specimen with specification chart.				
Module 3	Metrology of Gears and screw threads	Case Study	CMM study in lab	05 sessions
Topics: Gear tooth terminology, Measurement of tooth thickness. **Screw Thread Measurement**: Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3- wire methods. Study conducted in lab. **Advances in metrology:** Basic concepts of Coordinate Measuring Machines-constructional features, applications, Image acquisition and digitization.				
Module 4	Mechanical Measurements	Assignment	Awareness of different software for surface texture.	05 sessions
Topics: Need of mechanical measurement, Measurement methods, Generalized Measurement system. Transducers, transfer efficiency, advantages of each type transducers. Assignment on different transducers for industrial applications. **Metrology of Surface finish:** Surface Metrology Concepts and terminology, Specification of surface Texture characteristics and symbols, and Method of measuring surface finish: Stylus system of measurement, Stylus probe instruments-Tally Surf. Texture designing based software assignment.				
Module 5	Measurement of Force, Torque and Strain	Assignment	Lab based activity.	05 sessions
Topics: **Force measurement**: load cells, proving rings. **Measurement of torque:** Types of dynamometers, Absorption dynamometer, Prony brake and hydraulic dynamometer. **Measurement of strain**: Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor. Lathe tool and drill tool dynamometer. **Temperature Measuring Devices:** Thermocouples, Resistance Temperature Detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer. **Pressure measurement**: Principle, use of elastic members, Bridgman gauge, McLeod gauge, Pirani gauge, bourdon gauge. Assignment on AI based measuring system.				

List of Laboratory Tasks:

Experiment No 1: Calibration of Vernier caliper & Micrometer.

Level 1: Comparison of measurement value between a shop floor specimen and standard specimen using M112 slip block.
Level 2: Determine the criteria for accuracy and precision for specimen dimensions considering the effect of least count and various techniques of measurement from single instrument.

Experiment No. 2: Measurements of angle using Sine Center / Sine bar / bevel protractor.

Level 1: Measurement of angle for a cubical block and finding the difference in least count in angle measurement over linear measurement system.
Level 2: Measurement of a tapered cylindrical block and its comparison with the theoretical derivation.
.
Experiment No. 3: Calibration of Pressure transducer/LVDT/Thermocouple

Level 1: Finding different purposes of a transducer used in industry and its working.
Level 2: The impact of variants taken into consideration while measuring pressure. Displacement or temperature and converting it into readable output.

Experiment No. 4: Measurements of gear tooth profile using gear tooth Vernier /gear tooth micrometer.

Level 1: Simple vernier calculation of chordal addendum and chordal thickness and comparison with theoretical expression.
Level 2: Employing tool maker's microscope in another method and calculating the tooth profile such as pitch, major and minor diameter as well as flank angle.

Experiment No. 5: Measurements of Screw thread Parameters using floating carriage micrometer.

Level 1: Error analyzing between gear teeth and screw thread and understanding its various reason.
Level 2: Using prism, two wire method to find major and minor diameter of a screw thread in comparison with standard specimen.
Level 3: Employing projector in another method and calculating the tooth profile such as pitch, major and minor diameter as well as flank angle.

Experiment No. 6: Measurements of Surface roughness. Using Taly surf / mechanical Comparator.

Level 1: understanding the texture and pattern requirement in different mechanical components.
Level 2: Optical flats using basic diffraction pattern can also be utilized for better understanding of surface structure for the purpose of inspection.

Experiment No. 7: Measurements of temperature, strain and pressure.
Level 1: To calibrate the given Chromel-Alumel thermocouple and to determine the true temperature using calibration curves.
Level 2: To calibrate the given load cell for compressive loads and calculate the error and cumulative error.
Level 3: To calibrate the given pressure transducer by coupling the pressure transducer to indicator.

<table>
<tr><td colspan="2">Targeted Applications :

Legal Metrology. Industrial Metrology. Aerospace. Construction. Communications. Energy. Health Care. Other job titles might include calibration engineers, calibration technicians, quality engineers, quality technicians, process control technicians, and safety engineers.</td></tr>
<tr><td colspan="2">Text Book
1]Metrology and Measurement: Bewoor Anand K, Kulkarni Vinay A., 1st Edition, Tata McGraw Hill,New Delhi, 2009

2] R. K. Jain, ‘Engineering Metrology’, Khanna Publishers, 1999.</td></tr>
<tr><td colspan="2">References
1] “Metrology and Mechanical Measurements Lab Manual”, Presidency University.

2] Anand K Bewoor and Vinay Kulkarni, ‘Metrology and Measurement’, 2009.
3) Frank R Spellman, “ The handbook of Meterology”,
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=507299&site=ehost-live
Web Resources:
https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433</td></tr>
<tr><td colspan="2">Topics relevant to “SKILL DEVELOPMENT”: Screw Thread Measurement, Bevel Protractor for SKILL DEVELOPMENT through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout</td></tr>
<tr><td>Catalogue prepared by</td><td>Priyanka Umarji, Asst. Professor, Dept. of Mechanical Engg.</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td>BOS NO: 15th BOS held on 27/8/2022</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td>Academic Council Meeting No. 18, Dated 03/08/2022.</td></tr>
</table>

Course Code: MEC2017	**Course Title: Computer Aided Machine Drawing** **Type of Course: Program Core/ Laboratory only**	**L-T-P-C**	0	0	4	2
Version No.	1.0					
Course Pre-requisites	MEC1006					
Anti-requisites	NIL					
Course Description	The course includes: section of solids, introduction to machine drawing, part drawings and assembly of simple assemblies and subassemblies of machine parts, like joints, power screw, couplings, the Plummer block, the machine vice, fuel injector, I. C. Engine components, machine tools, etc. The course is designed with the objective of providing knowledge about drawing, modelling, assembling and sub assembling of machine elements using software tools. It provides an exposure to different software tools (solid works) for modelling and drafting various machine elements, sheet metal and surface modelling.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Computer Aided Machine Drawing**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1] Draw different fasteners, joints and sections of parts as per B.I.S.& Practices CO2] Distinguish between cut sections of components and assembly by using knowledge of limits, fits and tolerances through drawings. CO3] Demonstrate 3-D models of machine parts and assembly using CAD software enabling 2-D drawings CO4] Demonstrate the knowledge of surface modeling of 3-D components/parts					
Course Content	**Task 01: Sections of solids** Level No 01: Analyzing the views of the component Level No. 02: construction of machine component using solid works **Task 02: Iso to ortho conversions** Level No 01: Detailed geometrical study of machine components Level No. 02: construction of machine component using solid works **Task 03: to ortho to Iso conversions** Level No 01: Detailed geometrical study of machine components Level No. 02: construction of machine component using solid works **Task 04: Riveting and Couplings** Level No 01: Types of riveted joints Level No. 02: Types of joints and couplings **Task 05: Assembly of machine components- Screw Jack** Level No 01: Detailed studying of parts of screw jack Level No 02: construction of all the parts using solid works **Task 06: Assembly of machine components- Plummer Block** Level No 01: Detailed studying of parts of Plummer Block Level No 02: construction of all the parts using solid works **Task 07: Assembly of machine components- Machine vise** Level No 01: Detailed studying of parts of Machine vise Level No 02: construction of all the parts using solid works					

	Task 08: Assembly of machine components- Knuckle joint Level No 01: Detailed studying of parts of Knuckle joint Level No 02: construction of all the parts using solid works **Task 09: Assembly of machine components- Fuel Injector** Level No 01: Detailed studying of parts of Fuel injector Level No 02: construction of all the parts using solid works **Task 10: Assembly of machine components- Tailstock** Level No 01: Detailed studying of parts of Tailstock Level No 02: construction of all the parts using solid works
Targeted Application & Tools that can be used: Design engineer, draftsmen and Solid works	
Text Book N.D. Bhatt, Machine Drawing, Charotar Book Stall, Anand, 1996 K L Narayana, P kannaiah, K Venkata Reddy, "Machine Drawing" third edition, 2006 K.L.Narayana, Production drawing, New Age International Pvt. Ltd. New Delhi, 2003.	
References S Trayambak Murthy, "Text book of Computer Aided Machine Drawing", CBS K.R.Gopalakrishna, Machine Drawing, Subhas Stores, Bangalore, 2002 **Web Resources:** https://presiuniv.knimbus.com/openFullText.html?DP=https://search-ebscohost-com-presiuniv.knimbus.com/login.aspx?direct=true&db=iih&jid=0MA	
Topics relevant to "SKILL DEVELOPMENT": Analyzing the views of the component and assembly of machine components for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Madhusudhan M
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: MEC3006	**Course Title: Mechatronics** **Type of Course: Program Core theory And Laboratory integrated**	**L-T-P-C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course is designed with an objective of giving an overview of designing mechatronic systems, which require integration of the mechanical and electrical engineering disciplines within a unified framework. The course includes: System modelling, Sensors and Transducers, Actuators, Digital logic, Microprocessors and Advanced application in Mechatronics. It deals with Hall and pitch sensors, DC motors, Stepper motors, Guide ways, Architecture of Microprocessor, Logic Gates and Pin diagrams.The course aims at learning the practical concepts in Mechatronics. It also includes Hydraulic and Pneumatic system along with the simulation software. The experiments involve design and testing of fluid power circuits to control velocity, direction and force on single and double acting actuators, design of circuits with logic sequence using Electro-Pneumatic trainer kits, Simulation of basic Hydraulic, Pneumatic and Electric circuits with the help of software tool. It also involves hand-on approach on modelling and analysis of basic electrical, hydraulic and pneumatic systems, computerized data logging system with control for process variables like pressure flow and temperature..					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Mechatronics** " and attain **SKILL DEVELOPMENT** through Experiential learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1] Describe the fundamentals of mechatronic system and its applications. CO2] Identify the types of sensors, transducers and signal conditioning processes used in automated machines. CO3] Recognize sequencing schedule for a specific process using various actuating systems. CO4] Describe logic gates and working of controllers. CO5] To Practically use the hydraulic and pneumatic circuits for given application. CO6] To identify the correct sequencing of pneumatic circuits and simulate in AUTOSIM-200 software. CO7] To understand the working principles of electric motors.					
Course Content:						

Module 1	Introduction to Mechatronics	Assignment	Data Collection	08 Sessions
Topics: Multi-disciplinary Scenario, Origins, Evolution of Mechatronics, Elements of mechatronic system, system, measurement systems, control systems - open loop, closed loop systems, feedback and feed forward control systems, servomechanisms, advanced applications of mechatronic system.				
Module 2	Sensors Transducers and Signal Conditioning	Case Study	Data collection	08 Sessions
Topics: Introduction and background, difference between transducer and sensor, transducers types, transduction principle, photoelectric transducers, thermistors, thermo devices, thermo couple, inductive transducers, capacitive transducers, pyro				

electric transducers, piezoelectric transducers, Hall-effect transducers, Fiber optic transducers. Light sensors, Thermal sensors, Touch sensors, Pressure sensors, Magnetic sensors.				
Module 3	Actuation Systems	Case Study	Data collection	08 Sessions
Topics: Pneumatic and hydraulic systems, overview of components of hydraulic system, overview of components of pneumatic system, basic hydraulic circuits-single acting cylinder, double acting cylinder, sequencing circuit. Mechanical systems & Electrical systems-sequencing, all types of electrical motors. Sequencing of double and single acting cylinders.				
Module 4	Digital Electronics, Microprocessors, and Controllers	Assignment	Data Collection	06 sessions
Digital Electronics, Microprocessors, and Controllers: Programmable logic controllers - Basic structure, programming and ladder diagram.				

List of Laboratory Tasks:

Experiment N0 1: Operation of a single acting & double acting cylinder in pneumatic trainer kit

Level 1: Understand the various parts of pneumatic system, direction control valves, hose pipe connections and circuit diagrams.

Level 2: Simulation of the circuit in AUTOSIM-200 software and control the movement of single and double acting cylinders.

Experiment No. 2: Operation of single acting cylinder using Pneumatic Dual pressure valve and Shuttle valve

Level 1: Understand the various parts of pneumatic system, direction control valves, hose pipe connections, pneumatic dual pressure valve & shuttle valve working and circuit diagrams.

Level 2: Simulation of the circuit in AUTOSIM-200 software and control the movement of single acting cylinders, and knowthe applications in safety systems.

Experiment No. 3: Simulation and operation of single cycle automation of multiple cylinders using cascading method in A+B+A-B-and A+B+B-A-sequence of motions.

Level 1: Understand the various parts of pneumatic system, direction control valves, roller DCV's, cascading types, working, applications and circuit diagrams.

Level 2: Simulation of the circuit in AUTOSIM-200 software and control the movement multiple double acting cylinders, and know the applications in automations.

Experiment No. 4: To perform the time delay and counting operation using pneumatic trainer kits

Level 1: Understand the various parts of pneumatic system, direction control valves, time delay valve and its working, working of counters, applications and circuit diagrams.

NO: PU/AC-16/EEE/2021-2025/2021

Level 2: Simulation of the circuit in AUTOSIM-200 software and control the movement multiple double acting cylinders, and know the applications in automations.

Experiment No. 5: Speed control of AC and DC motors

Level 1: Understand the working principle of AC, DC Motors and its circuit diagram.

Level 2: Control the AC and DC motor by varying inputs (current/voltage) and plot the graph to know the relationship between speed or load characteristics.

Experiment No. 6: Operation of double acting cylinders using Electro-pneumatic and PLC

based Pneumatic kits Level 1: Understand the concept of relays, solenoids, sensors and its working, Programmable logical controllers, ladder logics. Level 2: Simulate the double acting in AUTOSIM-200 software to know the working of electro-pneumatic and PLC. Later Control the double acting using Push-buttons, PLC software & computer. Targeted Application & Tools that can be used: This course finds applications mainly in automobile, space, defense, medical, consumer goods etc. Jobtitles might include Hydraulic or Pneumatic Design engineer, Maintenance engineer, calibration technician, Embedded Programmers, Automation engineer etc. Tools used in profession: PLC-Ladder Logic, AUTOSIM 200 –Software, keil □vision.
Text Book W. Bolton," Mechatronics ", Pearson Publication
References 1. HMT, "Mechatronics and Machine Tools", Tata McGraw Hill Education. 2. Mahalik," Mechatronics-Principals, concepts and Applications", Tata Mc Graw Hill Publication 3. https://nptel.ac.in/courses/112/107/112107298/ Web links: 1.https://www-sciencedirect-com-presiuniv.knimbus.com/journal/mechatronics 2.https://presiuniv.knimbus.com/user#/searchresult?searchId=mechatronics&_t=1655961642518
Topics relevant to "SKILL DEVELOPMENT": Elements of mechatronic system, system, measurement systems, control systems - open loop, closed loop systems, feedback and feed forward control systems for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout

Catalogue prepared by	Dr.Arpitha G R
Recommended by the Board of Studies on	15TH BOS held on 29/07/2022
Date of Approval by the Academic Council	No.18, 3/08/2022

<table>
<tr><td>Course Code:
MEC3085</td><td colspan="3">Course Title: Dynamics of Machines
Type of Course: Program core</td><td>L-T- P-C</td><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Version No.</td><td colspan="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">MEC2011</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The Course is designed with an objective of giving an overview of static and dynamic force analysis of machines and its methods. The Course discusses Static force analysis using graphical method and dynamic force analysis of basic mechanisms such as four bar mechanism, Slider crank mechanism using analytical method. Analysis of flywheel using turning moment diagrams is discussed with emphasis on I C Engines. The Course also includes the concepts of primary and secondary balancing of rotating masses and locomotives. The Course also contains Gyroscope, gyroscopic effects on engineering applications such as Aeroplanes, Naval ships and Automobiles. Further, Governors, types of governors and its applications are discussed</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of "Mechanical Engineering" and attain SKILL DEVELOPMENT through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
C01 Identify static and dynamic forces in a scenario.

C02 Compute the flywheel dimensions for engine and punching press application.

C03 Illustrate the effect of gyroscopic couple on aero planes, ships and automotive vehicles.

C04 Employ various methods to balance rotating and reciprocating masses.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Static and dynamic force analysis</td><td>Assignment</td><td colspan="2">Analytical thinking</td><td colspan="4">8 sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction- Static and dynamic force analysis, Conditions for static equilibrium, Static force analysis of mechanisms. Dynamic force analysis of mechanisms, dynamic analysis of slider crank mechanism, Engine force analysis, turning moment on crank shaft.</td></tr>
<tr><td>Module 2</td><td>Dynamics of Analysis of Flywheel</td><td>Quiz</td><td colspan="2">Analytical thinking</td><td colspan="4">6 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction, turning moment (crank effort) diagrams for reciprocating machines, coefficient of fluctuation of speed and energy, Design of flywheels for engines and punching machines</td></tr>
<tr><td>Module 3</td><td>Gyroscope</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td colspan="4">8 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.</td></tr>
<tr><td>Module 4</td><td>Balancing of Masses</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td colspan="4">8 Sessions</td></tr>
</table>

Topics:

Introduction, Balancing of rotating masses, balancing of reciprocating masses, Effect of partial balancing in locomotives, balancing of inline engines, Balancing of V Engines.

Targeted Application & Tools that can be used:

Application Area is collision of vehicles, aerospace, automobile kinematics and dynamics, vibration of machines.
Professionally Used Software: MATLAB

Text Books

1. S. S. Rattan, "Theory of Machines", Tata McGraw Hill.
2. J. R. Taylor, *Classical mechanics*, University Science Books, 2005.

References

1.J. J Uicker (Jr), G. R Pennock, and J. E Shigley, "Theory of Machines and Mechanisms" Oxford International Student Edition.
2. P L Ballaney, "Theory of Machines and Mechanisms", Khanna publishers.
3.The resources from the Engineering Dynamics Course from MIT OpenCourseWare from Fall, 2011, are available here: Link.
4.The resources from the Engineering Mechanics Course from SWAYAM-NPTEL from December, 2009 are available here: Link.
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609

Topics relevant to "SKILL DEVELOPMENT": Balancing of machines, Gyroscope working for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Mr. Kunwar Chandra Singh
Recommended by the Board of Studies on	**BOS No:** 15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

Course Code: MEC4005	Course Title: **Production Techniques-II** Type of Course: **Program Core & Lab Integrated**	L- P- C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course help students to develop the understanding of concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching, and CNC of machine tools and CNC Programming					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Production Techniques-II**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1 Describe the nomenclature of cutting tool and tool life. CO2 Explain various lathe and drilling operations CO3 Distinguish various milling, shaping & abrasive operations. CO4 Comprehend CNC programme on turning and milling operations.					
Course Content:						

Module 1	Theory Of Metal Cutting	Case Study	Compare and analyze the microstructure obtained during chip formation through matlab.	8 sessions

Topics:
Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

Module 2	Turning & Drilling Machines	Assign ment	Learning different lathe & drilling operations	6 sessions

Topics:
Lathe: Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle: Swiss type, automatic screw type – multi spindle
Drilling Machine: constructional features, specification, operations.
Lab: Conduct operations related to turning, milling drilling

Module 3	Shaper, Milling Gear Cutting, Abrassive & Broaching Machines	Assign ment	Simulate the gear cutting operation process using Deform software.	8 sessions

Topics:
Shaper – Types of operations. Drilling , reaming, boring, Tapping. Milling operations-types of milling cutter. **Gear cutting** – forming and generation principle and construction of gear milling hobbing and gear shaping processes –finishing of gears.

Abrasive processes: grinding wheel – specifications and selection, types of grinding process–

cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines. Lab: Conduct operations related to shaping				
Module 4	CNC Machining	Assign ment	CNC part programming	10 sessions
Topics: Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining. Lab: Conduct operations related to CNC turning.				
Targeted Application & Tools that can be used: Lathe, drilling,milling, shaper & abrasive machines are used in all manufacturing, Automobile, Aerospace, agriculture…etc. CNC machines are largely used in automobile and aerospace industry to make different parts.				
Text Book: **T1.** Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters 2014 **T2.** Rao. P.N "Manufacturing Technology – Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013.				
References: 1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White "Machine Tool Practices", Prentice Hall of India, 1998 2. Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 1984 3. HMT, "Production Technology", Tata McGraw Hill, 1998. 4. Roy. A.Lindberg, "Process and Materials of Manufacture," Fourth Edition, PHI/Pearson Education 2006 **Web-Resources:** W1: https://onlinecourses.nptel.ac.in/noc22_me28/preview W5. https://presiuniv.knimbus.com/openFullText.html?DP=http://journal.utem.edu.my/index.php/jamt				
Topics relevant to "SKILL DEVELOPMENT": CNC manual part programming, micromachining, wafer machining and Gear cutting through milling machine for **SKILL DEVELOPMENT** through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Mr. Aravinda T Assistant Professor, Dept. of Mechanical Engineering, Presidency University.			
Recommended by the Board of Studies on	15th BOS held on 29/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022			

Course Code: **MEC3090**	**Course Title: Design of Machine Elements I** **Type of Course:** **Program Core**	**L- T- P- C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	MEC2011					
Anti-requisites	NIL					
Course Description	The Course is designed with an objective of giving an overview of designing appropriate machine transmission components and their applications. Develops students' competence and self-confidence as design engineers. Emphasis on the creative design process bolstered by application of physical laws. Robustness and manufacturability are emphasized. Subject relies on active learning via a minor design-and-build project. Lecture topics include idea generation, estimation, concept selection, visual thinking, computer-aided design (CAD).					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Design of Machine Elements I**" and attain **SKILL DEVELOPMENT** through Problem solving methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1. Analyze machine components against static and dynamic loads using theories of failure CO2. Design springs for withstanding static and fatigue loads CO3. Design welded, riveted and bolted joints for general applications CO4. Design keys, cotter and knuckle joints for motion transmission. CO5. Design shafts, design engine components like gear.					
Course Content:						

Module 1	Introduction to Design Process	Assignment	Programming Task	08 sessions
Topics: Introduction to Design process – Factors – Materials selection - direct - Bending and Torsional stress equation - Impact and Shock loading - Factor of safety - Design stress - Theories of failures – Problems.				
Module 2	Fatigue strength	Case Study	Simulation and data analysis task	07 sessions
Topics: Stress concentration - theoretical stress concentration factor - Size factor - Surface limits factor - fatigue stress concentration factor - notch sensitivity - Variable and cyclic loads – Fatigue strength – S-N curve – Continued cyclic stress – Soderberg and				

Goodman equations.				
Module 3	Design of Mechanical Springs	Assignment	Simulation and data analysis task	07 sessins
Topics: Stresses and deflections of helical springs – extension -compression springs – springs for fatigue loading, energy storage capacity – helical torsion springs – Flat Spiral Springs - leaf springs. Computer aided design of springs				
Module 4	Design of Riveted, Welded and Bolted Joints	Assignment	Simulation	07 sessions
Topics: Riveted, Welded and Bolted Joints, Computer aided design of joints.				
Module 5	Design of Keys, cotters and knuckle joints	Assignment	Simulation/Data Analysis	06 sessions
Topics: Design of keys-stresses in keys-cotter joints-spigot and socket, sleeve and cotter, jib and cotter Joints- knuckle joints.				
Module 6	Design of Shafts	Assignment	Simulation/Data Analysis	06 sessions
Topics: Design of solid and hollow shafts for strength and rigidity – design of shafts for combined bending and axial loads – shaft sizes. Computer aided design of shafts and analysis				
Module 7	Design of spur gear	Assignment	Simulation/Data Analysis	04 sessions
Topics: Spur Gears: Definitions, Stresses in Gear Tooth: Lewis Equation and Form Factor, Design for Strength, Dynamic Load and Wear Load.				
Targeted Application & Tools that can be use**d:** **Contemporary issues: Knowledge of DME can help** students in becoming Design engineer, CAD release engineer, Dimensional engineer where various employability opportunities are available at all automotive industries, OEM's, Tier 1 and Tier 2 organizations Professionally Used Software: SolidWorks.				
Textbooks: V.B. Bhandari, Design of Machine elements, Tata Mc Graw Hill, 3rd Edition, 2010.				
References 1. P.C.Sharma & D.K.Aggarwal, A Text Book of Machine Design, S.K.Kataria & Sons, New Delhi,12th edition, 2012. 2. Jack A.Collins, Henry Busby, George Staab, Mechanical Design of Machine Elements and Machines, 2nd Edition, Wiley India Pvt. Limited, 2011. 3. Steven R. Schmid, Bernard J. Hamrock, Bo. O. Jacobson, Fundamentals of Machine Elements, CRC Press, Third Edition, 2014. 4. Juvinal, R.C and Kurt M.Marshek, Machine component design, John Wiley, 2012. 5. Design Data – K. Lingaiah, 2012. 6. E learning https://nptel.ac.in/courses/112/105/112105125/ https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&_t=1656917902483				
Topics relevant to "SKILL DEVELOPMENT": Design of Hollow shafts, gears for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.				

Catalogue prepared by	Mr. Sandeep G M
Recommended by the Board of Studies on	15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

Course Code: **MEC3091**	**Course Title: Finite Element Analysis** **Type of Course: Program Core & Lab Integrated Course**	**L-T-P- C**	2	0	2	3

Version No.	1.0
Course Pre-requisites	MAT1001, MAT1002
Anti-requisites	NIL
Course Description	The course is designed with the objective of giving an overview of the basics of finite element modeling of structures. It deals with the finite element formulation of one dimensional problems, like trusses and beams, two dimensional problems with constant triangles, axisymmetric solids subjected to axisymmetric loading, two dimensional isoparametric elements and time dependent problems.
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Finite Element Analysis**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.
Course Outcomes	**On successful completion of this course the students shall be able to:** **CO1:** Apply the principle of variational techniques to different machine/structural elements. **CO2:** Analyze the structural integrity of a machine with rods and bars. **CO3:** Analyze the structural integrity of a concrete building with beams and columns. **CO4:** Analyze the structural integrity of a steel reinforced skywalk. **CO5:** Analyze the temperature variation within an enclosure.
Course Content:	

Module 1	Introduction to Finite Element Method	Case Study	Programming	7 sessions

Topics:
General description of Finite Element Method – Historical development – Comparison with classical methods – Other numerical methods such as FDM, BEM, etc. - General procedure of FEM – Application software's in FEM.
General field problems - GDE formulation - discrete and continuous models – approximate solution as a polynomial - minimization of residue – Weighted residual methods –Galerkin method - Variational formulation Ritz method - numerical problems.

Module 2	Analysis of Bars	Case Study	Data collection. Programming & Data Analysis	8 sessions

Topics:
II order problems - Bar Problem – Formulation for the whole domain computing element matrices - Assembly of element matrices – Application of B.Cs – solution – post processing.

<table>
<tr><td>Module 3</td><td>Analysis of Beams</td><td>Case Study</td><td>Data collection. Programming & Data Analysis.</td><td>8 sessions</td></tr>
<tr><td colspan="5">Topics:
(IV order problems) – B.Cs & loading conditions on to nodes – element matrices - solution and post processing of results – I Dimension problems such as Heat transfer problems, Vibration problems in bar and beams.</td></tr>
<tr><td>Module 4</td><td>Analysis of Trusses</td><td>Case Study</td><td>Data collection. Programming & Data Analysis</td><td>7 sessions</td></tr>
<tr><td colspan="5">Topics:
Discretization: Geometrical approximations – Simplification through symmetry – Element shapes and behaviour – Choice of element types – Simplex - Complex and Multiplex elements – Selection of interpolation polynomials (shape functions) - Convergence requirements – Element shape and distortion – Location of nodes – Node and Element numbering, B.Cs & loading conditions on to nodes – element matrices - solution and post processing of results</td></tr>
</table>

List of Laboratory Tasks: No. of Sessions 15

ACTIVITY. 1: Introduction to Python and Ansys

Level 1: Installation of Python Studio, Data types in Python, Lists
Level 2: Matrices, mathematical operands, vector generation, sequence generation

ACTIVITY. 2: Structural analysis of Bars.
Level 1: Modelling.
Level 2: Simulation.

ACTIVITY. 3: Structural analysis of Beams
Level 1: Modelling.
Level 2: Simulation.

ACTIVITY. 4: Structural analysis of Trusses
Level 1: Modelling.
Level 2: Simulation.

ACTIVITY. 5: Structural analysis of Trusses
Level 1: Modelling.
Level 2: Simulation.

Targeted Application & Tools that can be used:
Application

- Automation and Robotics
- Automobile design and fabrication
- Construction and housing
- Machine Design and Analysis

Tools

- MATLAB
- Python
- Ansys

Text Book's

1. Introduction to finite elements in engineering by Chandrupatla, Tirupathi Belegundu, Ashok D. 4th Edition, Publications: New Delhi Pearson 2015.
2. Finite Element Analysis Theory and Application with Ansys by Saeed Moaveni, 4th Edition, Pearson Publications 2015.
3. Finite Element Analysis with Ansys Workbench by Pramote Dachaumphai, 1st Edition, Oxford Press, 2018.

4. Modelling and Simulation Lab manual – Presidency University, Bangalore.	
References 1. Finite Element Method in Engineering, by Rao, Singiresu S. 5th Edition Publisher: Amsterdam; Elsevier/Butterworth-Heinemann; 2014. 2. Introduction to the finite element method by Reddy, J N. Edition: 3, Publisher: New Delhi McGraw Hill Education 2005. 3. Finite element methods for engineers by Dixit, U S. Publisher: Andover Cengage Learning 2009. 4. Finite Element Analysis: Theory and Programming by C Krishnamoorthy second edition, McGraw Publications, 2017. Web Resources: https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_1105.	
Topics relevant to "SKILL DEVELOPMENT": Finite Element Method (FEM) – Application software's, General field problems - GDE formulation, discrete and continuous models for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Mr. ARUN AROGYASWAMY G
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022

<table>
<tr><td>Course Code: MEC3089</td><td colspan="3">Course Title: Heat-Mass Transfer
Type of Course: Program Core & Integrated Laboratory</td><td>L-T- P- C</td><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">MEC4001, MEC4003</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">This Course is designed to teach engineering students the concepts of heat transfer and application of heat transfer principles to the design. This Course provides an introduction to the fundamental concepts of heat transfer; Thermal conductivity steady-state and unsteady-state heat conduction multilayer conduction, heat transfer through a composite wall, critical insulation thickness, analytical and empirical relations for forced and free convection heat transfer; empirical relations used for pipe and tube flow, boundary layer and its thickness, heat exchanger analysis and design; to design and analyse the performance of heat exchangers and evaporators.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of " Heat-Mass Transfer" and attain SKILL DEVELOPMENT through Experiential learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">CO1] Apply the concept of steady state conduction heat transfer in solids.
CO2] Employ the methods of heat transfer with effective resistence.
CO3] Compute the heat transfer coefficient for natural and forced convection.
CO4] Apply the concept of radiation heat transfer between surfaces.
CO5] Compute the effectiveness of a specific heat exchanger.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Conduction</td><td>Assignment</td><td colspan="4">Data collection</td><td colspan="2">8 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction - basic modes of heat transfer and governing laws– conduction – general heat
conduction equation in Cartesian – one dimensional steady state conduction with and without heat generation – concept of thermal resistance – concept of composite wall – overall heat transfer coefficient – critical thickness of insulation – extended surface heat transfer – fin performance –effect of variable thermal conductivity- problems. Unsteady state conduction in one dimension, lumped heat capacity system
.</td></tr>
<tr><td>Module 2</td><td>Convection</td><td>Assignment</td><td colspan="4">Mathematical</td><td colspan="2">6 Sessions</td></tr>
<tr><td colspan="9">Topics:
Newton's law – concept of boundary layer – significance of Prandtl number – boundary layer
equations – flat plate heat transfer– laminar and turbulent flow – Reynolds analogy – empirical
relations in forced convection – internal flow – boundary conditions – laminar and turbulent flow
– heat transfer coefficients – empirical correlations. Natural convection.</td></tr>
<tr><td>Module 3</td><td>Radiation</td><td>Assignment</td><td colspan="4">Mathematical</td><td colspan="2">8 Sessions</td></tr>
</table>

Topics: Fundamentals of radiation – radiation spectrum – thermal radiation – concept of black body and grey body – monochromatic and total emissive power – absorptivity, reflectivity and transmissivity- laws of radiation – radiation between two surfaces – geometrical factors for simple configuration– radiation shields				
Module 4	Heat exchangers	Assignment	Mathematical	8 Sessions
Topics: Classification – log mean temperature difference – overall heat transfer coefficient – fouling and scaling of heat exchangers – LMTD and NTU method of performance evaluation of heat exchangers. Introduction to mass transfer – Fick's law of diffusion - problems				

List of Laboratory Tasks:

Experiment No. 1: To calculate the thermal conductivity of metal rod and to plot temperature distribution along the length of rod .
Level 1: To note down the temperatures readings on surface of copper rod.
Level 2: To measure the flow rate of water .
Experiment No. 2: To calculate the thermal conductivity of insulating powder.
Level 1: Measure the temperature on both sides of spherical shell.
Level 2: To determine the conductivity of powder.
Experiment No. 3: To study the heat transfer through insulating medium.
Level 1: To study the heat transfer through insulating medium .
Level 2: To calculate the heat transfer through insulating medium
Experiment No. 4: To study the heat transfer through conduction in composite wall
Level 1: To plot the performance characteristics..
Level 2: To calculate heat transfer.
Experiment No. 5: To study the heat transfer in forced convection
Level 1: To calculate surface heat transfer co-efficient for a pipe by forced convection .
Level 2: To compare heat transfer co-efficient for different air flow rates and heat flow rates..
Experiment No. 6: To study the heat transfer in natural convection
Level 1: To determine the heat transfer in natural convection
Level 2: To study the heat transfer in natural convection
Experiment No. 7: To study the heat transfer in a pin fin apparatus by forced convection..
Level 1: To determine the heat transfer in a pin fin apparatus by forced convection.
Level 2: To determine the heat transfer in a pin fin apparatus by forced convection.

Targeted Application & Tools that can be used:

Application Area is Geophysical phenomenon, Hydrology, Aerospace, Aerodynamics, Microfluidics, Pipe network, heat exchangers.
Industries using above applications and tools – Siemens, Quest Global, Simulent consulting, Triveni Engineering, TATA, GE etc

Text Book:

J P Holman, Souvik Bhattacharyya, "Heat Transfer" McGraw Hill Education (India)Pvt Ltd

References

1. S. P. Sukhatme, "A text book on heat transfer", Universities press (India) private limited.
2. F. P. Incropera and D.P.Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons.

Topics for Technology Enabled Learning:

NPTEL :: Mechanical Engineering - https://nptel.ac.in/courses/112108149

W2:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_1106	
Topics relevant to "SKILL DEVELOPMENT": LMTD, NTU Design for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through the assessment component mentioned in the course handout.	
Catalogue prepared by	Mr. Neeraj Singh
Recommended by the Board of Studies on	15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

Course Code: MEC3086	**Course Title: Design of Machine Elements-II** **Type of Course: Program Core & Theory**	**L-T-P- C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	MEC3090					
Anti-requisites	NIL					
Course Description	The Course is designed with an objective of giving an overview of designing appropriate machine transmission components and their applications. The Course covers: Design of Gears; Lubrication and Wear consideration in Design; Design and selection of Bearings: Hydrodynamic lubrication theory, Hydrostatic and Hydrodynamic bearings, Rolling Element Bearings; belts chains and Clutches Systems Approach to Design: Decision Making, Simulation of mechanical systems using CAD tools, Sensitivity analysis of design parameters, Value Analysis and Value Addition to design components and systems					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Design of Machine Elements-II**" and attain **SKILL DEVELOPMENT** through Problem solving methodologies.					
Course Outcomes	CO1 Select belts, ropes and chains for different engineering applications, CO2 Compute dimensions and stresses in different types of springs for different applications, CO3 Compute gear specifications for various engineering applications, CO4 Determine specifications for brakes and clutches used in practice,					
Course Content:						

Module 1	Belts, Ropes and Chains	Assignment	Data collection	07 Sessions
Topics: Flat Belts, Length & Cross Section, and Selection of V-belts, Ropes and Chains for Different Applications.				
Module 2	Springs	Assignment	Mathematical	09 Sessions
Types of springs - stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, leaf springs: stresses in leaf springs & equalized stresses.				
Module 3	Spur Gears	Assignment	Mathematical	20 Sessions
definitions, stresses in gear tooth, Lewis equation and form factor, design for strength, dynamic load and wear load. Helical Gears: Definitions, formative number of teeth, design based on strength, dynamic and wear loads. Bevel Gear: Definitions, formative number of teeth, design based on strength, dynamic and wear loads. Worm Gears: Definitions, design based on strength, dynamic, wear load and efficiency of worm gear drives.				
Module 4	Clutches and Brakes	Assignment	Mathematical	09 Sessions
Topics: Design of clutches: single plate, multi plate and cone clutches. Design of brakes, block and band brakes: self-locking of brakes: heat generation in brakes.				

Targeted Application & Tools that can be used: Application Area is Geophysical phenomenon, Hydrology, Aerospace, Aerodynamics, Microfluidics, Pipe network, Turbo-machinery. Industries using above applications and tools – Siemens, Quest Global, Simulent consulting, Triveni Engineering, TATA, GE etc
TEXTBOOKS: 1.Design of Machine Elements: V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition 2007. 2.Mechanical Engineering Design: Joseph E Shigley and Charles R. Mischke McGraw Hill International Edition, 6th Edition 2003. **Reference Book(s):** 1.Machine Design: Robert L. Norton, Pearson Education Asia, 2001. 2.Design of Machine Elements: M.F.Spotts, T.E. Shoup, L.E. Hornberger, S.R. Jayram and C.V. Venkatesh, Pearson Education, 2006. 3.Machine Design: Hall, Holowenko, Laughlin (Schaum‛s Outlines Series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008. 4.Fundamentals of Machine Component Design: Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007. **Web links:** https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=OAL1_7920
Topics relevant to "SKILL DEVELOPMENT": Ropes, belts, clutches design for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Mr. Wasim Akram
Recommended by the Board of Studies on	BOS NO: 11th BoS held on 05/09/2020
Date of Approval by the Academic Council	14th Meeting of the Academic Council held on 24/12/2020

Course Code: MEC4008	**Course Title: Mechanisms, Machines and Design Lab** **Type of Course: Program Core & Practical Only**	**L-T-P-C**	0	0	2	1
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	It is a new state of the art facility for experimental design research the Design Lab is providing facilities for students to learn different courses related to Mechanical Vibrations, Kinematics of Machines, Design of Machine Elements, Dynamics of Machines etc., and the concepts are demonstrated for better understanding to explore towards research and industrial engineering design field.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Mechanisms, Machines and Design Lab**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.					
Course Outcomes	**On successful completion of the course the students shall be able to:** CO1. To practically relate to concepts discussed in Design of Machine Elements, Mechanical Vibrations & Dynamics of Machines courses. CO2. To identify forces and moments in mechanical system components and identify vibrations in machine elements and design appropriate damping methods. CO3. To understand the working Principles of machine elements such as Governors, Gyroscopes and measure strain in various machine elements using strain gauges CO4. Perform the journal bearing experiments and record the observation.					
Course Content						

Syllabus:

PART-A

1. Determine the natural frequency of the given Simple Pendulum
2. Determine the radius of gyration 'k' of given compound pendulum
3. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional).
4. Determination of critical speed of a rotating shaft.

PART-B

1. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Proell / watt Governor (Only one or more).
2. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
3. Determination of stresses in Curved beam using strain gauge.
4. Determination of Pressure distribution in Journal bearing.
5. Gyroscope

Targeted Application & Tools that can be used:	
References R1: "Shigley's Mechanical Engineering Design", Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015. R2: "Design of Machine Elements", V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_8920.	
Topics relevant to "SKILL DEVELOPMENT": Determination of Principal Stresses and strains in a member subjected to combined loading, Curved beam, rotating shaft for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Yuvaraja Naik
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 22/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

<table>
<tr><td>Course Code:
MEC 3068</td><td colspan="3">Course Title: Production and Operations Management
Type of Course: Professional Core & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The purpose of this course is to enable the students to understand various components of Production management, Production planning, Production scheduling and model production management tools. The course is both conceptual and analytical in nature. The course develops the analytical, critical thinking, and decision making skills. The course also enhances the problem solving abilities through assignments.</td></tr>
<tr><td>Course Objective</td><td colspan="8">This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:

CO1) Recognize the importance of production management in industry.

CO2) Describe Facility location problems and aggregate planning.

CO3) Solve problems in sequencing and Scheduling in

production environment.

CO4) Summarize the various modern production

management tools.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Introduction to Production Management</td><td>Assignment</td><td colspan="3">Data Collection and Analysis</td><td colspan="3">10 Sessions</td></tr>
<tr><td colspan="9">Topics: Introduction, Production Management, Scope of Production Management, Production System, Types of Production Systems - Flow Shop, Job Shop, Batch Manufacturing and the Project, Benefits of Production Management, Productivity, Decisions of Production Management.</td></tr>
<tr><td>Module 2</td><td>Production Planning and Control</td><td>Case Study</td><td colspan="3">Simulation and data analysis task</td><td colspan="3">10 Sessions</td></tr>
<tr><td colspan="9">Topics: Characteristics of Production Planning and Control, Objectives of Production Planning and Control, Facility Location, Factors Influencing Plant Location, Single Facility Location Problem, Minimax Location Problem, Gravity Location Problem, Classification of Layout, Aggregate Planning, MRP Concept, MRP Calculations.</td></tr>
</table>

<table>
<tr><td>Module 3</td><td>Sequencing and Scheduling</td><td>Assignment</td><td>Data Collection and Analysis</td><td>13 Sessions</td></tr>
<tr><td colspan="5">Topics: Concept of Single Machine Scheduling - Shortest Processing Time (SPT) Rule to Minimize Mean Flow Time, Weighted Mean Flow Time, Earliest Due Date (EDD) Rule to Minimize Maximum Lateness, Introduction</td></tr>
<tr><td colspan="5">to Branch and Bound Technique to Minimize Mean Tardiness. Flow Shop Scheduling - Introduction, Johnson's algorithm, Extension of Johnson's Rule, Branch and Bound Technique, CDS Heuristic.</td></tr>
<tr><td>Module 4</td><td>Modern Production Management Tools</td><td>Case Study</td><td>Data collection and Programming</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics: Just-In-Time Manufacturing, Computer Integrated Manufacturing and Flexible Manufacturing System, Total Quality Management, Poka Yoke, Kaizen, Business Process Reengineering, Supply Chain Management, Lean Manufacturing, Quality Function Deployment.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:

Application Area include almost all manufacturing organizations (Automotive – Suzulki, Toyota, Hyundai, KIA, Ford etc.,) Processing industries (Petroleum – Reliance, Shell, HP etc., Cement industries – Dalmiya, UltraTech),

Professionally Used Software: DYNAMIC 3i Production Planning, IQMS, Fishbowl</td></tr>
<tr><td colspan="5">Project work/Assignment:
Project: Assuming yourself as an entrepreneur, carryout the analysis facility location for your new project.

Assignment: 1] Consider a flow shop environment and use the suitable algorithms to solve the problem considered.

Assignment 2: From your perspective, which are the modern tools of production management will have huge impact in the transition to industry 4.0 from current setting.</td></tr>
<tr><td colspan="5">Text Book
1. Pannerselvam. R, Production and Operations Management, PHI. 2012

2. Richard B. Chase, Nicholas J. Aquilano, F. Robert Jacobs, Production and Operations Management: Manufacturing and Services, Irwin/McGraw-Hill, 1998</td></tr>
<tr><td colspan="5">References
1. Chary, S. N. Production and operations management. McGraw Hill Education, 2017.

2. Singh S.P. Production and operations management. Vikas Publishing

House Pvt. Ltd., 2014. Website: https://praxie.com/top-operations-management-tools-and-templates/

Journal of Production and Operations Management, Knimbus Open Journals.

https://presiuniv.knimbus.com/openFullText.html?DP=http://uijs.ui.ac.ir/jpom/index.php?slc_lang=en&sid=1</td></tr>
<tr><td>Catalogue</td><td colspan="4">Dr. R. Jothi Basu</td></tr>
</table>

prepared by	
Recommended by the Board of Studies On	BOS NO: 15th BOS held on 29/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

<table>
<tr><td>Course Code:
MEC 3032</td><td colspan="2">Course Title: Energy Conversion Engineering Lab
Type of Course: Professional core & Laboratory only</td><td>L-T-P-C</td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">MEC4001, MEC4003</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The course aims at learning the practical concepts in different working cycles and operation of two stroke, four stroke SI and CI Engine cycles. Ignition, combustion, alternative fuels, emission and their control.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7">On successful completion of the course the students shall be able to:
CO1: Differentiate among different internal combustion engine designs.
CO2: Identify the various properties of fuels and lubricating oils.
CO3: Evaluate the engines performance characteristics of various engines.
CO4: Analyze the performance of the engine with computerized set up which enables the understanding of pressure variation with crank angle during a cycle of operation</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Energy Conversion Engineering Lab" and attain SKILL DEVELOPMENT through Experiential learning techniques.</td></tr>
<tr><td rowspan="8">Course Content:</td><td>Experiment No</td><td colspan="6">Experiment Name</td></tr>
<tr><td>1</td><td colspan="6">Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio heat balance sheet for Four stroke Diesel Engine
Determination of Flash point and Fire point using:
Cleveland Open cup apparatus (Kerosene)</td></tr>
<tr><td>2</td><td colspan="6">Abel's - Closed cup (Light oil – Kerosene)Pensky Martin - Closed cup (Diesel)</td></tr>
<tr><td>3</td><td colspan="6">Valve Timing Diagram of 4-stroke Petrol Engine</td></tr>
<tr><td>4</td><td colspan="6">Performance test on 4 – Stroke Petrol Engine with Eddy current dynamometer</td></tr>
<tr><td>5</td><td colspan="6">Performance test on 4 – stroke Diesel engine with eddy current dynamometer.</td></tr>
<tr><td>6</td><td colspan="6">Performance test on 4 – Stroke twin cylinder Diesel Engine with resistance loading test rig.</td></tr>
<tr><td>7</td><td colspan="6">Performance test on 4 – Stroke 4 cylinder Petrol Engine with hydraulic loading test rig</td></tr>
</table>

	8	Performance test on 4-Stroke 4 Cylinder Diesel Engine for Morse Test.
	9	Variable compression ratio for diesel engine with constant speed
	10	Performance test on 4-Stroke 4 Cylinder Petrol Engine for Morse Test

Targeted Application & Tools that can be used: Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio heat balance sheet for Four stroke Diesel Engine

Text Book

T1: "Energy Conversion Engineering Laboratory Manual", Presidency University.

T2: https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_264

References

R1**:** Internal Combustion Engine Fundamental by John B Heywood – Indian Edition, Tata McGraw-Hill

R2: Internal Combustion Engines by V Ganesan – 4th edition, Tata McGraw-Hill publication.

R3: Internal Combustion Engines by R.P Mathur & M L & Sharma – Dhanpat Rai publication.

(iii) Web-Resources:

https://presiuniv.knimbus.com/user#/searchresult?searchId=energy%20conversion&_t=1660731503338

Topics relevant to "SKILL DEVELOPMENT": Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency and Mechanical efficiency for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Narendra Singh , Asst. Professor, Dept. of Mechanical Engg.
Recommended by the Board of Studies on	**BOS No:** 15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022

Course Code: MEC3087	**Course Title: I.C. Engine and Fuels** **Type of Course: Program Core**	**L –T- P - C**	2	0	0	2
Version No.	2.0					
Course Pre-requisites	MEC4001 Basic Thermodynamics MEC4003 Applied Thermodynamics					
Anti-requisites	NIL					
Course Description	This course reviews the basic principles of physics for analysis of performance of IC engines. This course also includes fuels that are used for combustion, alternate fuels and different injection systems (mechanical and electronic). The course covers: Thermodynamic analysis of SI and CI engine combustion, Comparison of knocking in SI and CI engine. Fuels and Alternative fuels for I.C. engines, Formation and Control of Engine Emissions.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**IC Engines and Fuels**" and attain **SKILL DEVELOPMENT** through Participative learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1- Describe basic concepts of Internal Combustion Engines and evaluate their performance. CO2- Understand the necessity of different conventional and alternate fuels. CO3- Select appropriate injection systems for the given Engine. CO4- Explain the stages of combustion in both SI and CI Engines and their Knocking processes. CO5-Discuss different Emission Control packages and Emission Norms.					
Course Content:						

Module 1	Introduction to I. C. Engines	Assignment	Data Analysis Task	6 Sessions
Topics: **Introduction to I. C. Engines**: Heat engines. Types of heat engines, Difference between engines and turbines. Engine Nomenclature, IC engine classification, Engine performance Parameters. Numerical**.**				
Module 2	Conventional and Alternate Fuels	Assignment	Data Analysis Task	8 Sessions
Topics: **Conventional Fuels:** About fuels, Types of fuels (Solid, liquid, gaseous), , Petroleum Refining process, important qualities of Engine fuels. Chemical Structure of Petrol and Diesel **Alternate fuels** - Need for alternate fuels, Liquid fuels- methanol & ethanol for SI and CI Engines, Gaseous Fuels - Hydrogen, CNG, Biogas. Biodiesels – Production, Characterisation and testing				
Module 3	Carburetion and injection Systems	Assignment	Data Analysis Task	6 Sessions

<table>
<tr><td colspan="5">Introduction, Definition, Air-Fuel mixtures, Principle of carburetion, Simple carburetor-working principle.
Mechanical injection system –. Introduction. Functional requirement of an injection system, Classification of injection systems.
Electronic Injection System – Introduction, Electronic fuel injection systems. MPFI systems, Functional divisions of MPFI systems, Electronic control system (ECU).</td></tr>
<tr><td>Module 4</td><td>Combustion in IC Engines</td><td>Assignment</td><td>Data Analysis Task</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics
About combustion, Homogenous and Heterogeneous mixtures, Combustion in SI Engines, Stages of Combustion in SI engines, Flame front propagation, factors influencing Flame Speed, Rate of pressure rise, Abnormal combustion, The phenomenon of Knock in SI engines, Effect of Engine variables on Knock. Combustion in CI engines, Stages of Combustion in CI Engine, Factors affecting the delay period, The Phenomenon of Knocking, Comparison of Knock in SI and CI Engines.</td></tr>
<tr><td>Module 5</td><td>Engine Emissions and their Control</td><td>Assignment</td><td>Data Analysis Task</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics:
Pollutant from emissions - Carbon Monoxide, Carbon dioxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter. Emission Control packages – Catalytic converter Package, Thermal reactor package, Exhaust gas recirculation (EGR), Emission Norms, Bharath and Euro norms.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Application area are Indian Railways and power generation sector.
Tools used: CFD software</td></tr>
<tr><td colspan="5">References
R1: V.Ganesan, “Internal Combustion Engines”, Tata McGraw Hill Pub. Co. Ltd

R2: Pundir B.P, “IC Engines combustions and Emissions”, Narosa Publishers.
R3: John B. Heywood: “Internal Combustion Engines Fundamentals”, McGraw Hill International
Edition.
R4: M.L. Mathur and R.P Sharma: “A Course in Internal Combustion Engines”, D. Rai and Sons
e- learning:
https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&_t=1656917902483
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=iih&AN=124896850&site=ehost-live</td></tr>
<tr><td colspan="5">Topics relevant to “SKILL DEVELOPMENT”: The phenomenon of Knock in SI engines, Effect of Engine variables on Knock. Combustion in CI engines, Phenomenon of Knocking, Comparison of Knock in SI and CI Engines for SKILL DEVELOPMENT through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Dr. Udaya Ravi Mannar</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td colspan="4">11th BoS held on 05/09/2020</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td colspan="4">14th Meeting of the Academic Council held on 24/12/2020</td></tr>
</table>

23. Discipline Elective Courses Catalogues

Course Code: **MEC3045**	**Course Title: Polymer Engineering** **Type of Course: Discipline Elective & Theory Only**		**L-T- P- C**	3	0	0	3
Version No.	2.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	This course relates to polymers that constitute one of the most important materials used presently. Knowledge on solid state structure and properties of polymers will enable the proper selection for applications in domestic as well as industrial appliances.						
Course Out Comes	On successful completion of the course the students shall be able to: CO1] Summarize the classification, applications and principals of polymerization of Polymers CO2] Explain the different types of synthesis of polymers CO3] Explain the characterization of polymers CO4] Explain phase structure, morphology and properties of Bulk Polymers						
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **"Polymer Engineering"** and attain **EMPLOYABILITY SKILLS** through **Participative Learning** techniques.						
Course Content:							
Module 1	Introduction	Assignment	Data Collection				13 Sessions
Topics: Background, Nomenclature, Molecular Weight, Examples of Applications, Principles of Polymerization. Classification of polymers thermoplastic/ thermoset, addition/ condensation, natural /synthetic, crystalline/amorphous, step growth /chain growth, commodity…specialty, homochain/ 7 heterochain, confirmation: homo & copolymers configuration cis/trans; tacticity, branched/ crosslinked, Classification of polymers based on end use etc.							
Module 2	Synthesis of Polymers	Assignment	Data Collection				12 Sessions
Topics: Step-Growth Polymerization, Radical Chain Polymerization, Controlled Radical Polymerization, Chain Copolymerization, Emulsion Polymerization, Ionic Chain Polymerization, Ring-Opening Polymerization, Stereo-Regular Polymerization.							
Module 3	Characterization of Polymers	Assignment	Data Collection				10 Sessions
Topics: Polymers in Solution, Determination of Molecular Weight, Determination of Hydrodynamic Size, Chemical Composition, the molecular structure, the morphology of the polymer, thermal properties, mechanical properties, and any additives.							
Module 4	Phase Structure, Morphology and properties of Bulk Polymers	Assignment	Data Collection				10 Sessions
Topics: Amorphous and Crystalline States, Viscoelasticity, Multicomponent Polymer Systems, Polymer Characteristics, Mechanical, Optical, Electrical and Other Industrially Relevant Properties							

Targeted Application & Tools that can be used: Polymer engineering is relevant in various industries including Automotive, Aerospace, Medical, Building, Consumer Goods and Packaging.
Text Book 1. Introduction to Polymers, Third Edition by Robert J. Young, Peter A. Lovell, CRC Press,
References 1. Polymer Science and Technology, JR Fried,Prentice Hall, 2014 2. Materials Science of Polymers for Engineers,TA Osswald and G Menges, Hanser, 2012 3. https://nptel.ac.in/courses/103/106/105106205/ **Web links:** https://presiuniv.knimbus.com/user#/searchresult?searchId=polymer%20engineering&_t=1665999241542
Topics relevant to "EMPLOYABILITY SKILLS": Step-Growth Polymerization, Radical Chain Polymerization, Controlled Radical Polymerization, Chain Copolymerization, Emulsion Polymerization for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr.Arpitha G R
Recommended by the Board of Studies on	15th BOS held on 29/07/2022
Date of Approval by the Academic Council	No.18, dated 03/08/2022

Course Code: **MEC3065**	**Course Title: Introduction to Robotics and Automation** **Type of Course: Discipline Elective & Theory Only**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course provides an overview of robot anatomy, motion control system and intelligent controls. A wide scope is given to the area of Applications where in students understand how robotics can be applied in different industrial applications. The course also enhances the practical applications of robots and automation through case studies.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **"Introduction to Robotics and Automation"** and attain **EMPLOYABILITY SKILLS** through **Participative Learning techniques.**					
Course Out Comes	**On successful completion of the course the students shall be able to:** CO1] Describe Robot, Robotics and Various Components of Robots. CO2] Describe various types of sensors, actuators and its applications in robotics. CO3] Discuss different type of Automation and applications. CO4] Describe the different types of Automated manufacturing systems.					
Course Content:						

Module 1	Introduction to Robotics	Assignment	Data Collection	10 Sessions
Topics: Definition of Robot, History of robotics, Robotics market and the future prospects, Robot Anatomy, Robot configurations: Polar, Cartesian, cylindrical and Jointed-arm configuration. Robot motions, Joints, Work volume, Robot drive systems, End effectors – Tools and grippers.				
Module 2	Robot Sensors and Machine vision system	Assignment	Data Collection	13 Sessions
Topics: Sensors in Robotics - Tactile sensors, Proximity and Range sensors, use of sensors in robotics. Machine Vision System: Introduction to Machine vision, the sensing and digitizing function in Machine vision, Image processing and analysis, Training and Vision systems. Machine Vision System: Introduction to Machine vision, the sensing and digitizing function in Machine vision.				
Module 3	Introduction to Automation	Assignment	Data collection and Analysis	12 Sessions
History of Automation, Reasons for automation, Disadvantages of automation, Automation systems, Types of automation – Fixed, Programmable and Flexible automation, Automation strategies. Industrial Applications of Automation systems.				
Module 4	Automated Manufacturing Systems	Case Study	Data collection and analysis	10 Sessions
Components, classification and overview of manufacturing Systems, Flexible Manufacturing				

Systems (FMS), Types of FMS, Applications and benefits of FMS. Review of NC, CNC, DNC, Adaptive control and robotics in manufacturing. Advantages, disadvantages and applications.
Targeted Application & Tools that can be used: Industrial applications of robots: Pick and place robots, welding and other industrial applications. Automation in industries.
Text Book: 1.Robotics for Engineers by Yoram Koren, Mc Graw-Hill. • 2. An Introduction to Automated Process Planning Systems- Tiess Chiu Chang & Richard A. Wysk. Categories.
References: 1. Robot Technology by Philippe Coffet (Vol. 1 to Vol. 7) 2. Walking Machines, An introduction to legged Robots by D J Todd 3. Fundamentals of Robot Technology by D J Todd 4. Introduction to Autonomous by Roland Siegwart, Illah R Nourbakhsh, MIT Press, 2004 5. Rotobis: State of the art and future, **Web links:** 1. https://presiuniv.knimbus.com/user#/searchresult?searchId=Introduction%20to%20robotics%20and%20automation&_t=1655968277251
Topics relevant to "EMPLOYABILITY SKILLS": The sensing and digitizing function in Machine vision, Image processing and analysis, Training and Vision systems **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	**Dr. Arpitha G R**
Recommended by the Board of Studies on	15th BOS, 29/7/2022
Date of Approval by the Academic Council	No.18, 3/08/2022

<table>
<tr><td>Course Code:
MEC3049</td><td>Course Title: Mechanics of Composite Materials
Type of Course: Discipline Elective</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">Introduction to composite Materials, Fiber Reinforced Plastic Processing, Applications and Mechanics of Fiber Reinforced Plastics, Characteristics of Fiber-Reinforced lamina, Laminated structure, Metal Matrix Composites, Fabrication Process for MMC‵s and Study Properties of MMC‵s, Micromechanics and Macro-mechanics of lamina and Failure theories.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of ‶ Mechanics of Composite Materials ″ and attain EMPLOYABILITY SKILLS through Problem Solving methodologies</td></tr>
<tr><td>Course Out Comes</td><td colspan="6">On successful completion of the course the students shall be able to:
CO1. Describe the various techniques of manufacturing metal matrix and fiber reinforced composites.
CO2. Compute the Various Elastic Properties Using the Micromechanics Principle.
CO3. Compute the Various Elastic Properties Using the Macromechanics Principle.
CO4. Describe the Various Failure Theories and Methods Involved in Recycling of Composite Materials.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Introduction to Composite Materials:</td><td colspan="2">Assignment</td><td colspan="2">Data Collection</td><td>10 Sessions</td></tr>
<tr><td colspan="7">Introduction to Composite Materials:
Definition and classification of composite materials: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon-Carbon Composites. Reinforcements and Matrix Materials.
Manufacturing Techniques of Composites:
Fiber Reinforced Plastic (FRP) Processing: Layup and curing, fabricating process, open and closed mould process, Hand layup method, filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding.
Fabrication Process for Metal Matrix Composites (MMC’s): Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.</td></tr>
<tr><td>Module 2</td><td>Elastic Behaviour of</td><td colspan="2">Case Study</td><td colspan="2">Data</td><td>15 Sessions</td></tr>
</table>

<table>
<tr><td></td><td>Composite Lamina-Micromechanics:</td><td></td><td>collection</td><td></td></tr>
<tr><td colspan="5">Scope and approaches, Micromechanics methods: Mechanics of Materials Methods, Semi Empirical Methods, Geometric Aspects and Elastic Symmetry, Longitudinal and Transverse Elastic Properties-Continuous Fibers, In-Plane Shear Modulus, Longitudinal and Transverse Elastic Properties-Discontinuous (short) Fibers, Numericals.</td></tr>
<tr><td>Module 3</td><td>Elastic Behaviour of Composite Lamina-Macromechanics</td><td>Case Study</td><td>Data collection</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Stress Strain Relationship, Relations between Mathematical and Engineering Constants, Stress-Strain Relations for a Thin Lamina, Transformation of Stresses and Strain, Transformation of Elastic Parameters, Transformation of Stress-Strain Relations in Terms of Engineering Constants, Transformation Relations for Engineering Constants, Related Numericals.</td></tr>
<tr><td>Module 4</td><td>Strength of Composite Lamina:</td><td>Assignment</td><td>Data Collection</td><td>10 sessions</td></tr>
<tr><td colspan="5">Strength of Composite Lamina: Tensile and Compressive strength of Unidirectional Fiber Composites. Fracture Modes in Composites; Single and Multiple Fracture, Debonding, Fiber Pullout and Delamination Fracture. Strength of an Orthotropic Lamina; Maximum Stress Theory, Maximum Strain Criterion, Tsai-Hill Criterion, Tsi -Wu tensor theory. Comparison of Failure Theories</td></tr>
<tr><td colspan="5">Text Book
Composite Science and Engineering by K.K. Chawla Springer Verlag 1998</td></tr>
<tr><td colspan="5">References
1. Engineering Mechanics of Composite Materials, Second Edition, Issac M Daniel, Ori Ishai.
2. Mechanics of Composite Materials, Robert M.Jones, McGraw Hill Kogakusha Ltd.1998.
3. Mechanics of composites by Autar K Kaw, CRC press.2002.
Web links:
1.https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER4_2168
2.https://presiuniv.knimbus.com/user#/searchresult?searchId=introduction%20to%20composite%20materials&_t=1655967300201</td></tr>
<tr><td colspan="5">Topics relevant to "EMPLOYABILITY SKILLS": Layup and curing, fabricating process, open and closed mould process, Hand layup method, filament winding, pultrusion, pulforming for developing EMPLOYABILITY SKILLS through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Dr. Arpitha G R</td></tr>
<tr><td>Recommended by the Board of</td><td colspan="4">11th BOS held on 05/09/2020</td></tr>
</table>

Studies on	
Date of Approval by the Academic Council	No.14, 24/12/2020

<table>
<tr><td>Course Code: MEC3039</td><td>Course Title: Non Destructive testing
Type of Course: Discipline Elective theory</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">Nondestructive testing (NDT) is a wide group of analysis techniques used in science and industry to evaluate the properties of a material, component or system without causing damage. Because NDT does not permanently alter the article being inspected, it is a highly-valuable technique that can save both money and time in product evaluation, troubleshooting, and research. Common NDT methods include ultrasonic, magnetic particle, liquid penetrant, radiographic, and eddy-current testing. Penetrant is used to check discontinuities i.e. cracks, pits etc. open to the surface on parts made of non-porous materials. This method depends on the ability of the penetrant to enter into a surface discontinuity in the material to which it is applied. It is applicable to all solid non-porous material</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of " Non Destructive Testing" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="6">On successful completion of the course the students shall be able to:
CO1.Describe various types of nondestructive testing methods.
CO2.Explain the various techniques in Magnetic particle inspection
CO3.Select an appropriate NDT method for a specific material in Ultrasonic testing.
CO4.Discuss advantages and limitations of Radiographic testing methods.
CO5.Recognize the developments and future trends in Eddy current testing.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Introduction to Non Destructive Testing</td><td>Assignment</td><td>Data Collection</td><td colspan="3">12 Sessions</td></tr>
<tr><td colspan="7">Outline to NDT, Assessment, Flaw detection and evaluation, Scope and limitations of NDT. Defects: Catastrophic failures, defects in materials, selection of NDT methods. Economics aspects of NDT. Visual Inspection: Methods and equipment's use for visual inspection. Applications and limitation. Leak and Pressure testing. Liquid Penetrant Testing: Physical principles, Procedure for penetrant testing, characteristics of penetrant.</td></tr>
<tr><td>Module 2</td><td>Magnetic Particle Testing</td><td>Case Study</td><td>Data collection</td><td colspan="3">8 Sessions</td></tr>
<tr><td colspan="7">Significant terminologies related to magnetic properties of material, principle of magnetic particle inspection, procedure for testing, methods used for magnetization, magnetic particles and suspending liquids, applications and limitations. Applications of Magnetic Particle Testing and its techniques.</td></tr>
<tr><td>Module 3</td><td>Ultrasonic Testing</td><td>Case Study</td><td>Data collection</td><td colspan="3">8 Sessions</td></tr>
</table>

Overview, principle, characteristics of ultrasonic waves, wave propagation, reflection and attenuation of ultrasonic beams, variables in ultrasonic inspection, equipment's, transducer elements, search units and basic inspection methods, Standards, Applications of Ultrasonic Testing and its techniques.				
Module 4	Radiographic Inspection	Assignment	Data Collection	8 sessions
Discovery of X-rays, Introduction, basic principle, methods used for radiographic inspection, Production of X-ray, X-ray and Gamma– ray radiography, properties of X-ray and Gamma rays, real time radiography and film radiography. Advantages, limitations and applications, (inspections of flat surfaces, Weldments and tubular sections). Interpretation of radiographs, Safety in industrial radiography.				
Module 5	Eddy Current Inspection	Assignment	Data Collection	8 sessions
Processing and defects, Materials in service, Quality and standardization Electricity Magnetism, principles, Magnetic field produced by a current, Electromagnetic induction law, Factors effecting eddy currents, Principles and basic characteristics of eddy current probes Technology and Practical characteristics of probes, different types of eddy current equipment Influence of material temperature, Influence of structure and geometry of tested parts (noise), Influence of relative part/probe speed, Reference standards used in eddy current testing, Eddy current testing codes and standards, Safety, applications of eddy current inspection.				

Textbook(s)

T1. Practical Non – Destructive Testing, Baldev Raj, Narosa Publishing House ,2007

T2. Non-Descriptive Testing, Dr. S. Ramachandran, Mr. T. Raja Santhosh Kumar, Dr. Anderson,

(ii) Reference Book(s)

R1. Barry Hull & Vernon John, Non-destructive Testing, Springer-Verlag, New Yor Inc, 1988.

R2. R. Halmshaw, Non-destructive Testing, 2nd edition. Edward Arnold, London, 1991.

R3. Mc Gonnagle W. J., Non-destructive testing, Gordon & Beach Science, New York, 1983.

(iii) Web-Resources:

https://www.nde-ed.org

https://nptel.ac.in/courses/113106070

https://www.youtube.com/results?search_query=non+destructive+testing+methods

Non-Destructive Testing, Fausto Pedro Garcia Marquez (ed.) 2016.

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBOOKDIRECTORY_1_3387

Topics relevant to "EMPLOYABILITY SKILLS": Principle of magnetic particle inspection, procedure for testing, methods used for magnetization, magnetic particles and suspending liquids, applications and limitations for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr.Arpitha G R
Recommended by the Board of Studies on	15TH BOS held on 29/07/2022
Date of Approval by the Academic Council	No.18, 3/08/2022

Course Code: MEC3021	**Course Title: Intelligent Machining and Manufacturing** **Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	Manufacturers are increasingly utilizing machine tools that are self-aware – they perceive their own states and the state of the surrounding environment – and are able to make decisions related to machine activity processes. This is called intelligent machining, and through this course student will receive a primer on its background, tools and related terminology. Learn how the integration of smart sensors and controls are helping to improve productivity. You'll be exposed to various sensors and sensing techniques, process control strategies, and open architecture systems that can be leveraged to enable intelligent machining. This course will prepare you to contribute to the implementation of intelligent machining projects.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Intelligent Machining and Manufacturing** " and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1. To define intelligent manufacturing. CO2. To describe different type of sensors with their application for different manufacturing process. CO3. To list different process control strategies used for intelligent manufacturing and machining. CO4. To discuss future direction in advanced machining.					
Course Content:						
Module 1	Introduction to Intelligent Machining	Assignment	10 Sessions			
Topics: Introduction to intelligent machining, machining basics, the evolution of intelligent machining, components of intelligent machining.Scope of machine intelligence in manufacturing systems - modelling and control of processes and machines.						
Module 2	Sensors and Sensing Techniques	Case Study	13 Sessions			
Topics: Introduction of sensors, types of sensors, signal processing transforming data into information, practical uses of machine learning. Sensor-based Robotic systems for assembly, welding, machining etc. and mobile robots. Task level planning and path planning. Visuo-motor coordination and navigation problems. Intelligent structures. Behavioural approach and subsumption architecture for learning from environment						
Module 3	Process Control Strategies	Assignment	12 Sessions			

Topics: Programmable of logic controllers (PLC), Closed loop Process control systems, introduction to adaptive control, commercially available software. Neuro-Fuzzy-Expert systems for uncertain reasoning. Concept learning, associative memory and connectionist learning systems. Data abstraction in parallel distributed architectures.			
Module 4	Future Directions in Advanced Machining	Assignment	10 Sessions
Topics: Intelligent Machining and the future, roadmap to success.			
Targeted Application & Tools that can be used: 1. Creating intelligent factories where manufacturing technologies are upgraded and transformed by cyber-physical systems (CPSs), the Internet of Things (IoT), and cloud computing 2. To make manufacturing systems able to monitor physical processes, create a so-called "digital twin" (or "cyber twin") of the physical world, and make smart decisions through real-time communication and cooperation with humans, machines, sensors, and so forth. 3. Industry 4.0 combines embedded production system technologies with intelligent production processes to pave the way for a new technological age that will fundamentally transform industry value chains, production value chains, and business models. **Professionally Used Software:** • AI & Machine Learning: no-code visual workflows, • Python language.			
Text Books: 1. Turgul Ozel and J Paulo Davim, "Intelligent Machining: Modeling and Optimization of the Machining Processes and Systems" Willy, 2009. 2. C Prakash, S Singh, J P Davim, G Krolczyk, "Advances In Intelligent Manufacturing", Springer, 2019.			
References 1. Sunil Pathak ., "Intelligent Manufacturing, Springer". 2. R, Bick Lesser, " Intelligent Manufacturing" ,CRC Press, 2013. 3. Website: www.pgcl.gov.in			
Topics relevant to "EMPLOYABILITY SKILLS": Sensor-based Robotic systems for assembly, welding, machining etc. and mobile robots. Task level planning and path planning. Visuo-motor coordination and navigation problems for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.			
Catalogue prepared by	Mr. Ajay Kumar Mishra		
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21		
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21		

Course Code: **MEC3012**	**Course Title: Material and Characterisation Techniques** **Type of Course: Discipline Elective & Theory only**		**L-T- P- C**	3	0	0	3
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	In this course student will have an opportunity to learn something about the fundamentals of the structure/properties relationships of all types of materials. This Course introduce the students to the principles of optical and electron microscopy, X-ray diffraction and various spectroscopic techniques like X-ray diffraction, optical, scanning electron and transmission electron microscopy along with demonstrations of the instrument details and imaging experiments through videos.						
Course Objectives	The objective of the course is to familiarize the learners with the concepts of " **Material and Characterisation Techniques**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.						
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1] Identify the different engineering materials and associated properties. CO2] Choose appropriate microscopy techniques to investigate microstructure of materials at high resolution. CO3] Explain the martial composition and their phases using diffraction techniques. CO4] Summarize the Thermal, Electrical and optical chaectrization form materials						
Course Content:							

Module 1	Introduction to materials	Assignment	Report on General characterization techniques of metals	16 Sessions
Topics: Classification of engineering materials, Structure-property relationship in engineering materials, Crystalline and noncrystalline materials, Miller Indices, Crystal planes and directions. Defects; Point, line and surface defects. Overview of properties of engineering materials, Selection of materials for different engineering applications. Need of materials characterization and available techniques				
Module 2	Microscopy techniques	Case Study	Identify the micro structure morphology	16 Sessions
Topics: Introduction to Microscopes, Optical microscopy (OM), Transmission Electron Microscopy (TEM); Basic Electron scattering, Concepts of resolution, TEM instruments, Various imaging modes, Analysis of micrographs, Electron Energy Loss Spectroscopy Scanning Electron Microscopy, Rutherford backscattering spectrometry Atomic Force Microscopy, Scanning Probe Microscopy, Specimen preparation, Applications.				
Module 3	Structure analysis	Assignment	Report on material phases and associated properties	11 Sessions
Topics: X-ray diffraction, Phase identification, indexing and lattice parameter determination,				

Analytical line profile fitting using various models Neutron diffraction; Reflection High energy electron Diffraction (RHEED), Low energy Electron Diffraction (LEED).	
Targeted Application & Tools that can be used: Application Area is material characterization Professionally Used Software: Image analysis software, Phase analysis software, etc...	
Text Book 1. William D. Callister, Jr., " Materials Science and Engineering " Eighth Edition, Wiley india Pvt. Ltd,. 2. Materials Characterization Techniques, S Zhang, L. Li and Ashok Kumar, CRC Press (2008)	
References 1. Tyagi, A.K., Roy, Mainak, Kulshreshtha, S.K., and Banerjee, S., Advanced Techniques for Materials Characterization, Materials Science Foundations (monograph series), Volumes 49 – 51, (2009) . 2. Characterization of Materials (Materials Science and Technology: A Comprehensive Treatment, Vol 2A & 2B, VCH (1992). https://nptel.ac.in/courses/113/106/113106034/ 3. https://presiuniv.knimbus.com/openFullText.html?DP=https://ieeexplore-ieee-org-presiuniv.knimbus.com/document/133425/	
Topics relevant to "EMPLOYABILITY SKILLS": Electron scattering, Concepts of resolution, TEM instruments, Various imaging modes, Analysis of micrographs, Electron Energy Loss Spectroscopy Scanning Electron Microscopy, Rutherford backscattering spectrometry Atomic Force Microscopy, Scanning Probe Microscopy, Specimen preparation, Applications for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Ashish
Recommended by the Board of Studies on	15th BOS Dated of BOS 29/07/22
Date of Approval by the Academic Council	16thAcademic Council Meeting & the date of the meeting: 23/10/21

Course Code: **MEC3066**	**Course Title: Python for Automation** **Type of Course: Discipline Elective**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course aims at helping students understand the basics of Python from a mechanical engineering perspective. Python is widely used in many industries owing to its ease of use and simple syntax. The course covers topics from the basic variable definition and covers the basic tools in Python to perform mathematical operations and data analysis of text files. This knowledge would be of use for mechanical engineers since Python offers widespread applications in the field of automation and data analysis.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of " **Python for Automation**" and attain **EMPLOYABILITY SKILL** through Experiential learning techniques					
Course Out Comes	On successful completion of the course the students shall be able to: CO1. Gain a fundamental grasp of Python to use graphing library for visualization. CO2. Use Python to perform various mathematical operations as well as data manipulation.					
Course Content:						

Module 1	Introduction to Python Data Structures	Term paper/Assignment	Programming	10 sessions
Topics: Integers + Floats; Variables; Strings; Methods + Functions; Booleans; Conditonal Statements; Lists; Indexing into strings + lists; Looping over lists.				
Module 2	Plotting, Visualization & Solving equations	Assignment	Programming	10 sessions
Topics: Learn to write programs to plot the relation between 2 variables (like Pressure-Volume lines). Solve ordinary differential equations using scipy module.				
Module 3	Curve Fitting, Regression & Iterative Solvers	Assignment	Programming	09 sessions
Topics: Predicting the relationship between different variables for which an existing relationship doesn't exist, and also predict what will happen in the future using the trend of the plot. (SciPy module).				
Module 4	Webscraping	Assignment	Programming	08 sessions
Topics: Introduction to using packages; Performing a GET request; String manipulation; Debugging a Python script , Beautiful Soup package; Honing in on data; Common webscraping pitfalls; Using loops in webscraping				
Module 5	Data Analysis	Case Study	Programming	8 sessions

Topics: Data manipulation to post-process the results from simulation. Automate the post-processing procedure
List of Laboratory Tasks: **Experiment N0 1:** Study of Integers + Floats; Variables; Strings; Methods + Functions; Booleans . **[Level 1]** **Experiment No. 2:** Study of Indexing into strings + lists; Looping over lists . **[Level 1]** **Experiment No. 3:** write programs to plot the relation between 2 variables (like Pressure-Volume lines). **[Level 1]** **Experiment No. 4:** ordinary differential equations using scipy module . **[Level 1]** **Experiment No. 5:** Performing a GET request; String manipulation . **[Level 1]** **Experiment No. 6:** Debugging a Python script , Beautiful Soup package **[Level 2]** **Experiment No. 7:** Predicting the relationship between different variables for which an existing relationship doesn't exist **[Level 2]**
Targeted Application & Tools that can be used: Job profiles like Data Analyst, PLM engineer etc Python 3.0 programming language.
Text Book 1. Python for Mechanical & Aerospace Engineering by Alexander Kenan, December 2020. (Not Available in Library)
References 1. Automate the Boring Stuff with Python, 2nd Edition: Practical Programming for Total Beginners, By Al Sweigart, 2019 2. Web Scraping with Python: Collecting Data from the Modern Web by Ryan Mitchell, OReilly Publication, April 2015. 3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_290
Topics relevant to "EMPLOYABILITY SKILLS": Integers + Floats; Variables; Strings; Methods + Functions; Booleans; conditional Statements; Lists; Indexing into strings + lists; Looping over lists for developing **EMPLOYABILITY SKILLS** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Sudheer R
Recommended by the Board of Studies on	12th BOS Number and the Date of BOS 06/8/21
Date of Approval by the Academic Council	16th Academic Council Meeting No. & the date of the meeting: 23/10/21

Course Code: MEC3095	**Course Title: Advanced Fluid Mechanics** **Type of Course: Discipline Elective**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	MEC2010 Fluid Mechanics					
Anti-requisites	NIL					
Course Description	This is an advanced course in Fluid Mechanics. The subject Fluid Mechanics has a wide scope and is of prime importance in several fields of engineering and science. Present course emphasizes the fundamental underlying fluid mechanical principles and application of those principles to solve real life problems. Special attention is given towards deriving all the governing equations starting from the fundamental principle. There is a well-balanced coverage of physical concepts, mathematical operations along with examples and exercise problems of practical importance.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Advanced Fluid Mechanics**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: CO1] solve the boundary layer equations for laminar flows. CO2] obtain the exact solutions to N-S equations for different geometries CO3] solve the equations for turbulent flow and its models. CO4] apply the numerical techniques for fluid flow problems.					
Course Content:						

Module 1	Introduction and Equations of Fluid Motion	Assignment	Mathematical	12 Sessions
Topics: Definition of fluids, continuum concept, indicial notation, tensors, Cauchy stress tensor, fluid statics, fluid properties, importance of studying viscous flows, examples of fluid flow problems, Eulerian and Lagrangian description, strain-rate, vorticity, circulation, streamlines, streamlines and path lines, stream function, Derivation of continuity equation, Navier--Stokes (N--S) equation and energy equations; Stokes hypothesis, special cases, conservative and non-conservative forms, boundary conditions, cylindrical coordinates, vorticity equation, control volume formulation, integral and differential approaches in fluid dynamics, laminar and turbulent flow.				
Module 2	Exact solution of N--S equations	Assignment	Mathematical	12 Sessions
Topics: Planar Poiseuille flow and Couette flow problems, Hagen-Poiseuille flow, flow between two concentric cylinders - axially moving and rotating; unsteady flow - pressure gradient effects and boundary effects (Stokes first and second problems); similarity solution - plane stagnation flow, flow near a rotating disk, flow in wedge-shaped regions; potential flow; low-Reynolds number creeping flows - Stokes solution, Oseen's approximation, theory of hydrodynamic lubrication.				
Module 3	Boundary Layer analysis and Stability	Assignment	Mathematical	11 Sessions

<table>
<tr><td colspan="5">Topics:
Derivation of boundary layer equations, displacement, momentum and energy thickness, order of magnitude analysis, shape factor, momentum integral method, exact solution, separation, pressure gradient effects, approximate methods, free-shear boundary layers, asymptotic expansion, 3D laminar boundary layers Introduction to hydrodynamic stability; linearised stability analysis -- Orr-Sommerfeld equation; transition to turbulence</td></tr>
<tr><td>Module 4</td><td>Turbulent flow</td><td>Assignment</td><td>Mathematical</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Introduction to the physical and mathematical nature of turbulent flow, Reynolds averaging and RANS equations, turbulence modelling, empirical laws, turbulent boundary layers (without and with pressure gradient), turbulent internal flows, free stream turbulence. non-Newtonian flow.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:

Application Area is Geophysical phenomenon, Hydrology, Aerospace, Aerodynamics, Microfluidics, Pipe network, Turbo-machinery.
Industries using above applications and tools –Oil Companies (IOCL, SHELL, BPCL and others), Automobile and Aviation companies (GE, AIRBUS, TATA Motors and others)</td></tr>
<tr><td colspan="5">Text Book:
Schlichting, H., Boundary layer Thoery, Mc Graw Hill, (1987).</td></tr>
<tr><td colspan="5">References:
1. Hinze, Jo., Turbulence, McGraw Hill, (1975).
2. Anderson D. A., Tannhill, I.C., and Pletcher, R.H., Computational Fluid Mechanics and Heat Transfer, Hemisphere Publication, (1984).
3. Fox, R. W. and McDonald, A. T., Introduction to fluid Mechanics, John, Wiley & Sons, (1985).
4. Tennekes, H. and Lumley, J. L., A First Course in Turbulence, M.I.T. Press, (1972).
5. Streeter, V.L. and Wylie, E.B., Fluid Mechanics, McGraw Hill, (1979).
Topics for Technology Enabled Learning:

Knimbus - Your Library. Anywhere, Anytime.</td></tr>
<tr><td colspan="5">Topics relevant to “EMPLOYABILITY SKILLS”:Planar Poiseuille flow and Couette flow problems, Hagen-Poiseuille flow, flow between two concentric cylinders - axially moving and rotating; unsteady flow - pressure gradient effects and boundary effects for developing EMPLOYABILITY SKILLS through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Dr. Devendra Singh Dandotiya</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td colspan="4">15th BOS held on 27/08/2022</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td colspan="4">18th Meeting of the Academic Council held on 03rd August, 2022</td></tr>
</table>

<table>
<tr><td>Course Code:
MEC3028</td><td colspan="3">Course Title: Compressible Fluid Flow
Type of Course: Discipline Elective</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">MEC2010</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The course begins with the basics of thermodynamics and fluid mechanics, including types of flows. The next large block of lectures covers wave motion, and isentropic flows and effect of friction and heat transfer on ducts. The second half of the course deals with shock waves and its effect on various properties and concludes with another small block dealing with introduction of multi-dimensional flows.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of “Compressible Fluid Flow” and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="8">On successful completion of the course the students shall be able to:
CO1 Define various thermodynamics and fluid flow properties and types of flows;
CO2 Analyze the assumptions and physical meaning of terms in the equations of motion for continuum flow;
CO3 Solve the governing equations for various flows including flow through ducts, normal and oblique shocks and its effect on various flow properties;
CO4 Solve the problems based on various shock waves, nozzle and diffuser, Rayleigh line and Fanno Curves;
CO5 Understand the concepts of the multi-dimensional flow.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Basic</td><td>Assignment</td><td colspan="3">Experiment</td><td colspan="3">5 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction, Thermodynamic properties like pressure, temperature, density, volume, equilibrium, ideal gas, 1st, 2nd, and 3rd laws of thermodynamics, enthalpy and entropy, various Fluid flows like laminar and turbulent, steady and unsteady, compressible and incompressible flows, Mach number.
Assignment: Teal time temperatutre measurement using thermocouple</td></tr>
<tr><td>Module 2</td><td>Isentropic Flow and Wave Motion</td><td>Assignment</td><td colspan="3">Analysis</td><td colspan="3">20 Sessions</td></tr>
<tr><td colspan="9">Topics:
Comparison of isentropic and adiabatic process, Mach number variation, stagnation function, Mass flow rate, Impulse function, Flow through nozzle and diffuser, Wave propagation in elastic solid medium, sound waves, steep finite pressure waves and expansion waves.
Assignment: Analyse an aerodynamics body under sub-sonic, sonic and supersonic flow condition by using Fluent software.</td></tr>
<tr><td>Module 3</td><td>Shocks (Normal and Oblique)</td><td>Assignment</td><td colspan="3">Data Analysis</td><td colspan="3">11 Sessions</td></tr>
<tr><td colspan="9">Topics:
Development of shock waves, Governing equations, Prandtl-Meyer relation, Static pressure ratio, temperature ratio, density ratio, stagnation pressure ratio, change in entropy across the shock, strength of shock, Mach number for subsonic flow, introduction to oblique shock, its relation, Prandtl equation, Rankine-Hugoniot equation.</td></tr>
</table>

Assignment: Obtain the fluid flow behavior of normal shock over various shaped-bodies using Ansys Fluent.				
Module 4	Flow in constant area ducts with friction and heat transfer	Case study	report	7 Sessions
Topics: Fanno Curves, Fanno Flow equations and its solutions, variation of flow properties, table and charts for Fanno flow, Rayleigh line, Fundamental equation, variation on flow properties, charts and tables for Rayleigh flow. **Assignment:** Write a brief report on below article related to flow in constant area duct. https://www.researchgate.net/publication/332798145_Fanno Flow AdiabaticFlow in a Constant Area Duct with Friction				
Module 5	Introduction to Multidimensional Flow	Assignment	Study based	2 Sessions
Topics: Continuity, momentum for Cartesian coordinates, Navier-stokes equation. **Assignment:** Derive a Navier strokes equation for cylindrical body				
Targeted Application & Tools that can be used: Application area mainly includes in Aerospace, aerodynamics of aircraft, Rocket propulsion, etc. Tools used: MS Excel, ANSYS Fluent				
Text Book: **T1:** S M Yahya, "Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion", 5th Edition, New Age International Private Limited, 2016. **References:** **R1:** Michel A Saad, "Compressible Fluid Flow", 2nd Edition, Pearson Publication, 1992. **R2:** Ascher H. Shapiro, "The Dynamics and Thermodynamics of Compressible Fluid Flow", 1st Edition, John Wiley & Sons Publication, 1953. **E-Resources:** **W1**: https://nptel.ac.in/courses/112/103/112103294/ **W2**: https://presiuniv.knimbus.com/user#/searchresult?searchId=compressible%20fluid%20flow&_t=1662529184385				
Topics relevant to "EMPLOYABILITY SKILLS": Thermodynamic properties like pressure, temperature, density, volume, equilibrium, ideal gas, 1st, 2nd, and 3rd laws of thermodynamics, enthalpy and entropy, various Fluid flows like laminar and turbulent, steady and unsteady for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout				
Catalogue prepared by	Mr. Pranay Nimje			
Recommended by the Board of Studies on	15th BoS held on 22/07/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

<table>
<tr><td>Course Code: MEC3031</td><td>Course Title: Computational Fluid Dynamics
Type of Course: Discipline elective</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">MEC2010</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The Course is designed with an objective of giving an overview of computational fluid dynamics (CFD), governing equations of fluid dynamics, mathematical behavior of partial differential equations, basic aspects of discretization, grids with appropriate transformations, and simple CFD techniques and their applications, numerical solutions of quasi-one-dimensional nozzle flows, numerical solution of a two-dimensional supersonic flow, incompressible Counter flow, and supersonic flow over a flat plate and advanced topics in CFD.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "Computational Fluid Dynamics" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">On successful completion of the course the students shall be able to:
CO1. Understand the fundamentals of CFD and deriving governing equations.
CO2. To give a basic understanding to the discretization of equations of mass, momentum and energy.
CO3. Apply different CFD techniques to diffusion problems.
CO4. Solving convection-diffusion problems and N-S equation.
CO5. Understand numerical grid generation and apply time integration and turbulence methods to complex flows</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Introduction</td><td>Assignment</td><td colspan="2">Mathematical</td><td colspan="2">6 Sessions</td></tr>
<tr><td colspan="7">Topics:
Introduction to CFD, Advantages, applications and the future of CFD, CFD solution procedure, problem setup processes, numerical solution, results report and visualization.</td></tr>
<tr><td>Module 2</td><td>Governing Equations for CFD</td><td>Assignment</td><td colspan="2">Mathematical</td><td colspan="2">8 Sessions</td></tr>
<tr><td colspan="7">Topics:
Conservation equation; mass; momentum and energy equations; convective forms of the equations and general description, Classification into various types of equation; parabolic elliptic and hyperbolic; boundary and initial conditions; over view of numerical methods.</td></tr>
<tr><td>Module 3</td><td>CFD mesh generation and techniques</td><td>Assignment</td><td colspan="2">Mathematical</td><td colspan="2">13 Sessions</td></tr>
<tr><td colspan="7">Topics:
Types of meshes, local mesh refinement, moving meshes, guidelines for mesh quality and mesh design, Discretization of governing equations: FDM, FVM, converting</td></tr>
</table>

governing equations to algebraic equation, FDM, FVM and comparison of the finite difference and finite volume method, numerical solutions to algebraic equations, pressure velocity coupling.				
Module 4	CFD solution analysis: Essentials	Assignment	Mathematical	8 Sessions
Topics: Consistency, stability, convergence, accuracy Efficiency, case studies: channel flow and flow over a 90° bend.				
Module 5	Practical guidelines for CFD simulation and analysis	Assignment	Mathematical	10 Sessions
Topics: Guidelines for boundary conditions, turbulence modelling, strategy for selecting turbulence modelling, near wall treatments, test case: assessment of two equation turbulence modelling Indoor air flow distribution, gas particle flow in a 90° bend, heat transfer coupled with fluid flow.				
Targeted Application & Tools that can be used: Application Area is Geophysical phenomenon, Hydrology, Aerospace, Aerodynamics, Microfluidics, Pipe network, Turbo-machinery. Industries using above applications and tools – Siemens, Quest Global, Simulent consulting, Triveni Engineering, TATA, GE etc				
References 1. Jiyuan Tu, Guan Yeoh, Chaoqan Liu, "Computational Fluid Dynamics: A Practical Approach", Elsevier. 2. John D. Anderson Jr, "Computational Fluid Dynamics: The basics with Applications" McGraw Hill Education.. 3. J. C. Anderson, D. A. Tannehil and R. H. Pletcher, "Computational Fluid Mechanics and Heat Transfer", Taylor & Francis publications, USA (1997) **4.** H. Versteeg, W. Malalasekra, "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", Pearson edition **Topics for Technology Enabled Learning:** https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_1106 https://nptel.ac.in/courses/112105045				
Topics relevant to "EMPLOYABILITY SKILLS": Conservation equation; mass; momentum and energy equations; convective forms of the equations and general description, Classification into various types of equation for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Devendra Singh Dandotiya			
Recommended by the Board of Studies on	15th BoS held on 22/07/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

Course Code: **MEC3027**	**Course Title: Refrigeration & Air Conditioning** **Type of Course: Discipline elective& Theory Only**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	MEC4001					
Anti-requisites	NIL					
Course Description	The Course is designed with an objective of giving an overview of principles of Refrigeration and Air conditioning (R and AC), thermodynamic analysis of R and AC systems, load estimates and design of various R and AC systems for comfort and industrial applications. The Course also includes theoretical or experimental investigation of refrigeration and air-conditioning problems.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Refrigeration & Air Conditioning**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1. Evaluate the performances of complex vapor compression systems. CO2 Choose suitable components for refrigeration system. CO3. Execute thermodynamic analysis of absorption refrigeration systems CO4. Evaluate various psychrometric properties from measured values of barometric pressure, dry bulb and wet bulb temperatures. CO5. Calculate the internal and external cooling loads on a building.					
Course Content:						

Module 1	Introduction	Assignment	Data Analysis	Session-8
Topics: Basic concepts: unit of refrigeration and COP, refrigerators, heat pump, Carnot refrigerator, applications of refrigerators, vapor compression refrigeration, ideal cycle, effect of sub cooling of liquid, super heating of vapor, deviations of practical (actual cycle) from ideal cycle, construction and use of p-h chart problems.				
Module 2	Refrigerator Components	Assignment	Data Analysis	Session-10

Topics:
Compressors: classification, working, advantages and disadvantages; Condensers: classification, working Principles. Evaporators: classification, working Principles; Expansion devices: types, working principles. Refrigerants: Properties, nomenclature selection of refrigerants, effects of refrigerants on global warming, alternate refrigerants.

Module 3	Vapour Absorption Refrigeration	Assignment	Data Analysis	Session-6

Topics: Vapor absorption refrigeration: description, working of NH3-Water, Li Br–water system, calculation of HCOP, Principle and operation of three fluid vapor absorption refrigeration systems.

Module 4	Properties of Moist Air (Psychrometry)	Assignment	Data Analysis	Session-6

Topics: Composition of moist air, Methods for estimating moist air properties, Methods for estimating moist air properties, Important psychrometric properties, Relations between psychrometric properties, Introduction to humidity ratio vs. dry-bulb temperature, psychrometric chart

Module 5	Air Conditioning Systems	Assignment	Data Analysis	Sessions-15

Topics: Psychometric properties and processes, sensible and latent heat loads, characterization, need for ventilation, consideration of Infiltration, load concepts of RSHF, ASHF, ESHF and ADP; concept of human comfort and effective temperature, comfort air conditioning, industrial air conditioning and Requirements, air conditioning load calculations.

Targeted Application & Tools that can be used:

Application area includes HAVC systems

Tools used: MS Excel, Matlab

References:

1. C. P. Arora, Refrigeration and Air Conditioning‖ Tata McGraw-Hill, 17th Edition, 2006.
2. S.C. Arora, S Domkundwar, "A Course in Refrigeration and Air-Conditioning: Environmental Engineering", Dhanpat Rai.
3. 2. J. W. Jones, W. F. Stoecker, "Refrigeration and Air-Conditioning", McGraw Hill Education.
4. Ananthanarayanan, Basic Refrigeration and Air Conditioning‖, Tata McGraw-Hill, 2015.
5. Manohar Prasad, "Refrigeration and Air Conditioning‖ New Age International, Third Edition, 2015

6. P. L. Ballaney, Refrigeration and Air Conditioning‖ Khanna Publishers, 16th Edition, 2015. Web link [Presidency University (knimbus.com)] https://nptel.ac.in/courses/112105129	
Topics relevant to "EMPLOYABILITY SKILLS": Composition of moist air, Methods for estimating moist air properties, Methods for estimating moist air properties, Important psychrometric properties, Relations between psychrometric properties for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout	
Catalogue prepared by	Dr. Devendra Singh Dandotiya
Recommended by the Board of Studies on	12th BoS held on 06/08/2021
Date of Approval by the Academic Council	16th Meeting of the Academic Council held on 23rd October, 2021

Course Code: MEC3016	Course Title: Statistics and Quality Control Type of Course: Discipline Elective & Theory only		L-T-P-C	3	0	0	3
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	The purpose of this course is to enable the students to understand underlying concepts in statistical quality control and to develop ability to apply those concepts to the design and management of quality control processes in industries. The course is both conceptual and analytical in nature. The course develops the analytical, critical thinking, and decision making skills. The course also enhances the problem solving abilities through assignments.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Statistics and Quality Control**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.						
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1. Explains the basic concept of Quality, Quality tools CO2. Analyze process capability and operating characteristic curves CO3. Construct control charts and evaluate revised control limits CO4. Describe Six sigma methodology to improve quality						
Course Content:							
Module 1	Quality – An overview	Assignment	Data Collection and Analysis	6 Sessions			
Topics: Introduction and definition of quality, quality control, Cost of quality, 7 basic Quality control tools.							
Module 2	Data collection and measurement analysis.	Case Study	data analysis task	15 Sessions			
Topics: Type of data – variable and attributes, Data Sampling –Population and sampling, determining sample size, types of sampling, variation, types of variation- common cause, special cause, total variation. statistical hypothetical test, practical examples. Measurement system analysis- discrimination, accuracy, precision, Gauge R&R, Kappa analysis, Base lining- for discrete data- DPO, DPU, DPMO, using sigma value. For continuous date – Process Capability. Data analysis using Minitab Software.							
Module 3	Control Charts	Assignment	Data Collection and Analysis	14 Sessions			
Topics: Control limits vs Specification Limit, Classification of Control charts, Control charts for variable data – I&MR chart, X bar R chart, X bar S chart. Control chart for attribute data							

– C chart, U chart, P chart, Np chart Data analysis using Minitab Software.				
Module 4	Six Sigma – Quality Improvement Tool	Case Study	Data Collection and Analysis	10 Sessions
Topics: Introduction, DMAIC approach, DMADM approach, case studies.				
Targeted Application & Tools that can be used: Application Area is in health services, government organizations, banking and others such as marketing, finance, purchasing, industrial relations etc. Professionally Used Software: Minitab/ Excel				
Text Book **T1: M. Mahajan, Statistical Quality Control, Dhanpat Rai & Co. (P) Limited (2016),** T2: Chandra, M. Jeya. Statistical quality control. CRC Press, 2001. **References** R1: Montgomery, D. C., Introduction to Statistical Quality Control, John Wiley & Sons, 2002. R2: Dhillon, B. S., Applied Reliability and Quality: Fundamentals, methods, and Procedures, Springer, London, 200 **Weblinks:** https://www.mt.com/in/en/home/applications/Laboratory_weighing/statistical-quality-control.html https://www.iise.org/TrainingCenter/CourseDetail/?EventCode=SQC Work Study Journal, Emerald insight https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/00438029810238606/full/html International Journal of Quality & Reliability Management, Emerald insight https://presiuniv.knimbus.com/openFullText.html?DP=https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/02656719710165428/pdfplus/html				
Topics relevant to "EMPLOYABILITY SKILLS": Measurement system analysis- discrimination, accuracy, precision, Gauge R&R, Kappa analysis, Base lining- for discrete data- DPO, DPU, DPMO, using sigma value. For continuous date – Process Capability for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Ms. Antara Ravindra Sarode			
Recommended by the Board of Studies on	BOS NO: 11th BOS held on 05/09/2020			
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 24/12/2020.			

Course Code: MEC3041	**Course Title: CAD/CAM Laboratory** **Type of Course:1] Discipline Elective** **2] Laboratory only**	**L- T-P-C**	0	0	2	1
Version No.	2.0					
Course Pre-requisites	MEC1006					
Anti-requisites	NIL					
Course Description	The techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes and writing part program for simple machine parts. develop Confidence and ability to tackle problems related to CAD based modelling and CNC programming. Ability to interpret and assess errors and eliminate them, Select suitable codes, operations and materials for part manufacturing. The ability to follow standard programming and modelling procedures and write reports.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**CAD/CAM Laboratory** " and attain **EMPLOYABILITY SKILL** through Experiential learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1] Use CAD packages for Modeling of simple machine parts and assemblies from the part drawings. CO2] Write CNC Turning and Milling codes for different operations using standard CAM packages. CO3] Develop manual part programming using ISO codes for turning and milling operations					
Course Content:	**Mention the List of tasks proposed to be conducted indicating at least 2 different levels of experiment for each of the task [Where ever possible]** **Task 01:** Cotter joint **Level No 01:** Part modelling of Cotter joint **Level No. 02** 3D Assembly of Cotter joint **Task 02:** Screw jack **Level No 01** Part modelling of Screw jack **Level No. 02** 3D Assembly of Screw jack **Task 03** Fuel Injector **Level No 01** Part modelling of fuel injector **Level No 02** 3D Assembly of fuel injector **Task 04** Connecting rod **Level No 01** Part modelling of Connecting rod **Level No 02** 3D Assembly of Connecting rod **Task 05** Universal Coupling **Level No 01** Part modelling of Universal Coupling **Level No 02** 3D Assembly of Universal Coupling **Task 06** Write and simulate CNC programming for hobbing operation as per given drawing **Level No 01** Write and simulate the CNC programming for hobbing operation as per given drawing **Level No 02** Write and simulate the CNC programming for Taper hobbing as per given drawing using canned cycle **Task 07** Write and simulate the CNC programming for Thread cutting operation as per given drawing **Level No 01** Write and simulate the CNC programming for Thread cutting operation as per given drawing **Level No 02** Write and simulate the CNC programming for Thread cutting operation as per given drawing using canned cycle					

	Task 08 Write and simulate the CNC programming for tapping operation as per given drawing **Level No 01** Write and simulate the CNC programming for tapping operation as per given drawing **Level No 02** Write and simulate the CNC programming for tapping operation as per given drawing using canned cycle **Task 09** Write and simulate the CNC programming for Drilling operation as per given drawing **Level No 01** Write and simulate the CNC programming for Drilling operation as per given drawing **Level No 02** Write and simulate the CNC programming for Drilling operation using canned cycle **Task 10** Write and simulate the CNC programming for Drilling and milling operation as per given drawing **Level No 01** Write and simulate the CNC programming for Drilling and milling operation as per given drawing **Level No 02** Write and simulate the CNC programming for Drilling and milling operation as per given drawing using canned cycle
Targeted Application & Tools that can be used: Standard CAD Packages e.g. Catia, SolidWorks, Pro E, UG-NX etc. Standard CAM packages e.g. CAMworks, Gibbs CAM, NX CAM etc. **Industry:** Engineering and manufacturing technology solutions companies, e. g. Automobile companies, aerospace etc.	
Text Book **1]** CAD/CAM Theory and Practice by Ibrahim Zeid.	
Reference 1] CAD/CAM Principles and Applications by P.N. Rao, Tata McGraw Hill Publishing Company Ltd. 2] CAD/CAM Computer Aided Design and Manufacturing by Mikell P. Groover and Emory W. Zimmer, Jr. 3] https://nptel.ac.in/courses/112/102/112102102/ Web links: 1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=OAL1_5119. 2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_5353	
Topics relevant to "EMPLOYABILITY SKILLS": 3D assembly of different parts and CNC program for turning and drilling operation for developing **EMPLOYABILITY SKILLS** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Madhusudhan M
Recommended by the Board of Studies on	15th BOS and the Date of BOS 22/07/22
Date of Approval by the Academic Council	18thAcademic Council Meeting & the date of the meeting: 03/08/22

Course Code: **MEC3042**	**Course Title: Powder Metallurgy** **Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course provides detailed knowledge of powder production and processing as well as to choose the right method to suit application in hand. The course discusses various techniques which are used for powder production and the versatile nature of these techniques to produce a wide range of products. The major goal of the course is to hasten development of the necessary scientific and engineering base in the field of Powder Metallurgy i.e., to establish the powder fabrication route as a technologically and economically viable means of materials production.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Powder Metallurgy**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1] Acquire the knowledge of Powder Metallurgy History, Applications and its importance. CO2] Measure various powder characteristics like apparent density, tap density, flow rate, friction index etc. CO3] Distinguish between various metal powder productions techniques. CO4] Explain the mechanism of sintering and types of sintering for development of various mechanical properties along with its applications.					
Course Content:						

Module 1	Introduction	Case Study	Data collection	05 Sessions
Topics: Historical and modern developments in Powder Metallurgy. Advantages, limitations and applications of Powder Metallurgy**.** Microstructure control, Powder Characterization				
Module 2	Characteristics of Metal Powder	Assignment	Chemical Analysis of metal powder	10 Sessions
Topics: Chemical composition, Particle size, shape and size distribution, Characteristics of metal powder such as apparent density, tap density, flow rate, friction index**.** Powder Fabrication: Mechanical & Chemical fabrication				
Module 3	Metal powder production techniques	Assignment	Comparison of Powder production techniques	10 Sessions
Topics: Atomization, Reduction from oxide, Electrolysis, Crushing, Milling, Powder Fabrication: Electrolytic fabrication & Atomization, Hydride and carbonyl processes, Mechanical				

<table>
<tr><td colspan="5">Alloying, New developments.</td></tr>
<tr><td>Module 4</td><td>Powder Characterization</td><td>Assignment</td><td>Powder compaction techniques</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Powder conditioning, fundamentals of powder compaction, density distribution in green compacts, compressibility, green Strength, Powder packing, mixing and blending</td></tr>
<tr><td>Module 5</td><td>Sintering</td><td>Assignment</td><td>Sintering Analysis</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Definition, stages, effect of variables, sintering atmospheres and furnaces, Mechanism, liquid-phase sintering, Secondary operations, Activated and Liquid phase Sintering</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Application area is modern non-conventional manufacturing techniques for Industrial and commercial products.
Software : PMsolver</td></tr>
<tr><td colspan="5">Textbooks
1. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi.</td></tr>
<tr><td colspan="5">References
1. Principles of Powder Metallurgy, A.S. TSukerman, Pergamon.
2. Powder Metallurgy: Science, Technology, and Materials, Anish Upadhyaya, Gopal Shankar
Upadhyaya, CRC Press.
Weblinks:
1.https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER4_2528</td></tr>
<tr><td colspan="5">Topics relevant to "EMPLOYABILITY SKILLS":Atomization, Reduction from oxide, Electrolysis, Crushing and Milling for developing EMPLOYABILITY SKILLS through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Dr. Madhusudhan M</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td colspan="4">15th BOS and the Date of BOS 27/08/22</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td colspan="4">18thAcademic Council Meeting
& the date of the meeting: 3/08/22</td></tr>
</table>

<table>
<tr><td>Course Code:
MEC3055</td><td colspan="2">Course Title: Product Design for Manufacturing and Assembly
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3 | 0 | 0 | 3</td></tr>
<tr><td>Version No.</td><td colspan="4">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="4">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="4">NIL</td></tr>
<tr><td>Course Description</td><td colspan="4">The purpose of this course is to enable the students to appreciate the need for influence the design of parts and part systems. Students will be introduced to the Design for Manufacturability (DFM) methodology, and will be motivated to understand infeasible or impractical designs. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of “: Product Design for Manufacturing and Assembly” and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of this course the students shall be able to:

CO1] Understand constraints of manufacturing processes that limit design possibilities with respect to cycle time, material handling, and other factory costs.
CO2]Apply casting considerations in machining
CO3]Apply principles of DFA to make efficient patterns and moulds
CO4]Select proper materials and manufacturing processes Die casting</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Material and process selection</td><td>Assignment</td><td>Demonstration of the Experiment</td><td>12 sessions</td></tr>
<tr><td colspan="5">Topics:
Introduction, Advantages of applying DFMA, General requirements of early materials and process selection, Selection of Manufacturing processes, Selection of materials. Engineering Design features. – Dimensioning, Tolerances, General Tolerance, Geometric Tolerances, Assembly limits, achieving larger machining tolerances, Datum features.</td></tr>
<tr><td>Module 2</td><td>Machining Considerations</td><td>Assignment</td><td>Case study</td><td>12 sessions</td></tr>
<tr><td colspan="5">Topics:
Machining Considerations – Drills, Milling cutters, Drilling, Keyways, Dowels, Screws, Reduction in machining areas, Simplification by separation and amalgamation, work piece holding, surface grinding, Examples</td></tr>
<tr><td>Module 3</td><td>Casting Procedures</td><td>Assignment</td><td>Design of molds using AutoCAD</td><td>11 sessions</td></tr>
<tr><td colspan="5">Topics:
Pattern, Mould, parting line, cast holes, machined holes, identifying parting line, special sand cores, designing to obviate sand cores. Examples. Injection molding materials, Molding cycle, Systems, molds, machine size, cycle time, Cost estimation, Insert molding,</td></tr>
<tr><td>Module 4</td><td>Design for Die casting and Powder metal processing –</td><td>Assignment</td><td>Seminar</td><td>10 sessions</td></tr>
<tr><td colspan="5">Topics:
Die casting alloys, cycle, machines, dies, finishing, Assembly techniques, Design principles, Powder metallurgy processing, stages, compaction characteristics, Tooling, Sintering, Design</td></tr>
</table>

guidelines
Targeted Application & Tools that can be used: Finding the various fits and tolerances of components experimentally using gauges and analyzing the same using Autodesk invent software
Text Books 1.Product Design for Manufacture and Assembly – Geoffrey Boothroyd - Peter Dewhurst - Winston Knight – Marcel Dekker, Inc. – Newyork - Second Revison, ISBN 0-8247-0584-X.
References 1. Designing for Manufacturing – Harry Peck - Pitman Publications –1983. 2. Dimensioning and Tolerancing for Quantity Production – Merhyle F Spotts –Inc. Englewood Cliffs - New Jersey - Prentice Hall, 5thedition. **Web links** 1. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=553239&site=ehost-live 2. https://presiuniv.knimbus.com/user#/searchresult?searchId=Product%20Design%20for%20Manufacturing%20and%20Assembly&_t=1657343468338.
Topics relevant to "EMPLOYABILITY SKILLS": Work piece holding, Handling machining parameters and its features, selection of parameters for different operations on machines for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Madhusudhan M
Recommended by the Board of Studies on	19th BOS dated 05/07/2024
Date of Approval by the Academic Council	24th Meeting of the Academic Council held on 03/08/2024

Course Code: MEC3038	**Course Title: Smart Manufacturing** **Type of Course: Discipline Elective & Theory only**		**L-T-P-C**	3	0	0	3
Version No.	2.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	Smart Manufacturing is an amalgamation of Information Technology, Cloud Computing & traditional Mechanical, Production Engineering towards achieving excellence in manufacturing. Maximum results with minimum resources being used. concepts of Smart Manufacturing, how various technologies can be leveraged to achieve minimum breakdowns, First Time Right Production, 100% Delivery on Time with minimum turnaround time. Nine Pillars of Smart Manufacturing will be explained to the Students developments in Technology those are going to alter the Traditional Manufacturing scenario. The following topics may be broadly covered in the classroom. The practical will be in the form of Group Discussion based on Case Study.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Smart Manufacturing**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.						
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1] Explain the different areas of Industrial Internet CO2] Outline the designing industrial internet systems CO3] Explain the security of the Industrial Internet CO4] Outline the active part of industry 4.0 CO5] Explain the economic aspects and applications of day to day life smart factories						
Course Content:							

Module 1	Introduction to the Industrial Internet	Assignment	A report on use of IoT in common applications	08 Sessions
Topics: The Internet of Things: An overview; Horizontal and vertical aspects of the Internet of Things, What Is the Industrial Internet?, Innovation and the IIoT, Intelligent Devices, Introduction to Industry 4.0 , Industry 4.0 Reference assembly line, lean Manufacturing				
Module 2	Designing Industrial Internet Systems	Case Study	On IIoT	08 Sessions
Topics: The Concept of the IIoT, Modern Communication Protocols, Wireless Communication Technologies, Building Blocks of Industry 4.0, AI&ML				
Module 3	Securing the Industrial Internet	Case Study	Report on system Security	10 Sessions
Topics: Security in Manufacturing, PLC, Securing the OT, Network Level: Potential Security Issues, System Level: Potential Security Issues, Smart Factories in current trends and				

its impact				
Module 4	Introducing Industry 4.0	Assignment	Industrial revolution	10 Sessions
Topics: Defining Industry 4.0, Why Industry 4.0 and Why Now?, Four Main Characteristics of Industry 4.0, The Value Chain, Industry 4.0 Design Principles, Building Blocks of Industry 4.0, Big Data and Analytics, Autonomous Robots, Simulation, The Industrial Internet of Things (IoT), Industry 4.0 Reference Architecture, Smart Manufacturing, Equipment, Redefine the Workforce, Products, Business Processes, Application Area is any manufacturing/processing industries				
Module 5	Smart Factories	Case study	Identification of areas where Smart Manufacturing can flourish	09 Sessions
Topics: Introducing the Smart Factory, Smart Factories in Action, Why Smart Manufacturing Is Important, Real-World Smart Factories, Siemens' Amberg Electronics Plant (EWA), Industry 4.0: The Way Forward, Adopt Smart Architectures and Technologies, Industry 4.0 Design Principles, design principles of Industry 4.0				
Targeted Application & Tools that can be used: Application Area is any manufacturing/processing industries Professionally Used Software: PLC and IoT.				
References 1.OEE Guide to Smart Manufacturing, Dr. Jill A O'Sullivan, ISBN – 97809912142-4-2, Library of Congress, IMAE Business & Academic ERP Implementation Series 2.E learning https://nptel.ac.in/courses/112/105/112105125/ https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&_t=1656917902483				
Topics relevant to "EMPLOYABILITY SKILLS": Industry 4.0: The Way Forward, Adopt Smart Architectures and Technologies, Industry 4.0 Design Principles, design principles of Industry 4.0 for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Sachidananda K B			
Recommended by the Board of Studies on	15th BOS held on 22/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022			

Course Code: MEC3081	**Course Title: Quality Testing & Inspection** **Type of Course: Discipline Elective & Theory only**			**L-T-P-C**	3	0	0	3
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	This course is a study of various precision measurement, inspection techniques for non-destructive and destructive testing, sampling plans, investigation methods, and assessment of process variables and controls used in the materials joining / welding, manufacturing industry. Also the importance of quality control.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Quality Testing & Inspection** " and attain **EMPLOYABILITY SKILL** through Participative learning techniques.						
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1] Understanding of Quality Control, inspection, precision measurement and quality assurance management used in the organization. CO2] Develop the elementary knowledge of various techniques, procedures and methods used in the destructive inspection. CO3] Develop the elementary knowledge of various techniques, procedures and methods used in the non-destructive inspection CO4] Develop the elementary knowledge of various measurement techniques						
Course Content:							

Module 1	Introduction	Assignment	Data Collection and Analysis	12 Sessions
Topics: Introduction, Fundamental Concept of Quality, Role of Inspection and Measurement for Quality Control in Manufacturing.				
Module 2	Inspection	Case Study	Simulation and data analysis task	12 Sessions
Topics: Need of Inspection. Inspection types and Principles, Design for Inspection, Destructive Inspection, Testing of Composite Materials				
Module 3	Non-destructive Inspection	Assignment	Data Collection and Analysis	11 Sessions
Topics: Visual Inspection, Dye Penetrant Inspection, Magnetic Particle Inspection, Eddy Current Inspection, Ultrasonic Testing. Acoustic Emission Inspection, Radiography, Leak Testing, Thermographic Non-destructive Testing, Advanced Non-destructive Techniques, NDT Standards, Safety in NDT				
Module 4	Engineering Metrology	Case Study	Data collection and Programming	10 Sessions
Topics: Linear Measurement, Angular Measurement, Measurement of Surface Finish, Screw Thread Metrology, Gear Measurement, Miscellaneous Measurements.				

Targeted Application & Tools that can be used: Application Area include almost all manufacturing organizations	
Text Book 1. Gupta, I.C., "Text Book of Engineering Metrology", Dhanpat Rai Publishing Co.2	
References 1. "Nondestructive Evaluation and Quality Control", ASM Handbook, Vol. 17 of 9th Edition Metals Handbook.3. 2. "Welding Inspection", 3rd Edition, American Welding Society.4. Website: https://onlinecourses.nptel.ac.in/noc20_me27/preview https://presiuniv.knimbus.com/openFullText.html?DP=http://uijs.ui.ac.ir/jpom/index.php?slc_lang=en&sid=1	
Topics relevant to "EMPLOYABILITY SKILLS": Ultrasonic Testing. Acoustic Emission Inspection, Radiography, Leak Testing, Thermographic Non-destructive Testing, Advanced Non-destructive Techniques, NDT Standards and Safety in NDT for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Ramachandra C G
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 22/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: **MEC3015**	**Course Title: Reliability Engineering** **Type of Course: Discipline Elective/Theory Only**	**L-T-P- C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	Nil					
Anti-requisites	NIL					
Course Description	This course is intended to provide an overview of basic maintenance systems used in industry. The course highlights concepts of reliability, failure data analysis, hazard models, various system configurations to solve complex problems. It also explains various methods for improving reliability, and techniques available to improve maintainability and availability.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Reliability Engineering** " and attain **EMPLOYABILITY SKILL** through Participative learning techniques					
Course Out Comes	**On successful completion of the course students shall be able to** CO1. Describe engineering fundamentals to different types of maintenance. CO2. Analyze the impact of reliability of an equipment with the help of failure data analysis. CO3. Analyze the components of a mechanical system using equipment's system reliability. CO4. Explain maintainability & availability concepts					
Course Content:						

Module 1	Introduction to Maintenance	Assignment		12 Sessions
Topics: Introduction, Causes of Maintenance, Objectives, Benefits of maintenance, type of maintenance systems, Maintenance Cost, Engineering Maintenance in 21st Century, Computers in Maintenance.				
Module 2	Introduction to Reliability	Assignment		12 Sessions
Topics: Introduction, History, Root cause of equipment reliability, failure data analysis: introduction, failure data, MTTF MTBF, MTTR, MDT.				
Module 3	System Reliability	Assignment		11 Sessions
Topics: Introduction, Series Configurations, Parallel Configurations, Combination of Series & Parallel Configurations and methods of solving complex systems.				
Module 4	Availability & Maintainability	Assignment		10 Sessions
Topics: Introduction, formulas, techniques available to improve maintainability. Elements of Maintainability, Factors affecting Maintainability. Availability, System Downtime, Types of Availability, Factors affecting Availability. Trade-off among reliability, maintainability and availability .				
Targeted Application & Tools that can be used: **NIL**				
Text Book:				

1. L S Srinath, "Reliability Engineering", Affiliated East West Press Pvt. Ltd, 2005.	
References: 1. Kraus John W, "Maintainability and Reliability", Handbook of Reliability Engineering & Management, Editors: Ireson W A and Coombs C F, McGraw Hill Book Company Inc., U.S.A (1988). 2. R C Mishra, "Reliability & Maintenance Engineering ", New Age International, 2006. 3. E Balaguruswamy, "Reliability Engineering", Tata McGraw Hill **Web links:** https://nptel.ac.in/courses/105108128 https://nptel.ac.in/courses/11210504 Reliability Engineering Course Material https://presiuniv.knimbus.com/user#/searchresult?searchId=reliability%20Engineering&_t=1654843685864	
Topics relevant to "EMPLOYABILITY SKILLS": Root cause of equipment reliability and failure data analysis for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Ramachandra C G
Recommended by the Board of Studies on	MBOS NO: 15th BOS held on 29/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022

<table>
<tr><td>Course Code: MEC3053</td><td colspan="3">Course Title: Theory of Elasticity
Type of Course: Discipline Elective & Theory only</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">MEC2011</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The purpose of this course is to enable the students to understand the importance of the behavior of components in 3-dimnesional environment and practical application of theory of elasticity. Using Elasticity in the design process enables to attain more efficient structure as it can provide accurate values for the stress, strains and Displacements even for structures of complicated geometries and loadings.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of " Theory of Elasticity " and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1. Solve problems related to elasticity
CO2. Apply numerical methods to solve continuum problems.
CO3. Apply different principles to solve the 3 dimensional problems.
CO4. Reduce the computation effort by adopting the axisymmetric method.
CO5. Solve the problem related to thermal loading.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Analysis of Stress:</td><td>Assignment</td><td colspan="3">Programming Task, Data Analysis task</td><td colspan="3">10 sessions</td></tr>
<tr><td colspan="9">Topics:
Definition and notation of stress, Equations of equilibrium in differential form, Stress components on an arbitrary plane, Equality of cross shear, Stress invariants, Principal stresses</td></tr>
<tr><td>Module 2</td><td>Analysis of Strain:</td><td>Case Study</td><td colspan="3">Simulation and data analysis task</td><td colspan="3">10 sessions</td></tr>
<tr><td colspan="9">Topics:
Strain invariants, Principal strains, Octahedral strains, Plane state of strain, Compatibility equations, Strain transformation. Principle of super position, Saint Venant principle.</td></tr>
<tr><td>Module 3</td><td>Plane Stress And Plane Strain Problems</td><td>Assignment</td><td colspan="3">Data Collection and Analysis</td><td colspan="3">10 sessions</td></tr>
<tr><td colspan="9">Topics:
Airy's stress function, Bi-harmonic equations, Polynomial solutions, Simple two-dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams, etc.</td></tr>
<tr><td>Module 4</td><td>Polar Coor dinates &</td><td>Assignment</td><td colspan="3">Simulation/Data Analysis</td><td colspan="3">15 sessions</td></tr>
</table>

	Thermal Stress			

Equations of equilibrium, Strain displacement relations, Stress – strain relations, Axi – symmetric problems, Kirsch, Michell's and Boussinesque problems.

Targeted Application & Tools that can be used:

Application area of theory of elasticity in Design of structure buildings, machines, and cars, aircrafts, satellites, and the space shuttle, Biomedical.

Text Book (s)

T1. S. P. Timoshenko and J. N Gordier, "Theory of Elasticity" Mc-Graw Hill International 3rd edition, 20102.

T2. L. S. Srinath, "Advanced Mechanics of solids", Tata Mc. Graw Hill 2009

References (s)

R1: The Theory of Elasticity,Bruce K. Donaldson,2012 Cambridge University Press , Cambridge University Press - eBooks

R2: Elements of the theory of elasticity, Enrico Gnecco, Ernst Meyer 2015,Cambridge University Press , Cambridge University Press - eBooks

Weblinks:

https://archive.nptel.ac.in/courses/105/105/105105177/

W1:https://presiuniv.knimbus.com/user#/searchresult?searchId=Theory%20of%20Elasticity&curPage=1&layout=list&sortFieldId=none&topresult=false

Solving the Mixed Problem of Elasticity Theory with Mass Forces for Transversal-Isotropic Body,

D. A.Ivanychev 2020 2nd International Conference on Control Systems, Mathematical Modeling, Automation and Energy efficient

W2:https://presiuniv.knimbus.com/user#/searchresult?searchId=Theory%20of%20Elasticity&curPage=2&layout=list&sortFieldId=none&topresult=false

Three-dimensional Problems of the Theory of Elasticity. By A. I. Lur'e.1964. (Interscience Publishers)

R. J. Knops 2016 The Mathematical Gazette , Cambridge University Press

Topics relevant to "EMPLOYABILITY SKILLS": Theory of elasticity in Design of structure buildings, machines, and cars, aircrafts, satellites, and the space shuttle for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. YUVARAJA NAIK
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 22/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: MEC2018	**Course Title:** Value Engineering **Type of Course:** Discipline Elective & Theory only	**L-T-P- C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course is a study of resource management. It follows a systematic approach to solving problems and making decisions. The approach forces latent capabilities to be applied to challenging assumptions. The course will cover fundamentals of cost analysis, function analysis, creative problem solving, data evaluation, and reporting for decisive action. This explores the impact of technology on economics. The course is both conceptual and analytical in nature and develops the critical thinking and analytical skills through assignments.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Value Engineering**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1] Discuss the concepts of value engineering, identify the advantages, applications. CO2] Discuss various phases of value engineering. Analyze the function, approach of function and evaluation of function. Determine the worth and value. CO3] Discuss various value engineering techniques. CO4] Appraise the value engineering operation in maintenance and repair activities.					
Course Content:						

Module 1	Value engineering (VE) in organization	Assignment	Analytical task	12 Sessions

Topics:
Introduction: Value engineering concepts, advantages, applications, problem recognition, and role in productivity, criteria for comparison, element of choice.
Organization: Level of value engineering in the organization, size and skill of VE staff, small plant, VE activity, unique and quantitative evaluation of ideas.

Module 2	Job plan in VE	Assignment	Analytical task	12 Sessions

Topics:
Value Engineering Job Plan: Introduction, orientation, information phase, speculation phase, analysis phase. Selection and Evaluation of value engineering Projects, Project selection, methods selection, value standards, application of value engineering methodology.
Analysis Function: Anatomy of the function, use esteem and exchange values, basic vs. secondary vs. unnecessary functions. Approach of function, Evaluation of function, determining function, classifying function, evaluation of costs, evaluation of worth, determining worth, evaluation of value.

Module 3	VE techniques	Case Study	Data Analysis	11 Sessions

Topics:
Value Engineering Techniques: Selecting products and operation for value engineering action, value engineering programmes, determining and evaluating function(s) assigning rupee equivalents, developing alternate means to required functions, decision making for optimum alternative, use of decision matrix, queuing theory and Monte Carlo method make or buy, measuring profits, reporting results, Follow up, Use of advanced technique like Function Analysis System.

Module 4	Applications of Value Analysis	Assignment	Data Analysis	10 Sessions

Topics:
Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques.

Targeted Application:

Application Area is in process improvement of any existing process using VE techniques.

Textbook:
1. Anil Kumar Mukhopadhyaya, "Value Engineering: Concepts Techniques and applications", SAGE Publications 2010.

References:
1. Alphonse Dell'Isola, "Value Engineering: Practical Applications for Design, Construction, Maintenance &Operations", R S Means Co., 1997.
2. Del L. Younker, "Value Engineering analysis and methodology", Marcel Dekker Inc, New York, 2004.
3. Khanna, O.P., "Industrial Engineering and Management", Dhanpat Rai & Sons, 1993.

Web links:
https://nptel.ac.in/courses/112107282
https://onlinecourses.nptel.ac.in/noc19_me51/preview
https://presiuniv.knimbus.com/user#/searchresult?searchId=Value%20Engineering&_t=1656571834298

Topics relevant to "EMPLOYABILITY SKILLS": Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing and Material Management for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout

Catalogue prepared by	Dr. Ramachandra C G
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

<table>
<tr><td>Course Code:
MEC3034</td><td colspan="2">Course Title: Computer Integrated Manufacturing
Type of Course: Discipline Elective & Theory only</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course introduces computer assisted modern manufacturing technologies. The course include basics of automation, NC programming (manual and APT), concepts of group technology, Flexible Manufacturing system and CIM. This course relates to the important theoretical concepts, and the state-of-the-art technological developments in the area of modern manufacturing.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Computer Integrated Manufacturing" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1] Describe various types of automation and production concept
CO2] Distinguish various automated flow line and Assembly line.
CO3] Outline Flexible manufacture system and group technology.
CO4] Apply CNC Part Programming and inspection principles.
CO5] Explain the Computer aided process planning and concurrent engineering</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction and Scope of CIM in Industry</td><td>Assignment</td><td colspan="3">Automation</td><td colspan="2">08 Sessions</td></tr>
<tr><td colspan="8">Topics: Introduction, Evolution of CIM, CIM Hardware and software, Elements of CIM system, Types of automation, Manufacturing Systems, Types of Manufacturing Systems, , Machine Tools and related equipment"s, Computer monitoring and control, Manufacturing support systems, , Benefits of Computer integrated Manufacturing Systems.</td></tr>
<tr><td>Module 2</td><td>NC/ CNC Machine Tools</td><td>Assignment & Case study</td><td colspan="3">Machine tools</td><td colspan="2">08 Sessions</td></tr>
<tr><td colspan="8">Topics: General architecture of CNC Machine, Components of the CNC Systems: Machine Control Unit, CNC Driving system components: Hydraulic, Servo Motors, Stepper Motors, Feedback Devices: Encoder, Resolver, Inductosyn, Tachometers, Counting devices. Constructional Features of CNC Machines</td></tr>
<tr><td>Module 3</td><td>Constructional Features of CNC Machines</td><td>Seminar</td><td colspan="3">CNC system</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Topics: Design considerations of CNC machines for improving machining accuracy, Structural Members, Slide ways, bearings, Re-circulating ball Screws, Spindle drives, Work holding devices and tool holding devices, Automatic tool changers</td></tr>
<tr><td>Module 4</td><td>Adaptive Control</td><td>Assignment</td><td colspan="3">Application of Adaptive Control System</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="8">Topics: Machining systems. Adaptive control optimization system, adaptive control constraint system, applications to machining processes, Benefits of Adaptive control</td></tr>
</table>

Machining.Typical production planning and control system, Material planning systems, Capacity planning, Shop Floor Control, Automatic identification, Automated data collection systems				
Module 5	Computer Aided Planning & Concurrent Engineering	Case study	CAPP	06 Sessions
Topics:Topics: Introduction of Process planning, Retrieval CAPP system, Generative CAPP system, Computer managed Process plan (CMPP), Advanced Process Planning, Concurrent Engineering.				
Targeted Application & Tools that can be used: Application area: Manufacturing sector, Automobile and assembly sectors, military and aerospace sector.				
Text Book 1] Mikell P Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Pearson Education. 2] CAD, CAM, CIM by P.Radhakrishnan and S.Subramanyan, New Age International Publishers.				
References 1] Dr. A. John Rajan, Dr. S Ramachandran & M L Moorthy, "Computer Integrated Manufacturing", Air Walk Publications. 2] Computer Integrated Manufacturing by Paul G. Rankey, Prentice Hall. 3] A. Alavudeen, "Computer Integrated Manufacturing", PHI 4] Automation CIM Groover 4th Edition.pdf- By www.EasyEngineering.net.pdf - Google . Drive, https://drive.google.com/file/d/1ONOWDFfbj65FF-_pTSmfZ3UVVYFrktHb/view 5] CADCAMCIM Radhakrishnan Subramanyan and Raju- By EasyEngineering.net.pdf - Google Drive. https://drive.google.com/file/d/1JaPTdFgJlky3yMGz88vsHqlkM-aklZ96/view 6]https://presiuniv.knimbus.com/openFullText.html?DP=https://search-ebscohost-com- presiuniv.knimbus.com/login.aspx?direct=true&db=iih&jid=DIJ				
Topics relevant to "EMPLOYABILITY SKILLS": CNC part Programming exercises, Computer aided part programming: concept & need of CAP – CNC languages and APT language structure for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course plan.				
Catalogue prepared by	Aravinda T			
Recommended by the Board of Studies on	BOS NO: 19th BOS held on 05/7/2024			
Date of Approval by the Academic Council	24th Meeting of the Academic Council held on 03/08/2024			

Course Code: MEC3033	**Course Title: Alternate Fuels** **Type of Course: Discipline Elective**	**L- P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course is designed to introduce the world of alternate fuels. The course acquaints the learners about production of alternate fuels, their performance and emission characteristics when used with Diesel in IC Engine. Latest emission norms like BS-6 and its comparison with Euro norms will be done. This course also reviews all the basic principles of IC Engine working, fossil fuels production and its structure.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Alternate Fuels**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1-Understand basic concepts of Internal Combustion Engines and fossil fuels. CO2-Understand the production methods of liquid and gaseous alternate fuels CO3-Discuss combustion, performance and its emission characteristics of different conventional and alternate fuels. CO4-Explain the National and International Emission Norms and Emission Control packages.					
Course Content:						

Module 1	Basics of Engines and Fuels	Assignment	Data Analysis Task	15 Sessions

Topics:
Basics of Heat engines. Classification of IC engines, Nomenclature of engine components, working principle of four stroke Engines, Performance Parameters and their standards. Concept of theoretical Otto & Diesel cycles**.**
Conventional fuels: Solid, liquid, gaseous fuels, Characteristics of Engine fuels, fuels from Petroleum products, Chemical Structure of Petroleum fuels.

Module 2	Liquid and Gaseous Alternate Fuels	Assignment	Data Analysis Task	10 Sessions

Topics:
Alternate fuels – Types of alternate fuels, Liquid fuels- alcohols, Production of methanol, ethanol. Their usage in engines. Gaseous Fuels- Hydrogen, LPG, CNG - Production, properties, storage and handling. Their usage in engines.

Module 3	Bio Fuels	Assignment	Data Analysis Task	10 Sessions

Topics: Types of biofuels. Use of biomass as an energy source. Pyrolysis and Gasification processes. Biogas - Production and properties. Indian and Chinese biogas plants. Performance and emission characteristics of biogas. Types of bio-diesels and their origin Need of bio-diesels, Trans-esterification method of production, Comparison of properties of bio-diesels v/s petro-diesel, Comparison of performance parameters and emission characteristics of bio-diesels v/s Petro diesel. Discussion on need for engine modifications to use biodiesels.				
Module 4	Engine Emission norms in India and abroad	Assignment	Data Analysis Task	10 Sessions
Topics: Sources and types of emissions. Effects of release of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter to the atmosphere. Control of effects of Emission – EGR, and Catalytic converter Package, Indian Emission Norms- Bharath stage and Euro norms. Comparison of Bharath stage 6 and Euro 6.				
Targeted Application & Tools that can be used: Application area are Automobile sector, Indian Railways and power generation. Tools used: any CFD software				
References **R1**: G D Rai: "Non-conventional *Energy Sources*", Khanna Publishers. **R2:** M. K. Ghoshal :"Renewable Energy Technologies", Narosa Publishers. **R3:** B. Bharathiraja, J. Jayamuthunagai, R. Praveen Kumar " Biofuels" MJP Publishers R4: Kumari Swarnim, "Biofuels in India – A new revolution" Mangalam Publications **E resources:** https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&t=1656917902483 https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=iih&AN=124896850&site=ehost-live				
Topics relevant to "EMPLOYABILITY SKILLS": Production of methanol, ethanol. Their usage in engines. Gaseous Fuels- Hydrogen, LPG, CNG - Production, properties for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Udaya Ravi Mannar			
Recommended by the Board of Studies on	15th BoS held on 22/07/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

Course Code: **MEC3075**	**Course Title: Automotive Body Design** **Type of Course: Discipline Elective**	**L-T-P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course will introduce students into the both strength and looks required for a vehicle. This course is designed to acquaint the students with little deeper knowledge on vehicle body design. This involves design of Chassis, body cover and ergonomics.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Automotive Body Design**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1- Understand different design principles and methodologies CO2- Discuss on Chassis and their types CO3-Disuss on body design. CO4- Discuss on body ergonomics					
Course Content:						

Module 1	Basic Design Principles	Assignment	Assignment	12 Sessions
Topics: Design Methodologies. Types of engines, Basic Engine components and Engine Nomenclature. Vehicle body design parameters. Types of vehicles and their body shapes and specifications.				
Module 2	Design of Chassis	Assignment	Assignment	12 Sessions
Topics: Chassis – Definition and importance**.** Design parameters and concepts. Application of these to simple body designs. Case studies.				
Module 3	Body materials and design	Assignment	Assignment	11 Sessions
Topics: Different materials that can be used for body structure, their strengths and weaknesses. Body structure and contours. Methods to check the feasibility of body designs.				
Module 4	Body building and ergonomics	Case study	Case study	10 Sessions
Topics: Necessity and importance of bodybuilding. Implementation of principles of ergonomics. Different techniques adopted. Case study.				
Targeted Application & Tools that can be used: Application areas are vehicle manufacturing and body building. Tools used: CFD software				

References **R1**: R. N. Bahl, "*Automobile Design*", Dreamtech publishers through Wiley **R2:** Kirpal Singh: "*Automobile Engineering I & II*", Standard Publishers and Distributors. **E resources:** https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&_t=1656917902483 https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=iih&AN=124896850&site=ehost-live
Topics relevant to "EMPLOYABILITY SKILLS": Design parameters and concepts. Application of these to simple body designs body structure and contours. Methods to check the feasibility of body designs for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Udaya Ravi Mannar
Recommended by the Board of Studies on	15th BoS held on 22/07/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

Course Code: MEC3058	**Course Title: Vehicle Dynamics** **Type of Course: Discipline Elective**	**L-T-P- C**	3	0	0	3

Version No.	1.1
Course Pre-requisites	NIL
Anti-requisites	NIL
Course Description	The course deals with different aspects of Vehicle Dynamics that are necessary for proper design of a vehicle. The topics include, the vehicle body (sprung mass), the suspension component (spring and damper) and tyre (unsprung mass) and steering mechanism.
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Vehicle Dynamics**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.
Course Out Comes	On successful completion of the course the students shall be able to: CO1- Understand basic requirements of Vehicle Dynamics CO2- Discuss on Steering and Suspension system CO3-Discuss on drive train design. CO4- Discuss on unsprung mass calculation.
Course Content:	

Module 1	Basic Principles of Vehicle Dynamics	Assignment	Assignment	12 Sessions
Topics: Design principles of dynamics. Vehicle body and its concepts and considerations. Stability criterion for body. Need for dynamic stability and its components. Methods of analysis.				
Module 2	Drive Train Design	Assignment	Assignment	12 Sessions
Topics: Definition of Drive train and its importance. Techniques for different class of vehicles like LMV, MV, Heavy Vehicles etc.,				
Module 3	Design of Steering and Suspension mechanism	Assignment	Assignment	10 Sessions
Topics: Steering Requirements and types. Steering mechanism. Modern day steering mechanisms. Suspension Systems: Need for suspension. Basic concepts. Types of suspension systems. Damping.				
Module 4	Longitudinal & Lateral Dynamics	Case study	Case study	11 Sessions
Topics: Longitudinal dynamics - Explanation of the mechanism of Traction force generation in Braking and accelerating and explanation of working of Anti-lock brake systems. Lateral dynamics- Understeer, Oversteer behavior of vehicle and root cause for that behavior in turning.				
Targeted Application & Tools that can be used:				

Application areas are vehicle dynamics. Tools used: Simulation software
References **R1**: R. N. Bahl, "*Automobile Design*", Dreamtech Press through Wiley **E resources:** https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&_t=1656917902483 https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=iih&AN=124896850&site=ehost-live
Topics relevant to "EMPLOYABILITY SKILLS: Techniques for different class of vehicles like LMV, MV, Heavy Vehicles for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Udaya Ravi Mannar
Recommended by the Board of Studies on	15th BoS held on 22/07/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

<table>
<tr><td>Course Code: MEC3030</td><td>Course Title: IC Engines
Type of Course: Discipline Elective & Lab Integrated course</td><td>L-T-P-C</td><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The course deals with types of engines and its nomenclature. It covers Combustion phenomenon in both SI and CI engines and its requirements. It also discusses abnormal combustion and combustion chamber designs. Fuels used and their emissions are covered.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "IC Engines" and attain EMPLOYABILITY SKILL through Experiential learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="6">On successful completion of the course the students shall be able to:
CO1- Understand types of IC engines and their nomenclature
CO2- Discuss on Combustion phenomenon in SI and CI engines
CO3-Understand the types and requirements of fuels for IC engines
CO4- Differentiate between different combustion chamber designs for Si and CI engines
CO4- Know the different emission norms</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>IC Engines and their combustion chambers</td><td>Assignment</td><td colspan="2">Assignment</td><td colspan="2">08 Sessions</td></tr>
<tr><td colspan="7">Topics:
Types of heat engines, Basic Engine components and Engine Nomenclature, IC engine classification, working principle of Engines, Review of Otto cycle & Diesel cycle. Simple numerical on engines.
Combustion Chamber designs for SI and Ci engines – requirements and modifications.</td></tr>
<tr><td>Module 2</td><td>Fuels and their injection in Engines</td><td>Assignment</td><td colspan="2">Assignment</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="7">Topics:
Conventional fuels: Types of fuels (Solid, liquid, gaseous), Petroleum Refining process, Chemical Structure of Petroleum fuels. Important qualities of Engine fuels.
Alternate fuels – Need, for alternate fuels, Liquid fuels- alcohol, methanol, ethanol, Alcohol for S I and C I Engines, Gaseous Fuels - Hydrogen, LPG, Natural gas, CNG, Biodiesel, Biogas.
Fuel injection in in engines. Mechanism of injection for SI and CI engines. Mechanical and electronic injection systems.</td></tr>
<tr><td>Module 3</td><td>Combustion phenomenon in SI and CI engines</td><td>Assignment</td><td colspan="2">Assignment</td><td colspan="2">07 Sessions</td></tr>
<tr><td colspan="7">Topics:
Definition of Combustion, Homogenous and Heterogeneous mixtures, Combustion in S I Engines, Stages of Combustion in S I engines, Flame front propagation, factors influencing Flame Speed, Rate of pressure rise, Abnormal combustion, The phenomenon of Knocking in SI engines, Effect of Engine variables on Knock. Combustion in C I engines, Stages of Combustion in C I Engine, Factors affecting the delay period, The Phenomenon of Diesel Knock, Comparison of Knock in SI and CI Engines.</td></tr>
</table>

Module 4	Pollution and their control	Case study	Case study	06 Sessions
Topics: Pollutant from engines: Formation of Carbon Monoxide, Carbon di oxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter. Emission Control packages Catalytic converter Package, Thermal reactor package, Exhaust gas recirculation (EGR), Emission Norms, Bharat and Euro norms. Comparison of Bharat stage and Euro Norms.				
Targeted Application & Tools that can be used: Application areas are vehicle dynamics. Tools used: Simulation software				
References **R1**: M.L. Mathur and R.P Sharma: "*A Course in Internal Combustion Engines*", D. Rai and Sons R2: Ganesan, "*Internal Combustion Engines*", Tata McGraw Hill Pub. Co. Ltd **R3**: Pundir B.P, "IC Engines combustions and Emissions", Narosa Publishers. **R4:** John B. Heywood: "*Internal Combustion Engines Fundamentals*", McGraw Hill International Edition. **R5:** Amitava Datta "Combustion Fundamentals & Application", Narosa Publishers **E resources:** https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&t=1656917902483 https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=iih&AN=124896850&site=ehost-live				
Topics relevant to "EMPLOYABILITY SKILLS": Combustion in S I Engines, Stages of Combustion in S I engines, Flame front propagation, factors influencing Flame Speed, Rate of pressure rise for developing **EMPLOYABILITY SKILLS** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Udaya Ravi Mannar			
Recommended by the Board of Studies on	15th BoS held on 22/07/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

Course Code: MEC3044	**Course Title: Modelling and Simulation of Manufacturing System** **Type of Course: Discipline Elective**			**L-T-P-C**	3	0	0	3
Version No.	1.0							
Course Pre-requisites	NIL							
Anti-requisites	NIL							
Course Description	In today's digital world, modernization and automation of manufacturing units is of the highest importance. Mechanisation of factories has begun long ago but requires usage modern tools like modelling and simulation to optimize the design and production systems. This course takes care of all and provides basics of modelling and simulation with case studies.							
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Modelling and Simulation of Manufacturing System**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.							
Course Out Comes	On successful completion of the course the students shall be able to: CO1- Understand the designs and requirements of manufacturing systems. CO2- Understand basic concepts of modelling of components. CO3- Use simulation tools to simulate different situations CO4- Apply the modelling and simulation concept to any practical situation							
Course Content:								
Module 1	Manufacturing Units	Assignment	Data Analysis Task	10 Sessions				
Topics: Requirements of a proper manufacturing unit. Types of manufacturing units. Factors considered for selection of site and materials. Tendering process. Material procurement, storage and handling.								
Module 2	Modelling	Assignment	Data Analysis Task	12 Sessions				
Topics: Basics of modelling. Different software and their tools. Modelling requirements and principles. Modelling of any one type of system.								
Module 3	Simulation Techniques	Assignment	Data Analysis Task	12 Sessions				
Topics: Need and requirements for simulation of any process. Methods adopted. Principles to be followed for proper simulation of a model. Simulation of any one system.								
Module 4	Industry and Research Applications	Assignment	Data Analysis Task	11 Sessions				
Topics: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project								
Targeted Application & Tools that can be used: Application area are Space, Engineering, Automobile, power generation sector etc.,								

Tools used: ANSYS software	
References **R1**: Pratiksha Saxena, "*Modelling and Simulation*", Narosa Publishers **R2: Philip F Ostwald, Jairo Munoz, "** Manufacturing Processes and Systems" Wiley Student Edition **E resources:** https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&_t=1656917902483 https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=iih&AN=124896850&site=ehost-live	
Topics relevant to "EMPLOYABILITY SKILLS": Network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Udaya Ravi Mannar
Recommended by the Board of Studies on	15th BOS held on 22/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

Course Code: MEC3079	**Course Title: Design of Experiments** **Type of Course: Discipline Elective/Theory Only**		**L-T-P-C**	3	0	0	3
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	This course is intended to provide an overview of fundaments of Design of Experiments. The course highlights concepts of basic statistics, Hypothesis testing etc. It also focus on various methods in designing the experiments, analysis and interpretation of the same etc.,						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Design of Experiments**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.						
Course Out Comes	**On successful completion of the course students shall be able to** CO1. Describe basic principles for designing experiments. CO2. Understand basic statistical concepts. CO3. Understand the various experimental designs CO4. Analyze various methods in Designing of Experiments						
Course Content:							

Module 1	Introduction	Assignment		10 Sessions
Topics: Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiment.				
Module 2	Basic Statistical Concepts	Assignment		12 Sessions
Topics: Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples				
Module 3	Experimental Design	Assignment		13 Sessions
Topics: Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.				
Module 4	Analysis And Interpretation Methods	Assignment		10 Sessions
Topics: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples.				
Targeted Application & Tools that can be used: Manufacturing and process optimization, Tools used: Simulation software				

<table>
<tr><td colspan="2">Text Book:
1. Design and Analysis of Experiments (3-319-52248-5, 978-3-319-52248-7), 2nd ed. 2017.. Dean, Angela. Springer International Publishing, 2017.</td></tr>
<tr><td colspan="2">References:
1. Design and Analysis of Experiments: Vol. 3: Special Designs and Applications (0-470-53068-5, 978-0-470-53068-9), Hinkelmann, Klaus. Wiley [Imprint], 2012.
2. Design and Analysis of Experiments, Montgomery, John Wiley & Sons, 2003.

Web links:
https://nptel.ac.in/courses/110105087
https://onlinecourses.nptel.ac.in/noc21_mg48/preview
https://presiuniv.knimbus.com/user#/searchresult?searchId=design%20of%20experiments&_t=1658472153828</td></tr>
<tr><td colspan="2">Topics relevant to “EMPLOYABILITY SKILLS”: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE’s algorithm for ANOVA, Regression analysis, Mathematical models from experimental data for developing EMPLOYABILITY SKILLS through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td>Dr. Ramachandra C G</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td>15th BOS and the Date of BOS 29/07/22</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td>Mention the Academic Council Meeting
No. & the date of the meeting: 18, 03/08/2022</td></tr>
</table>

<table>
<tr><td>Course Code:
MEC3097</td><td colspan="2">Course Title: Plumbing Design
Type of Course: Discipline Elective/Theory only</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The Course enables the entry level and working engineers to understand the basics, different systems used in Plumbing systems for Domestic and commercial purposes. To achieve the optimal design, one should needs good analytical skills and up-to-date technical knowledge of various system designs. This Subject is useful to design Plumbing Systems. This is an opportunity to apply the academics and develop an understanding of how to develop solution-driven concepts and translate them into a complete set of plans and prototypes.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Plumbing Design" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of the course the students shall be to:

CO1: Understand the basic principles of mechanical, electrical, plumbing systems.
CO2: Apply construction management skills as an effective membe multi-disciplinary team.
CO3: Analyze construction documents for planning and managem construction related processes.
C04: Design of pump Calculation, pipe size calculation</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction to Plumbing System</td><td>Assignment</td><td colspan="2"></td><td colspan="3">10 Sessions</td></tr>
<tr><td colspan="8">Plumbing Introduction ,Plumbing – Codes & Standards, Fundamentals of Plumbing System, Water Supply System, Sanitary Drainage System, Storm Drainage System ,Irrigation System</td></tr>
<tr><td>Module 2</td><td>Water Supply System</td><td>Case Study</td><td colspan="2">Simulation and data analysis task</td><td colspan="3">15 Sessions</td></tr>
<tr><td colspan="8">Fixture Load as per Codes & Standard, Hot &Cold Water load, Water Supply Fixture Unit-WSFU, Fixture Water Requirement- GPM, Hot & Cold Water Pipe Size, Water Distribution – Pipe Routing ,Pipe Joining methods, Water Supply Demand Calculation, Storage Tank Types, Fundamental of Water Supply System Sources of Water, Water Supply – Commercial & Industrial</td></tr>
<tr><td>Module 3</td><td>Plumbing System Equipment</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td colspan="3">10 Sessions</td></tr>
</table>

Plumbing Fixtures, Booster Pumps, Submersible Pumps, Boiler and Gaesser, Water Storage Tanks, Jacuzzi, Grease Interceptor				
Module 4	Piping Systems Design & Calculations	Case Study	Data collection and Programming	10 Sessions
Pump calculation Pipe size calculation Design of process piping requirements per ASME B31.3				
Targeted Application & Tools that can be used: Plumbing Required in Commercial Buildings, Airports, Shopping malls, Petrochemical complex, refineries, pharmaceutical industry, Aerospace industry, Hospitals etc.				
Text Book T1. Engineering Plumbing Design II by Seryvatanak KY, Published by American Plumbing Society of Engineers				
References R1. Plumbing Design and Installation Reference Guide (McGraw-Hill Engineering Reference Guide Series) by Tyler G. Hicks (Author) Hardcover – Import, 1 September 1986 R2. Design And Practical Hand Book On Plumbing, C.R. Mohan & Vivek Anand, Standard Publishers Distributors, 2005 **Weblinks:** https://www.youtube.com/watch?v=vIGROL-iX1U https://presiuniv.knimbus.com/user#/searchresult?searchId=plumbing%20design&_t=1658297016314 Interdisciplinary design checklists for mechanical, electrical and plumbing coordination in building projects Mohamma A. Hassanain,Mohamma Aljuhani, Muizz O. Sanni-Anibire anAbullatif Aballah 2018 https://ieeexplore.ieee.org/document/7790183 A framework of a fast any-angle path finding algorithm on visibility graphs based on A for plumbing design				
Topics relevant to "EMPLOYABILITY SKILLS": Pump calculation, Pipe size calculation, Design of process piping requirements per ASME B31.3 for developing **EMPLOYABILITY SKILLS** through Problem Solving methodologies. This is attained through assessment component mentioned in course handout				
Catalogue prepared by	**Dr. Yuvaraja Naik**			
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 22/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

<table>
<tr><td>Course Code:
MEC3067</td><td colspan="3">Course Title: Engineering Instruments and Measurements
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The purpose of this course is to enable the students to appreciate the need for engineering instruments and Measurements and to develop the basic knowledge on various Metrological equipment's available to measure the dimension of the components. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.</td></tr>
<tr><td>Course objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of "Engineering Instruments and Measurements" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1] Describe the concepts of measurements to apply in various Measuring instruments
CO2] Outline the principles of linear and angular measurement tools used for industrial applications
CO3] Demonstrate the techniques of form measurement used for industrial components
CO4] Discuss various measuring techniques of mechanical properties in industrial applications</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Engineering Instruments and Basic Measurements</td><td>Assignment</td><td colspan="2">Error Measurement task</td><td colspan="4">12 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction–Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement. Bridge Measurement: DC bridges- wheat-stone bridge, AC bridges – Kelvin, Hay, Maxwell, Schering and Wien bridges, Wagner ground Connection</td></tr>
<tr><td>Module 2</td><td>Linear, Angular Measurements and Oscilloscopes</td><td>Assignments</td><td colspan="2">Data collection task</td><td colspan="4">11 Sessions</td></tr>
</table>

<table>
<tr><td colspan="5">Topics:
Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – Angular measuring instruments, Oscilloscopes: Cathode Ray Tube, Vertical and Horizontal Deflection Systems, Delay lines, Probes and Transducers, Specification of an Oscilloscope. Oscilloscope measurement Techniques, Special Oscilloscopes – Storage Oscilloscope, Sampling Oscilloscope</td></tr>
<tr><td>Module 3</td><td>Form Measurement and frequency counters</td><td>Assignment</td><td>Data Collection and Analysis</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Frequency Counters: Simple Frequency Counter; Measurement errors; extending frequency range of counters</td></tr>
<tr><td>Module 4</td><td>Power, Flow and Temperature Measurements and Digital Data Acquisition System</td><td>Assignment</td><td>Simulation/Data Analysis</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics: Force, torque, power - mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement, Digital Data Acquisition System: Interfacing transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier. An Introduction to Computer-Controlled Test Systems</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:

Application Area is fluid flow measurements, power measuring instruments and temperature measurements in various industries
Software : Aberlink 3D</td></tr>
<tr><td colspan="5">Text Books
1. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2009.

2 Gupta. I.C., “Engineering Metrology”, Dhanpat rai Publications, 2005

3. Modern Electronics Instrumentation & Measurement Techniques, by Albert D.Helstrick and William D.Cooper, Pearson Education. Selected portion from Ch.1, 5-13</td></tr>
<tr><td colspan="5">References
1. Alan S. Morris, “The essence of Measurement”, Prentice Hall of India 1996.

2. Raghavendra ,Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013.

3. https://nptel.ac.in/courses/112/103/112103261/

Weblinks:

https://presiuniv.knimbus.com/openFullText.html?DP=https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/00400910910960740/pdfplus/html</td></tr>
</table>

Topics relevant to "EMPLOYABILITY SKILLS": Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement **for** developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Neeraj Singh
Recommended by the Board of Studies on	19th BoS held on 05/07/2024
Date of Approval by the Academic Council	24th Meeting of the Academic Council held on 03/08/2024

ourse Code: MEC3050	**Course Title: Experimental Stress Analysis** **Type of Course: Discipline Elective & Theory only**		**L-T-P- C**	3	0	0	3
Version No.	2.0						
Course Pre-requisites	MEC2011:Mechanics of Solids						
Anti-requisites	NIL						
Course Description	The purpose of this course is to enable the students to appreciate the need for Strain gauge and Strain gauge Rosettes, Nature of light, 2-D & 3-Dimensional Photo elastic Analysis, Bire fringent coating and Introduction to holography. The course develops the critical thinking and analytical skills. The course also enhances the abilities through assignments.						
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1] Explain the different types of strain gauges and its arrangement CO2] Compute the stress and strain behavior of mechanical components using electrical strain gauges CO3] Compute the Photo elastic analysis with various techniques CO4] Explain the principles of circular polariscope						
Course Objectives	The objective of the course is to familiarize the learners with the concepts of "**Experimental Stress Analysis**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.						

Module 1	Electrical Strain Resistance Gauges	Assignment	Demonstration of the Experiment	13 sessions

Topics:
Introduction, Strain sensitivity in metallic alloys, Gage construction, Adhesives and mounting techniques, Gage sensitivity and gage factor ,Performance' Characteristics, Strain Gage circuits: Potentiometer, Wheatstone's bridges,

Module 2	Strain Analysis:	Assignment	Case study	12 sessions

Topics:
Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

Module 3	Photoelastic Analysis and coatings	Assignment	Analysis of Photo elastic Models using Ansys Software	20 sessions

Topics:
Nature of light, Wave theory of light - optical interference, Stress optic law –effect of stressed model in plane and circular polariscopes, Isoclinics &Isochromatics, Fringe order determination Fringe multiplication techniques , Calibration photoelastic model materials Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, and Materials for 2D photoelasticity.

Targeted Application & Tools that can be used:
Application Area is **HBK** Company selling and testing of Photo elastic models
Octagon company conducts Experimental Stress Analysis With using Strain Gauges During Load Tests On Door Fittings

Carryout the analysis using **Ansys Software**
Text Books **(i) Text Book (s) :** T1 - Experimental stress analysis: L.S. Srinath, M.R. Raghavan, K. Lingaiah, G. Gargesh, K. Ramachandara & B. Pant, Tata McGraw Hill publication 2000 T2 - Experimental stress analysis by Dally & Riley, Tata McGraw Hill Publication 2001.
References R1 - "Analysis of stress and strain": A.J. Duraelli, E.A. Phillips and C.H. Trao McGraw Hill, 1958 R2 - "Applied stress analysis": A.J. Durelli, prentice hall India, 1970 R3 - "Hand Book of experimental mechanics": A.S. Kobayassin (Ed.,) SEM/ VCH, 2ndedition. 2000 **(iii) Web-Resources** **W1**: http://www.nptelvideos.in/2012/12/experimental-stress-analysis.html **W2**: Experimental Stress Analysis by Prof.K.Ramesh, Department of Applied Mechanics,IIT Madras. For more details on NPTEL https://presiuniv.knimbus.com/user#/searchresult?searchId=experimental%20stress%20analysis&_t=1656570565499 **W3:** "Materials Engineering, Engineering and Technology" https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=ELEARNING864
Topics relevant to "EMPLOYABILITY SKILLS": Calibration photo elastic model materials Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, and Materials for 2D photo elasticity for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout

Catalogue prepared by	Dr Yuvaraja Naik
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

<table>
<tr><td>Course Code:
MEC3046</td><td>Course Title: Micro and Nano Manufacturing
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The Course is designed with an objective of giving an overview of Micro and Nano manufacturing and their applications. This Course is aimed at teaching basic concepts of Micro and Nano manufacturing for mechanical engineering students. The course also enhances the knowledge of advanced technology applications through assignments.</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "Micro and Nano Manufacturing" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">On successful completion of this course the students shall be able to:
CO1. Get an awareness of different techniques used in micro and nano manufacturing.
CO2. Understand micro and nanofabrication techniques and other processing routes in micro and nano manufacturing.
CO3. Discuss about different techniques used in micro joining and the metrology tools in micro and nano manufacturing</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
</table>

Module 1	Overview of Micro and Nano Manufacturing	Assignment	Applications of Micro and Nano machining	10 sessions

Topics:
Introduction to Precision engineering, macro milling and micro drilling, Micro-electromechanical systems – merits and applications, Micro phenomenon in Electro-photography – applications Introduction to Bulk micromachining, Surface micromachining steps.

Module 2	Micro/Nano machining and forming techniques	Case Study	Nano plastic forming applications	08 Sessions

Topics:
Introduction to mechanical micromachining, Micro drilling – process, tools and applications Micro turning- process, tools and applications, Diamond Micro turning – process, tools and applications.

Module 3	Micro and Nano Finishing Processes	Assignment	Real time application of Micro and Nano Finishing Processes	07 Sessions

Topics:
Introduction to Micro and Nano Finishing Processes, Magnetorheological Finishing (MRF) processes, Magnetorheological abrasive flow finishing processes (MRAFF) – process principle and applications, Force analysis of MRAFF process, Magnetorheological Jet finishing processes , Working principle and polishing performance of MR Jet Machine , Elastic Emission Machining (EEM) – machine description, applications.

Module 4	Micro and Nano Fabrication	Assignment	Applications of Diamond technology and CNT	10 Sessions
Topics: Introduction to Micro Fabrication: basics, flowchart, basic chip making processes, Introduction to Nanofabrication, Nanofabrication using soft lithography – principle, applications – Examples (Field Effect Transistor, Elastic Stamp), Manipulative techniques – process principle, applications, Diamond - Properties and applications, CVD Diamond Technology, LIGA Process.				
Module 5	Micro and Nano measurement and characterization techniques	Assignment	Report on Nano metrology	10 Sessions
Topics: Introduction to micro and nano measurement, defining the scale, uncertainty, Scanning Electron Microscopy – description, principle, Scanning White-light Interferometry – Principle and application, Optical Microscopy				
Targeted Application & Tools that can be used: Application Area is Aerospace and Space, Defense and Medical fields, Automobiles and special control systems, Energy sectors. Professionally Used Software: Nil.				
Text T1. Mark. J. Jackson, Micro and Nano-manufacturing, Springer, 2006. T2. Mark. J. Jackson, Micro-fabrication and Nano-manufacturing - Pulsed water drop micromachining CRC Press 2006.				
References R1. Nitaigour Premchand Mahalik, Micro-manufacturing and Nanotechnology, 2006. R2. V.K.Jain, Micro-manufacturing Processes, CRC Press, 2012. 3. https://nptel.ac.in/courses https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_6062				
Topics relevant to "EMPLOYABILITY SKILLS": Force analysis of MRAFF process, Magnetorheological Jet finishing processes , Working principle and polishing performance of MR Jet Machine , Elastic Emission Machining (EEM) for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Sudheer			
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 22/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

Course Code: MEC3054	Course Title: Theory of Plasticity Type of Course: Discipline Elective & Theory only	L-T-P-C	3	0	0	3
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to learn the current state of the plasticity theory, and then to show the fascinating possibility of this promising branch of solid mechanics. Many applications in mechanics, material science and technology require a comprehensive understanding and reliable representation of the elastoplastic behavior observed in a large class of engineering materials. The course develops the critical thinking and analytical skills. The course also enhances the abilities through assignments.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Theory of Plasticity**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1. Understand the stress, deformation, deformation, relationship between stress and deformation and plastic deformation in solids. CO2. Understand plastic stress/deformation relationships and flow rules. CO3. Perform stress analysis in beams and bars including Material nonlinearity CO4. Analyze the performance of a material according to different efficiency theories for a given state of plastic strain and deformation of metals in engineering problems.					
Course Content:						
Module 1	Fundamentals of Elasticity	Assignment	seminar	12 sessions		
Topics: Basics Concept of stress, stress invariants, principal Stresses, octahedral normal and shearstresses, spherical and deviatoric stress,stress transformation; concept of strain,engineeringandnaturalstrains, octahedralstrain,deviator and spherical strain tensors, strain rate and strain rate tensor, cubical dilation, generalized Hooke's law, numerical problems.						
Module 2	Permanent Deformation of Metals	Assignment	Case Study	10 sessions		
Topics: Plastic Deformation of Metals: Crystalline structure in metals, mechanism of plastic deformation, factors affecting plastic deformation, strain hardening, recovery, re crystallization and grain growth, flow figures or Luder's cubes. Yield Criteria: Introduction, yield or plasticity conditions, Von Mises and Tresca criterion, geometrical representation						
Module 3	Stress Strain Relations:	Assignm	Analysis using	10 sessions		

		ent	suitable software	
Topics: Idealised stress-strain diagramsfor different material models, empirical equations, Levy-VonMises equation, Prandtl-Reuss and SaintVenant theory, and experimental verification of Saint Venant's theory of plastic flow. Concept of plastic potential, maximum work hypothesis,				
Module 4	Bending of Beams, Torsion of Bars and Slip Line Field Theory	Assignment	Experimental Investigation	12 sessions
Topics: Beams: Stages of plastic yielding, analysis of stresses, linear and nonlinear stress strain curve, problems. Torsion of various shaped bars - Pure torsion of prismatic bars - Prandtle's membrane analogy - Torsion of thin walled tubes and hollow shafts.				
Targeted Application & Tools that can be used: Application Area is NAL, ISRO Bangalore Analysis of Structural members like beams, bars, plates and trusses Professionally Used Software: **Ansys Software, Abacus.**				
Text Book (s) T1. Timoshenko and Goodier, (2000), Theory of Elasticity, McGraw Hill Company, New York T2. Theory of Plasticity and Metal forming Process"-Sadhu Singh, Khanna Publishers, Delhi				
References(s) R1. "Engineering Plasticity-Theory and Application to Metal Forming Process" -R.A.C. Slater, McMillan Press Ltd. R2. "Basic Engineering Plasticity", DWA Rees, 1st Edition, Elsevier. **Weblinks:** W1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_17535				
Topics relevant to "EMPLOYABILITY SKILLS": Stages of plastic yielding, analysis of stresses, linear and nonlinear stress strain curve for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr Yuvaraja Naik			
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 22/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

<table>
<tr><td>Course Code:
MEC3064</td><td colspan="2">Course Title: Manufacturing Control and Automation
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">Manufacturing Control and Automation in manufacturing systems, acquire the fundamental concepts of automated flow lines and their analysis, classify automated material handling, automated storage and retrieval systems and illustrate adaptive control systems and automated inspection methods.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Manufacturing Control and Automation" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1) Illustrate the basic concepts of automation in machine tools.
CO2) Analyze various automated flow lines, explain assembly systems and line balancing methods.
CO3) Describe the importance of automated material handling and storage systems.
CO4) Interpret the importance of adaptive control systems, automated inspection systems.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Automation & flow lines</td><td>Assignment</td><td colspan="3">Cellular, Plant and Product Layout and flow lines analysis</td><td colspan="2">15 Sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction: Single-Station Manufacturing Cells, types and strategies of automation, Automation in machine tools, automation principles, Mechanical feeding and tool changing, machine tool control, elements in product realization.
Automated Flow Lines: Methods of work part transport, transfer mechanisms, buffer storage, control function, Design and fabrication consideration.</td></tr>
<tr><td>Module 2</td><td>Analysis of transfer line in automation</td><td>Assignment</td><td colspan="3">Line balancing analysis</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Topics:
Analysis of Automated Flow Lines: General terminology, analysis of transfer lines with and without buffer storage, partial automation, implementation of automated flow lines.</td></tr>
<tr><td>Module 3</td><td>Modeling and simulation for manufacturing plant automation</td><td>Assignment</td><td colspan="3">AI technologies</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Module 3: Modeling and simulation for manufacturing plant automation
Modern Tools-Fuzzy logic, Application of Fuzzy logic system, Artificial Neural Networks in manufacturing automation, Machining Learning, AI in manufacturing systems, Benefits of AI systems, AI technologies and techniques, Future trends and opportunities,</td></tr>
<tr><td>Module 4</td><td>Control technologies in automation</td><td>Assignment</td><td colspan="3">Programming of microprocessors</td><td colspan="2">10 Sessions</td></tr>
</table>

Module 4: Control technologies in automation Industrial Control Systems, process industries verses discrete-manufacturing industries, continuous versus discrete Control. Computer based control process and its forms. Programming of microprocessors using 8085 instructions. Programmable logic controllers.	
Targeted Application: process control loop.Application Area is Industrial Automation, Automated processing stations, Assembly line balancing, Industrial	
Textbook: 1.Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover./PE/PHI 2016.	
References: 1. Computer Control of Manufacturing Systems: Yoram Coren. 2. CAD/CAM/CIM, (2ndEdition) by Radhakrishnan and Subramanian, New Age Publications. 3. Automation by W. Buekinsham. **Links:** 1. https://nptel.ac.in/content/storage2/courses/108105063/pdf/L01(SM)(IA&C)%20((EE)NPTEL).pdf 2. https://www.te.com/content/dam/te-com/documents/about-te/marketing/global/select-campaign/industrial-control-and-automation-guide.pdf 3. https://nptel.ac.in/courses/108105088 4. https://www.knimbus.com/user#/searchresult?searchId=Manufacturing%20Control%20and%20Automation&curPage=0&layout=list&sortFieldId=none&topresult=false&resultTab=Research	
Topics relevant to "EMPLOYABILITY SKILLS": Assembly process, Manual Assembly Lines, Line balancing methods, ways for improving line balance, flexible assembly lines for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Aravinda T
Recommended by the Board of Studies on	19th BOS held on 05/07/2024
Date of Approval by the Academic Council	24th Meeting of the Academic Council held on 03/08/2024

Course Code: MEC3023	Course Title: Rapid Tooling and Industrial Application Type of Course: Discipline Elective/ Theory Only	L-T-P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	Rapid tooling and industrial application appreciate the need for Rapid Tooling Techniques and to develop the basic abilities of modeling and analyzing the various Rapid Prototyping systems. The course is both conceptual and analytical in nature and needs fair knowledge of Physics and computing.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Rapid Tooling and Industrial Application**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1. Understand and use techniques for the processing of CAD models for rapid prototyping. CO2. Understand and apply the fundamentals of rapid prototyping techniques. CO3. Use appropriate tooling for the rapid prototyping process. CO4. Apply rapid prototyping techniques for reverse engineering.					
Course Content	**The course consists of 5 Modules, each module covering the contents of the subject in a balanced manner.**					
Module 1	Introduction and Fundamentals	Data Collection	10 sessions			
Topics: Prototype fundamentals, historical development, fundamentals of rapid prototyping, advantages of rapid prototyping, fundamental automated processes, process chain, 3D Modelling, data conversion and transmission.						
Module 2	Liquid- Based RP Systems Term paper/Assignment	Data Collection	10 sessions			
Topics: Stereolithography Apparatus(SLA), Solid Ground Curing(SGC), Solid Creation Systems(SCS), Solid Object Ultraviolet Laser Printer(SOUP), Two Laser beams, Rapid Freeze Prototyping, Micro-fabrication						
Module 3	Solid- Based RP Systems	Assignment	Data Collection	9 sessions		
Topics: Laminated Object Manufacturing(LOM), Fused Deposition Modelling(FDM), Paper Lamination Technology(PLT), Multi Jet Modelling(MJM), Melted Extrusion Modelling(MEM), Multi-functional RPM systems(M-RPM)						
Module 4	Powder- Based RP Systems	Assignment	Data Collection	8 sessions		
Topics: Selective Laser Sintering(SLS), 3-D printing(3DP), Laser Engineered Net Shaping, Direct Shell Production Casting(DSPC), Multiphase Jet Solidification(MJS), Electron Beam						

<table>
<tr><td colspan="5">Melting(EMB).</td></tr>
<tr><td>Module 5</td><td>Data Formats and Applications</td><td>Term paper/Assignment</td><td>Data Collection</td><td>8 sessions</td></tr>
<tr><td colspan="5">Topics:
STL format, STL file problems, STL file repair, other translators, Newly Proposed Formats, Applications in design, Applications in engineering, Applications in Manufacturing and Tooling and other applications.</td></tr>
<tr><td colspan="5">Targeted Applications & Tools that can be used:
Application area in all manufacturing - related companies and Industries.
Professionally used software: AutoCAD, CATIA, Catalyst</td></tr>
<tr><td colspan="5">Text Book
1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
2. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.</td></tr>
<tr><td colspan="5">References
1) Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.
2) Kamrani A K, Nasr E A, Rapid Prototyping: Theory and Practice, Springer.
3.
https://www.knimbus.com/user#/searchresult?searchId=RAPID%20TOOLING%20AND%20INDUSTRIAL%20APPLICATION&curPage=0&layout=list&sortFieldId=none&topresult=false&resultTab=Research</td></tr>
<tr><td colspan="5">Topics relevant to “EMPLOYABILITY SKILLS”: Selective Laser Sintering(SLS), 3-D printing(3DP), Laser Engineered Net Shaping, Direct Shell Production Casting(DSPC), Multiphase Jet Solidification(MJS), Electron Beam Melting(EMB) for developing EMPLOYABILITY SKILLS through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Mr. Wasim Akram</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td colspan="4">15th BOS held on 27/07/2022</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td colspan="4">Academic Council Meeting No. 18, dated 03/08/2022</td></tr>
</table>

<table>
<tr><td>Course Code:
MEC3024</td><td colspan="3">Course Title: Reverse Engineering and Computer Aided Inspection
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">Reverse Engineering and Computer Aided Inspection focus on either software (or) hardware reverse engineering (RE). In the process of RE students understand existing technologies, functions, features, objects, components and systems. Also understanding carefully of disassembling, observing, testing, analyzing and reporting.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of "Reverse Engineering and Computer Aided Inspection" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1. Understand basic engineering systems.
CO2. Understand the terminologies related to re-engineering, forward engineering, and reverse engineering.
CO3. Disassemble products and specify the interactions between its subsystems and their functionality
CO4. Understand Reverse Engineering methodologies.
CO5. Understand Reverse engineering of Systems, Mechanical RE etc.,</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Introduction to Reverse Engineering</td><td>Assignment</td><td colspan="2">seminar</td><td colspan="4">10 sessions</td></tr>
<tr><td colspan="9">Topics: Introduction to Reverse Engineering Forward Engineering Design, Design Thought and Process, Design Steps, System RE, RE Methodology, RE Steps, System level Design, and Examples</td></tr>
<tr><td>Module 2</td><td>Objectives and Methodologies of Reverse Engineering</td><td>Assignment</td><td colspan="2">Practical Exposure</td><td colspan="4">14 sessions</td></tr>
<tr><td colspan="9">Topics:
Reverse Engineering: Objectives and common application fields, Existing Technologies, Contact systems, Non-contact systems, Manipulation of acquired data. RE Methodology, RE Steps, System level Design, and Examples Practical Experiences.</td></tr>
<tr><td>Module 3</td><td>Additive Manufacturing</td><td>Assignment</td><td colspan="2">Case Study</td><td colspan="4">8 sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction to the Basic Principles of Additive Manufacturing and Design for Additive Manufacturing</td></tr>
<tr><td>Module 4</td><td>Reverse Engineering in Industrial Applications</td><td>Assignment</td><td colspan="2">Mini Project</td><td colspan="4">13 sessions</td></tr>
<tr><td colspan="9"></td></tr>
</table>

Topics: Reverse Engineering in Computer Applications, Re-engineering of PLC programs. Employment of Reverse Engineering and Rapid Prototyping technologies in different industrial fields with an outlook on the South Tyrolean industrial fabric.
Targeted Application & Tools that can be used: Application Area is engineering and Animation Services, Quality Magazine uses Reverse engineering in model-based metrology
Text Books 1. Product Design: Techniques in Reverse Engineering and New Product Development by K.Otto and K. Wood Prentice Hall, 2001. 2. Reverse Engineering: An Industrial Perspective by Raja and Fernandes. Springer-Verlag 2008 3. RE as necessary phase by rapid product development by Sokovic and Kopac. Journal of Materials Processing Technology 2005
References 1. Reversing: Secrets of Reverse Engineering by Eldad Eilam Publisher: Wiley (April 15, 2005) 2. The IDA Pro Book: The Unofficial Guide to the World's Most Popular Disassembler by Chris Eagle **Web Links** https://www.knimbus.com/user#/searchresult?searchId=Reverse%20Engineering%20&_t=1665465891854
Topics relevant to "EMPLOYABILITY SKILLS": Reverse Engineering in Computer Applications, Re-engineering of PLC programs. Employment of Reverse Engineering and Rapid Prototyping technologies in different industrial fields for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Yuvaraja Naik
Recommended by the Board of Studies on	15th BOS held on 27/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

Course Code: MEC3060	**Course Title: Robotics** **Type of Course: Discipline Elective & Theory Only**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Robotics**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Description	Robotics and stimulate their interests in science and engineering through the participation of the entire engineering design process. This course provides an overview of robot mechanisms, dynamics, and intelligent controls.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1. Apply the concepts of inverse manipulator kinematics to a robot. CO2. Apply the concepts of kinetics and kinematics to a robot. CO3. Choose a suitable trajectory generation scheme for robot tasks. CO4. Identify the types of sensors used in various applications.					
Course Content:						
Module 1	Industrial Robots and Their Applications	Assignment	Problem on DOF, Manipulator.	12 Sessions		
Topics: Introduction to robotics, classification of robots, workspace analysis, Manipulator Kinematics: Convention for affixing frames to links – DH Representation, Derivation of Direct kinematic equations for various types of robots. Inverse Manipulator Kinematics: Solvability, algebraic vs. geometric, Examples of inverse manipulator kinematics, repeatability and accuracy.						
Module 2	Kinematics of Robot	Assignment	Jacobians, rigid body, dynamic study	11 Sessions		
Topics: Jacobians: Velocities and static forces: Linear and rotational velocity of rigid bodies, velocity propagation from link to link, jacobians, singularities, static forces in manipulators, jacobians in force domain, Cartesian transformation of velocities and static forces.						
Module 3	Trajectory Planning	Assignment	Trajectory analysis	12 Sessions		
Trajectory Generation: General consideration in path description and generation, joint space schemes, collision free path planning, Robot programming.						
Module 4	ROS	Case Study	Study different types of sensor	10 Sessions		
ROS: Introduction, ROS - Services, Actions, Launch Files, Building your own ROS environment, Autonomous Navigation, Manipulation, Robot Vision, Design: Blender Introduction						
Targeted Application & Tools that can be used:						

Industrial applications of robots: Pick and place robots, welding and other industrial applications. Automation in industries.
Text Book: 1. Robert J Schilling: Fundamentals of Robotics, Analysis and Control. Prentice Hall of India, 1996. 2. Gonzalez / Woods, Digital Image Processing, Addison Wesley, 1993. 3. R K Mittal and I J Nagrath: Robotics and control. 4. S K Saha: Introduction to Robotics. •
References: 1. K S Fu R C Gonzales, C S G Lee: Robotics Control, Sensing, Vision and intelligence, McGraw Hill 1987. 2. John J Craig, Introduction to Robotics, Mechanics and control, second edition Addison – Wesley, 1999. 3. Mark W Spong & M Vidyasagar, Robot Dynamics and Control, John Wiley & Sons, 1989. 4. R P Paul: Robot Manipulators Mathematics Programming, Control, The computer control of robotic manipulators, The MIT Press 1979. 5. **Web Resources:** W1- https://nptel.ac.in/courses/112105249 W2- https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-live%26ebv%3dEB%26ppid%3dpp_xiii W3- https://www.knimbus.com/user#/searchresult?searchId=Robotics&_t=1663561891101
Topics relevant to "EMPLOYABILITY SKILLS": Trajectory Generation: General consideration in path description and generation, joint space schemes, collision free path planning, Robot programming for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Mr. ARUN GEORGE
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022

Course Code: **MEC3061**	**Course Title: Robotics and Automation Laboratory** **Type of Course:** **1) Discipline elective** **2] Laboratory only**	**L-T-P-C**	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Anti-requisites	NIL		
Course Description	This lab course provides the essential part of robot programming, handling using FANUC robot, Automation using hydraulic and pneumatic circuits. **This course also exposes the students to use RoboGuide – Software. RoboGuide – Software** is the leading of offline programming product on the market for FANUC		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Robotics and Automation Laboratory**" and attain **EMPLOYABILITY SKILL** through Experiential learning techniques.		
Course Out Comes	On successful completion of the course the students shall be able to: CO1] Create a Robotic Work cell using Robot Software. CO2] Generate Robot Programs for a material handling application CO3] Design of Pneumatic and Hydraulic circuits for low cost automation		
Course Content:	**The Robotics and Automation lab consists of following experiments** **PART A (RoboGuide – Software & Fanuc – M10iD/12 Material Handling Robot))** **1) Robot Selection and Work cell creation** Level 1:Selection of Robot type depend on the work process Level 2: Work cell creation of Robot on the work process **2) System Integration for Material Handling for Pick and Place** Level 1:Understand the basic concepts of system integration Level 2:Understanding working of pick and place robot **3) Programming of robot using Teach Pendant** Level 1:Understanding the basics of robot programming Level 2: Understand the usage of Teach pendant **4) Gripper Movement using Linear and Circular Path** Level 1:Understand the basic programming of Gripper movement Level 2: Gripper Movement using Linear and circular path **5) Control of Robot using Teach Pendant** Level 1:Understand the basics of control of robot Level 2:Controlling robot using teach pendant **6) Application of Vacuum and Magnetic Gripper** Level 1: Understand the working and application of vacuum gripper.		

	Level 2: Understand the working and application of magnetic gripper. **PART B (Automation)** **1) Speed control circuits for double acting Pneumatic cylinder.** Level 1: Understand basics of speed control of pneumatic cylinder Level 2: Understand working of double acting pneumatic cylinder **2) Sequencing of two cylinders Pneumatic and Hydraulic Circuit** Level 1: understand the basics of sequencing Level 2: Sequencing of cylinders using pneumatic and Hydraulic circuit. **3) Cascading circuit for two groups** Level 1: Understand the difference between sequencing and cascading Level 2: Cascading of two groups using pneumatic circuits **4) Implementation of logic circuits: AND, OR** Level 1: Implementation of AND logic circuit and understand its application Level 2: Implementation of OR logic circuit and understand its application **5) Basic Electro Pneumatic circuits:** Level 1: Understand the basics of electro pneumatic circuit. Level 2: Practicing simple Electro Pneumatic circuits. **6) Continuous reciprocation of cylinder(with timer and counter) Sequencing of two cylinders** Level 1: Understand the basics and application of timer and counter circuits Level 2: Continuous reciprocation of cylinder using timer and Counter–Sequencing of two cylinder

Targeted Application & Tools that can be used: This course applications mainly in automobile, space, defense, medical, consumer goods industries etc.

Tools used in profession: **RoboGuide – Software -**FANUCs Simulation Software and System Animation Tool, used to create, program, and simulate a robotic work cell in 3-D.

Text Book

1] Anthony Esposito, "Fluid Power with applications", Prentice Hall International, 2009.

Reference

1] Help Manual of RoboGuide V9.0

2] https://nptel.ac.in/courses/112/101/112101099/

3. https://www.amazon.in/Advances-Laboratory-Automation-Robotics-1985/dp/0931565014

4.https://www.amazon.com/Handbook-Automation-Optimization-Wiley-Interscience-Laboratory/dp/0471031798

5. https://www.knimbus.com/user#/searchresult?searchId=Robotics%20and%20Automation%20Laboratory&curPage=0&layout=list&sortFieldId=none&topresult=false&resultTab=Research	
Topics relevant to **"EMPLOYABILITY SKILLS"**: Robot Selection and Work cell creation, Programming of robot using Teach Pendant, Gripper Movement using Linear and Circular Path for developing **EMPLOYABILITY SKILLS** through **Experiential Learning techniques.** This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Akshay Nanjangud
Recommended by the Board of Studies on	15th BOS held on 27/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

Course Code: MEC3080	**Course Title: Fundamentals of plastic Injection Moulding** **Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	Nil					
Course Description	The Course is designed with an objective of giving an overview of designing appropriate moulds and their applications.Develops students' competence and self-confidence as product design engineers. Emphasis on the creative design process bolstered by application of physical laws. Robustness and manufacturability are emphasized. Subject relies on active learning via a minor design-and-build project. Lecture topics include idea generation, estimation, concept selection, visual thinking, computer-aided design (CAD).					
Course Outcomes	On successful completion of this course the students shall be able to: CO1. Gain a commercial appreciation of the injection moulding process CO2.Understand advantages and disadvantages of injection moulding CO3. Understand material categories in relation to properties, performance and selection CO4.Understand product design CO5.Gain an awareness of injection moulding faults and how to overcome them					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Fundamentals of plastic Injection Moulding**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Content:						
Module 1	Product Design	Assignment	Industrial application	12 sessions		
Topics: Plastics product design - Concepts - Essential factors - Principles - Methodical approach -process variables vs product design. Uniform and symmetrical wall thickness - Draft angle- Rib design – Fillets & Radius **Assignment**: How can robots be used in plastic injection moulding with its applications						
Module 2	Injection Mould Design 1	Case Study		12 sessions		
Topics: Introduction -General mould construction- Mould design concepts - mould elements - parting line and parting surface **Case Study**: Study on metal injection moulding used in industry for plastic injection moulding						
Module 3	Injection Mould Design 2	Assignment	Data analysis	11 sessions		
Topics: Construction of core and cavities Bolsters - mould alignment, Feed system- Sprue, runner, gate & position of gate - runner & gate balancing. **Assignment**: Find the effects of injection molding parameters on shrinkage and weight of plastic part.						

Module 4	Injection Mould Design 3	Assignment	Auxillary parts cooling-analysis	10 sessions

Ejection - types of ejections - mould cooling -venting- ancillary parts.
Two plate mould - three plate - external undercut- split mould, Side cores, Split and side core actuation
Assignment: Water cooling system used for auxillary parts of moulding.

Targeted Application & Tools that can be used:
Contemporary issues: Knowledge of PIM can help students in becoming Tool & die makers, CAD release engineer, Dimensional engineer where various employability opportunities are available at all automotive industries, OEM's, Tier 1 and Tier 2 organizations
Professionally Used Software: SolidWorks.

Textbooks:
R. G. W. Pye, Injection Mould Design, Longman; 4th edition (1 September 1989)

References

7. Ronald D. Beck, Plastic Product Design, Van Nostrand Reinhold Inc.,U.S. (1 February 1971)
8. Hans Gastrow, Gastrow Injection Molds 4e: 130 Proven Designs, Hanser Pub Inc; 4th edition (1 May 2006)
9. László Sors, Plastic Moulds and Dies, Van Nostrand Reinhold Company (1 April 1981)

Web resources:

1. https://presiuniv.knimbus.com/openFullText.html?DP=https://www.emerald.com/insight/content/doi/10.1108/ir.2006.04933aaf.002/full/html
2. https://presiuniv.knimbus.com/openFullText.html?DP=https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/13552540910960271/pdfplus/html

Topics relevant to "EMPLOYABILITY SKILLS": Mould construction- Mould design concepts - mould elements - parting line and parting surface for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Mr. Sandeep G M
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 27/08/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

Course Code: **MEC3047**	**Course Title: Metal Forming and Simulation** **Type of Course: Discipline Elective**	**L-T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to develop the detailed understanding of various forms of metal forming operations and its relevant industrial applications. The course also enables the students to equip themselves with a industry relevant practical skills to deliver the solutions in the form simulations of various metal forming processes along with relevant industrial case studies.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of "**Metal Forming and Simulation**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1. Discuss the important fundamental aspects of metal working. CO2. Compute the forging load and rolling forces in closed die forging operations and rolling operations respectively. CO3. Compute the various process parameters associated with deep drawing and forming process. CO4. Compute the various process parameters associated with Sheet metal working operations. CO5. Simulate the various metal forming operations using an industry relevant analysis tool.					
Course Content:						

Module 1	Fundamentals of metal forming operations.	Assignment	Data collection	06 Sessions

Topics: Classification of Forming Processes, Mechanics of Metalworking, Flow-Stress Determination, Temperature in Metalworking, Strain-Rate Effects, Metallurgical Structure, Friction and Lubrication. Deformation-Zone Geometry, Hydrostatic Pressure, Workability, Residual Stresses, Experimental Techniques for Metalworking Processes.
Assignment: Case studies on effect of residual stresses, hydrostatic pressure and temperature in metal forming.

Module 2	Forging and Rolling Operations.	Case Study	Automotive and aerospace applications of forged and rolled components	10 Sessions

<table>
<tr><td colspan="5">Topics:
Forging: Forging in Plane Strain, Open-Die Forging, Closed-Die Forging, and Calculation of Forging Loads in Closed-Die Forging, Relevant Numericals.
Rolling of Metals: Forces and Geometrical Relationships in Rolling, Simplified Analysis of Rolling Load: Rolling Variables, Problems and Defects in Rolled Products. Relevant Numericals.
Case Study: Case study on Automotive and aerospace applications of forged and rolled
Components</td></tr>
<tr><td>Module 3</td><td>Deep Drawing And Forming Process</td><td>Assignment</td><td>Data Collection</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Drawing :
Deep drawing – Applications-Redrawing – Single acting press with combination tool -double acting press with combination tool -defects in deep drawing process -Erichsen cupping machine -marforming -hydro forming
Forming :
Cold working process – shearing operations – Bending operations – squeezing -peening -sizing -coining -hobbing -rubber pressing – spinning -flow turning – stretch forming -coining – Embossing – high energy rate forming – Explosive forming – Electro Hydraulic forming-electromagnetic forming
Assignment: Deep drawing and forming processanalysis tools used in industry</td></tr>
<tr><td>Module 4</td><td>Sheet Metal forming</td><td>Assignment</td><td>Data Collection</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics:
Sheet Metal Forming: Forming methods, Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, Limiting Drawing Ratio (LDR) in drawing, forming limit criterion,. Roll bending & contouring.
Simple problems.
Assignment: Roll bending and contouring analysis</td></tr>
<tr><td>Module 5</td><td>Simulation Techniques</td><td>Assignment</td><td>Data Collection</td><td>14 Sessions</td></tr>
<tr><td colspan="5">Simulation of Forming Operations: Various simulations tools used in forming, significance of simulation in forming operations, Advances in simulations in forming operations, career opportunities and prerequisites skills for simulation engineering professional, steps involved in simulating forming operations, Simulation of various forging, rolling, drawing, extrusion and sheet metal operations using Ansys software.
Assignment: Various simulation tools in forming</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Application Area is manufacturing industries to work as a design and simulation engineer.
Professionally Used Software: Ansys/Solidworks/Abaqus.</td></tr>
<tr><td colspan="5">Text Books:
T1. Mechanical Metallurgy Dieter G.E McGraw Hill publication.
References
1. Metal Forming: Technology and Process Modelling, Uday S. Dixit, R. Ganesh Narayanan, ISBN: 9781259007347, Publication Date & Copyright: 2013, McGraw-Hill Education Private Limited.
2. Mechanics of Sheet Metal Forming by Jack Hu, Zdzislaw Marciniak, John Duncan, Elsevier, 17-Apr-2002 - Technology & Engineering.
3. Formability: A Review of Parameters and Processes that Control, Limit or Enhance the Formability of Sheet Metal.</td></tr>
</table>

4. Material Science and Metallurgy -O.P. Khanna -S. Chand -1986.
5. Principle of Industrial Metal Working Processes Rowe Edward CBS Publication

Topics relevant to "EMPLOYABILITY SKILLS": Simulating forming operations, Simulation of various forging, rolling, drawing, extrusion and sheet metal operations using Ansys software for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout

Catalogue prepared by	Dr Sudheer
Recommended by the Board of Studies on	15^{th} BOS held on 27/08/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

Weblinks:
W1.https://nptel.ac.in/courses/112/107/112107250/

W2.
https://presiuniv.knimbus.com/user#/searchresult?searchId=metal%20forming%20and%20simulation&_t=1665070057392

<table>
<tr><td>Course Code:
MEC3052</td><td>Course Title: Machine Tool Design
Type of Course: Discipline Elective</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">This course is built upon the premise that the students already has a fairly good knowledge of fundamental subjects like Manufacturing Processes, Engineering Materials, Design of Machine Elements etc. This course will mainly focus on fundamental principles of machine tool design. Also this course will provide exposure to the students on modern development of machine tools like NC/CNC.
.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "Machine Tool Design" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="6">On successful completion of the course the students shall be able to:
CO1 Describe various types of motions in a machine tool.
CO2 Explain the basic principles of machine tool drives and mechanism.
CO3 Select an appropriate material for designing a machine tool.
CO4 Discuss advantages and limitations of machine tools.
CO5 Describe the various guideways and power screws.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>General principle of Machine Tool Design</td><td>Assignment</td><td colspan="2">Machine tool drive</td><td colspan="2">12 sessions</td></tr>
<tr><td colspan="7">Topics:
working and auxiliary motion in machine tools, parameters defining working motions of a machine tool, machine tool drives, general requirements of machine tool design.
Assignment: Various machine tool drives used CNC machine tools.
.</td></tr>
<tr><td>Module 2</td><td>Machine Tool Drives And Mechanisms</td><td>Case study</td><td colspan="2">Data analysis and its application</td><td colspan="2">7 sessions</td></tr>
<tr><td colspan="7">Topics:
Working and auxiliary motion. Drives- Electric drives, Hydraulic transmission, Kinematic structure, Regulation of speed and feeds, stepped regulation, standardization of speed and feed, stepless regulation of speeds and feeds
Case Study: Special type of gear boxes design and its application</td></tr>
<tr><td>Module 3</td><td>Design of Machine Tool structures</td><td>Assignment</td><td colspan="2">Machine tool structure profile</td><td colspan="2">8 sessions</td></tr>
<tr><td colspan="7">Topics:
function of machine tool structures and their requirements, design criteria for machine tool structures, materials for machine tool structures, static and dynamic stiffness, profiles of machine tool structures, basic design procedure for machine tool structures.
Assignment: Machine tool structure profile</td></tr>
<tr><td>Module 4</td><td>Design of</td><td>Case</td><td colspan="2">Effect of machine tool</td><td colspan="2">8 sessions</td></tr>
</table>

	spindles and spindle supports	study	compliance on machining accuracy	

Topics:
Function of spindle unit and requirements, material of spindles, effect of machine tool compliance on machining accuracy, design calculation of spindles.
Case Study: Effect of machine tool compliance on machining accuracy

Module 5	Design Of Guide Ways And Power Screws	Assignment		10 sessions

Topics:
Function and types of guide ways – Design and lubrication of slide ways - aerostatic slide ways - antifriction guide ways, combination guide ways - protecting devices, design of power screws.

Targeted Application & Tools that can be used:
Cutting tools used in producing automobile engine, aircraft engine and other parts where higher order complexity is involved.
Professionally Used Software:

Text Book:
T1. Machine Tool Design, N.K.Mehta, Tata McGraw Hill, 2001.
T2. Principles of Machine Tools, Sen and Bhattacharaya, Oxford IBM Publishing, 2000.

References:
R1. Machine Tool Design, Volume – II and III, N.Acharkan, MIR Publications, 2000.
R2. Design of Machine Tools, S.K.Basu and D.K.Pal, 2000.
R3. Principles of Machine Tool Design, Koensberger, 1993

Weblinks:
W1: https://nptel.ac.in/courses/112105124/
W2: https://presiuniv.knimbus.com/user#/searchresult?searchId=Machine%20tool%20design&_t=1662460116386

Topics relevant to "EMPLOYABILITY SKILLS": Design criteria for machine tool structures, materials for machine tool structures, static and dynamic stiffness, profiles of machine tool structures for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Mr. Wasim Akram
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/07/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

<table>
<tr><td>Course Code:
MEC3056</td><td colspan="2">Course Title: Product Design and Development
Type of Course: Discipline Elective</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The Course is designed with an objective of giving an overview of creative design; user research and requirements analysis, product specifications, Computer Aided Design; standardization, variety reduction, preferred numbers and other techniques; modular design; design economics, cost analysis, cost reduction and value analysis techniques, design for production; human factors in design: anthropometric, ergonomic, physiological considerations in design decision making; legal factors, engineering ethics and society</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Product Design and Development" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7">On successful completion of the course the students shall be able to:
C01 Describe the different types of product and its specifications.
C02 Explain phases of Product Development.
C03 Discuss various cost estimation, cost reduction techniques and their impact on Product life cycle.
C04 Classify various human factors in decision making approach.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction to Product Development:</td><td>Case Study</td><td colspan="4">Case studies on Successful implementation of product development in KIA industrY</td><td>12 sessions</td></tr>
<tr><td colspan="8">Topics:
Need for developing products, characteristics of successful product development, Design and development of Product, duration and cost of product development, challenges of product development, company realities, product development process, concept and generic, opportunity identification process and its six steps, identifying customer needs, Plan and establish product specifications.
Case Study: Case studies on Successful implementation of product development in KIA industry.</td></tr>
<tr><td>Module 2</td><td>Product development phases:</td><td>Case study</td><td colspan="4">Study on Analogy between a university and a product development organization.</td><td>11 sessions</td></tr>
<tr><td colspan="8">Topics:
Theory: Activity of concept generation, Structured approaches, clarification and search – externally and internally, exploring systematical approach, reflect on the solutions and processes, concept selection – methodology – benefits, concept screening and scoring, concept testing and its seven steps by illustrating example.
Case Study: Study on Analogy between a university and a product development organization.</td></tr>
<tr><td>Module 3</td><td>Design for manufacturing</td><td>Assignments</td><td colspan="4">Architecture: Geometric layout</td><td>10 sessions</td></tr>
</table>

	and product development			
Topics: *Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.* *Assignment: Latest Architecture Geometric layout used in product development*				
Module 4	Industrial design	Case study	Case study of major Environmental impacts which effect Industrial design.	12 sessions
Topic: **Integrate process design** – Assessing the need for industrial design, impact of industrial design, industrial design process, Management of industrial design process-technology driven products, quality of industrial design. **Design for environment and manufacturing:** Definition – Need of design for environment, Environmental impacts, DFE process and guidelines, Definition of Design for manufacturing, Estimation of Manufacturing cost – reducing the component costs and assembly costs, supporting production cost – Minimize system complexity – Impact of DFM decisions on other factor, Materials Cost and terminology. Robust design and its process. **Case Study:** Case study of major Environmental impacts which effect Industrial design				
Targeted Application & Tools that can be used: Manufacturing and processing industries **Professionally Used Software:**				
Text Book: T1. Karl T. Ulrich, Steven D. Eppinger, "Product Design and Development", McGraw Hill Education India.				
References: R1. Kevin Otto, Kristin Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", Pearson Education India. R2. Edward B. Magrab, et. Al., "Integrated Product and Process Design and Development", CRC Press **Weblinks:** W1: https://onlinecourses.nptel.ac.in/noc21_me83/preview W2: https://presiuniv.knimbus.com/openFullText.html?DP=https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/09544789910262743/pdfplus/html				
Topics relevant to "EMPLOYABILITY SKILLS": Estimation of Manufacturing cost – reducing the component costs and assembly costs, supporting production cost – Minimize system complexity – Impact of DFM decisions for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies.** This is attained through assessment component mentioned in course handout				
Catalogue prepared by	**Dr. G N Lokesh**			
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 27/08/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

Course Code: **MEC3035**	**Course Title: Production Planning and Control** **Type of Course: Discipline Elective**		**L-T-P-C**	3	0	0	3
Version No.	2.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	The Course is designed with an objective of giving an overview of planning, control and inventory systems. The Course discusses about the generalized model of production systems, types of production flows, life cycle concepts, facilities location and layout planning, aggregate and batch production planning, inventory systems, materials requirements planning, elements of monitoring and production control.						
Course Outcomes	On successful completion of this course the students shall be able to: CO1 Explain the function of Production, Planning and control CO2 Analyze the scope of forecasting principles and techniques CO3 Explain the function of inventories and its relevant cost techniques method. CO4 Outline the procedural activities of routing and scheduling CO5 Explain the functions of dispatching and follow-up activities.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Production planning and Control**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.						
Course Content:							
Module 1	Introduction to Production Planning and Control	Assignment	Industrial application	06 sessions			
Topics: Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect – Functional aspects-Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization-Break even analysis-Economics of a new design **Assignment**: Break Even analysis							
Module 2	Product Planning and Process Panning	Assignment	Data analysis	09 sessions			
Topics: Product Planning-Extending the original product Information-Value Analysis-Problems in lack of product Planning-Process planning and routing-Pre requisite information needed for process Planning-Steps in process Planning-Quantity determination in batch Production-Machine capacity, Balancing-Analysis of process capabilities in a multi-product system. **Assignment**: Study on value analysis of product with respect to process capabilities.							
Module 3	Production Scheduling	Assignment	Data analysis	10 sessions			

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems – Line of balance – Flow production scheduling-Batch production scheduling-Product sequencing – Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates				
Module 4	Inventory control and recent trends in PPC	Assignment	Data analysis	10 sessions
Inventory control -Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP				
Module 5	Quality Control Methods in PPC	Assignment	Data analysis	10 sessions
Quality process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies. Statistical Process Control : Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies				
Targeted Application & Tools that can be used: Contemporary issues: Knowledge of PPC can help students in planning the product design with less inventory and product cost. Professionally Used Software: PPC softwares online .				
Textbooks: T1.Stefan N. Chapman, "*Fundamentals of Production Planning and Control*", Pearson Education India				
References R1.Prof. L. C. Jhamb, "*Production Planning and Control*", Everest Publishing house. R2.S. K. Mukhopadhyay, "*Production Planning and Control: Text and Cases*", PH R3.Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984 R4.Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition, John Wiley and Sons, 2000 **Web resources:** W1: https://nptel.ac.in/courses/112107143 W2: https://presiuniv.knimbus.com/user#/searchresult?searchId=product%20planning%20and%20control&_t=1662448273401				
Topics relevant to "EMPLOYABILITY SKILLS": Kaizen, reengineering, six sigma, Statistical Process Control: Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Mr. Aravinda T			
Recommended	BOS NO: 15th BOS held on 27/08/2022			

by the Board of Studies on	
Date of Approval by the Academic Council	Academic Council Meeting No.18, dated: 3/8/22

Course Code: **MEC3014**	**Course Title:** **Smart Materials** **Type of Course:** **Discipline Elective**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	2.0					
Course Pre-requisites	NIL.					
Anti-requisites	NIL					
Course Description	Smart Structures and Intelligent System are nowdays extensively used in aerospace, automobile system and construction industries due to better performance and quick response feature. The subject is interdisciplinary in nature involving concepts of materials, composites, electronics and control system.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Smart Materials**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1. Understand the different types of smart material and their application. CO2. Understand the design of composite based smart material. CO3. Understand the different types of actuators and their application in MEMS					
Course Content:						
Module 1	Introduction to smart materials	Case study	Shape memory alloys	15 sessions		
Topics: Introduction to smart materials, need of smart materials, different types of smart materials such as piezoelectric material, magnetostrictive material, polymer based smart material and shape memory alloys. **Case study:** Case study on smart material application in architecture and engineering fields						
Module 2	Smart composite and their properties	Assignment	Smart Composites	15 sessions		
Topics: Introduction to composite, definition of smart composite, composite classification, composite application, Fibers and their types. **Assignment:** Composite material application in aerospace engineering						
Module 3	Introduction to shape Memory Alloys, Fibre optics and MEMS	Assignment	Smart material based MEMS	15 sessions		

Topics:

Shape Memory Alloys: Introduction, Phenomenology, Influence of stress on characteristic temperatures, Modelling of shape memory effect. Vibration control through shape memory alloys. Design considerations, multiplexing embedded NiTiNOL actuators.

FibreOptics: Introduction, Physical Phenomenon, Characteristics, Fibre optic strain sensors, Twisted and Braided Fibre Optic sensors, Optical fibres as load bearing elements, Crack detection applications, Integration of Fibre optic sensors and shape memory elements

MEMS: History of MEMS, Intrinsic Characteristics, Devices: Sensors and Actuators. Microfabrication: Photolithography, Thermal oxidation, Thin film deposition, etching types, Doping, Dicing, Bonding. Microelectronics fabrication process flow, Silicon based, Process selection and design.

Assignment : Smart materials based MEMS in medical applications

Targeted Application & Tools that can be used:

Parts produced composite material find its use in products like automobile parts, manufacturing units, machines, assembling of components, parts of electric and electronic items etc.

Professionally Used Software:

Text Book:

T1. "Smart Materials and Structures", M.V.Gandhi and B.S.Thompson Chapmen & Hall, London, 1992 (ISBN:0412370107)

References:

R1. "Foundation of MEMS, by Chang Liu. Pearson Education. (ISBN:9788131764756)

Weblinks:

W1: https://nptel.ac.in/courses/112104173

W2: https://presiuniv.knimbus.com/user#/searchresultsearchId=smart%20material&_t=1662460998316

Topics relevant to "EMPLOYABILITY SKILLS": Smart material based MEMS Devices, Sensors and Actuators for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Ashish Shrivatsa
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 27/08/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: MEC3029	**Course Title: Advanced Heat-Transfer** **Type of Course: Discipline Elective & Theory only**	**L-T- P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	MEC3089					
Anti-requisites	**NIL**					
Course Description	This Course is designed to teach engineering students the concepts of heat transfer and application of heat transfer principles to the design. This Course provides an introduction to the fundamental concepts of heat transfer; Thermal conductivity steady-state and unsteady-state heat conduction multilayer conduction, heat transfer through a composite wall, critical insulation thickness, analytical and empirical relations for forced and free convection heat transfer; empirical relations used for pipe and tube flow, boundary layer and its thickness, heat exchanger analysis and design; to design and analyse the performance of heat exchangers and evaporators.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Advanced Heat-Transfer**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	CO1] Apply the concept of steady state conduction heat transfer in solids. CO2] Employ the methods of heat transfer with effective resistence. CO3] Compute the heat transfer coefficient for natural and forced convection. CO4] Apply the concept of radiation heat transfer between surfaces. CO5] Compute the effectiveness of a specific heat exchanger.					
Course Content:						

Module 1	Conduction	Assignment	Data collection	12 Sessions
Topics: Introduction - basic modes of heat transfer and governing laws– conduction – general heat conduction equation in Cartesian – one dimensional steady state conduction with and without heat generation – concept of thermal resistance – concept of composite wall – overall heat transfer coefficient – critical thickness of insulation – extended surface heat transfer – fin performance –effect of variable thermal conductivity- problems. Unsteady state conduction in one dimension, lumped heat capacity system				
Module 2	Convection	Assignment	Mathematical	12 Sessions
Topics: Newton's law – concept of boundary layer – significance of Prandtl number – boundary layer equations – flat plate heat transfer– laminar and turbulent flow – Reynolds analogy – empirical relations in forced convection – internal flow – boundary conditions – laminar and turbulent flow – heat transfer coefficients – empirical correlations. Natural convection.				
Module 3	Radiation	Assignment	Mathematical	8 Sessions

Topics: Fundamentals of radiation – radiation spectrum – thermal radiation – concept of black body and grey body – monochromatic and total emissive power – absorptivity, reflectivity and transmissivity- laws of radiation – radiation between two surfaces – geometrical factors for simple configuration– radiation shields				
Module 4	Heat exchangers	Assignment	Mathematical	12 Sessions
Topics: Classification – log mean temperature difference – overall heat transfer coefficient – fouling and scaling of heat exchangers – LMTD and NTU method of performance evaluation of heat exchangers. Introduction to mass transfer – Fick's law of diffusion - problems				
Targeted Application & Tools that can be used: Application Area is Geophysical phenomenon, Hydrology, Aerospace, Aerodynamics, Microfluidics, Pipe network, heat exchangers. Industries using above applications and tools – Siemens, Quest Global, Simulent consulting, Triveni Engineering, TATA, GE etc				
Test book: **1.** J P Holman, Souvik Bhattacharyya, "Heat Transfer" McGraw Hill Education (India)Pvt Ltd				
References 1. S. P. Sukhatme, "A text book on heat transfer", Universities press (India) private limited. 2. F. P. Incropera and D.P.Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons. **Topics for Technology Enabled Learning:** NPTEL :: Mechanical Engineering - https://nptel.ac.in/courses/112108149 W2:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_1106				
Topics relevant to "EMPLOYABILITY SKILLS": Concept of composite wall – overall heat transfer coefficient – critical thickness of insulation – extended surface heat transfer – fin performance –effect of variable thermal conductivity for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Mr. Neeraj Singh			
Recommended by the Board of Studies on	15th BOS held on 29/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022			

<table>
<tr><td>Course Code:
MEC3013</td><td colspan="3">Course Title: Soft Computing Techniques
Type of Course: Discipline Elective & Theory Only</td><td>L-T- P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">MAT1001, MAT1002</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">Nil</td></tr>
<tr><td>Course Description</td><td colspan="8">This course introduces soft computing methods which, unlike hard computing, are tolerant of imprecision, uncertainty and partial truth. This tolerance is exploited to achieve tractability, robustness and low solution cost... The basics of each technique will be discussed and industrial applications will illustrate the strengths of each approach. The course is self-contained. Knowledge of calculus and familiarity with a medium-level programming language is assumed. The class will have several programming and homework assignments, and a final project</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1:Understand the fundamental concepts and components of soft computing techniques such as fuzzy logic, neural networks, and genetic algorithms.
CO2:Apply fuzzy logic and reasoning to solve real-life problems involving uncertainty and imprecision.
CO3:Design artificial neural networks for classification, regression, and pattern recognition tasks.
CO4:Implement genetic algorithms for solving optimization problems in engineering and decision-making domains.
CO5:Analyze the strengths and limitations of various soft computing techniques for different types of applications.
CO6:Integrate multiple soft computing paradigms (e.g., neuro-fuzzy systems, genetic-fuzzy systems) to develop hybrid intelligent systems.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of “Soft Computing Techniques” and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Fuzzy Logic</td><td>Case Study</td><td>Data collection. Programming & Data Analysis</td><td colspan="5">14 sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction to Soft Computing, classification, applications, Introduction to Fuzzy logic, Fuzzy set, Fuzzy numbers, Fuzzy membership functions, Fuzzy operations, Fuzzy relations, Fuzzy propositions, fuzzy implications, Defuzzification techniques, logic controller, application of fuzzy logic.</td></tr>
<tr><td>Module 2</td><td>Genetic Algorithm</td><td>Case Study</td><td>Data collection. Programming & Data Analysis</td><td colspan="5">10 sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction Genetic Algorithm, Genetic Algorithm for optimization, GA strategies, Terminologies, Techniques of GA: Multiobjective optimization, Cross over, Mutation. Classification of GA, Implementation of GA using MATLAB.</td></tr>
</table>

Module 3	Artificial Neural Networks	Case Study	Data collection. Programming & Data Analysis	10 sessions

Topics:
Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real-life problems.

Module 4	MATLAB for Soft Computing	Assign ment	Data collection. Programming & Data Analysis	8 sessions

Introduction to Matlab, Use of Matlab for Fuzzy logic, Genetic Algorithm & Artificial Neural Networks.

Targeted Application & Tools that can be used:

Application

- Hand Written Script Recognition, Image processing
- Automation and Robotics
- Decision Support Systems
- Investment and Trading
- Automotive Systems and Manufacturing

Tools

- MATLAB
- Python
- R Programming

Textbooks:

1. James M.Keller, "Fundamentals of Computational Intelligence", Wiley, First Edition, 2016.
2. Snehashish Chakraverty, "Concepts of Soft Computing", Springer -2019.

References

1. Ray.S.Kumar, "Soft Computingand Its Applications", Apple Academic Press, First Edition -2015
2. S.N Sivanandam, "Introduction to Genectic Algorithm", Springer –2019
3. Graupe Daniel, "Principles of Artificial Neural Networks", World Scientific Publishing – 2013E ResourceWeb resources:
   1. https://presiuniv.knimbus.com/user#/searchresult?searchId=soft%20computing%20techniques&_t=1666087571919

Topics relevant to "EMPLOYABILITY SKILLS": Techniques of GA- Multi objective optimization, Cross over, Mutation, Implementation of GA using MATLAB for developing EMPLOYABILITY SKILLS through Problem Solving methodologies. This is attained through assessment component mentioned in course handout

Catalogue prepared by	Mr. ARUN AROGYASWAMY G
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No.18, Dated : 3/8/22

Course Code: **MEC3063**	**Course Title: Control Engineering** **Type of Course: Discipline Elective & Theory only**			**L-T-P-C**	3	0	0	3
Version No.	2.0							
Course Pre-requisites	NIL							
Anti-requisites	NIL							
Course Description	The Modern-day control engineering is a relatively new field of study that gained a significant attention during 20th century with the advancement in technology. Control engineering has an essential role in a wide range of control systems, from simple household washing machines to high performance F-16 fighter aircraft. It seeks to understand physical systems, using mathematical modelling, in terms of inputs, outputs and various components with different behaviours; use control systems design tools to develop controllers for those systems; and implement controllers in physical systems employing available technology. A system can be mechanical, electrical, fluid and even biological and the mathematical modelling, analysis and controller design uses control theory in one or many of the time, frequency and complex S domains, depending on the nature of the design problem.							
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1. Identify the type of control system, controllers, various test signals, compensators, stability, concepts, analogous systems and frequency response terminologies, CO2. Develop mathematical models of mechanical, electrical, electro-mechanical and hydraulic control systems in order to obtain system response for given input test signals, CO3. Obtain the transfer functions by applying block diagrams reduction techniques and signal flow graphs for different applications of control system. CO4. Predict the stability of a control system by developing R-H criterion, bode and root locus plots.							
Course Objectives:	The objective of the course is to familiarize the learners with the concepts of "**Control Engineering**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.							
Course Content:								
Module 1	Introduction	Assignment	Programming Task					8 Sessions
Topics: Concept of automatic controls, open and closed loop systems, concepts of feedback, requirement of an ideal control system. Types of controllers - Proportional, Integral, Proportional Integral, Proportional Integral Differential controllers.								
Module 2	Mathematical Models	Case Study	Simulation and data analysis task					9 Sessions
Topics: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems. Analogous Systems: Force-voltage analogy and force – current analogy.								
Module 3	Block	Assignment	Simulation task					8

	Diagrams and Signal Flow Graphs			Sessions
Topics: Transfer Functions definition, function, block representation of system elements, problems on reduction of block diagrams.				
Module 4	Frequency Response Analysis	Assignment	Simulation/Data Analysis	10 Sessions
Topics: Frequency Response Analysis using Bode Plots: Bode attenuation diagrams. Root Locus Plots: Definition of root loci, general rules for constructing root loci				
Module 5	Series Feedback Compensation	Assignment	Simulation/Data Analysis	10 Sessions
Topics: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalmanand Gilberts test.				

Targeted Application & Tools that can be used:
Contemporary issues
Professionally Used Software: Matlab.

Text Book
T1. Modern Control Engineering: Katsuhiko Ogata, Pearson Education, 2003.
T2. Control Systems Principles and Design: M. Gopal, TMH, 2000

References
R1. Feedback Control Systems by Schism's series 2001.
R2. Control systems by I.J. Nazareth & M. Goal, New age International publishers 2002.
R3. Automatic Control Systems – B.C. Kuo, F. Golnaraghi, John Wiley & Sons, 2003.
R4. Control Engineering by U A Bakshi and V U Bakshi, Technical Publications, 2012

Web Links:
https://nptel.ac.in/courses/108106098

W1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2628
Control Engineering Practice, Science Direct

W2:
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=ELEARNING601

Control Engineering, Knimbus Multimedia

Topics relevant to "EMPLOYABILITY SKILLS": Frequency Response Analysis using Bode Plots, Bode attenuation diagrams and Root Locus Plots for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Sample Thought provoking questions 1. The root locus is a graphical representation in s-domain and it is symmetrical about the real axis. Because the open loop poles and zeros exist in the s-domain having the values either as real or as complex conjugate pairs. Calculate the angle of asymptotes and centroid for the given transfer function. 2. In order to obtain the desired performance of the system, we use compensating networks. Compensating networks are applied to the system in the form of feed forward path gain. Elucidate about Lag compensator with a neat sketch.	
Catalogue prepared by	Mr. Basavaraj Devakki
Recommended by the Board of Studies on	11th BoS held on 05/09/2020
Date of Approval by the Academic Council	14th Meeting of the Academic Council held on 24/12/2020

Course Code: MEC3082	**Course Title:** Elements of Solar Energy Conversion **Type of Course:** Discipline Elective & Theory Only			**L-T-P-C**	3	0	0	3
Version No.	1.0							
Course Pre-requisites	NIL							
Anti-requisites	NIL							
Course Description	This course intends to introduce the basic concepts required for the engineers to work in the field of solar energy technology, both industrial installations and research endeavours. The major focus is on the following topics: the apparent movement of the sun, irradiation prediction, intensity estimation on tilted plane, flat plate collectors, concentrating collectors of various kinds, thermal and photovoltaic routes of solar energy conversion. The course assumes basic knowledge in UG level thermodynamics, optics, semiconductor physics, heat transfer and engineering mathematics. The advanced UG ME students and the PG ME students intending to work in the field solar energy field should opt for this course.							
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Elements of Solar Energy Conversion**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.							
Course Out Comes	On successful completion of the course the students shall be able to: CO1] Recognize the significance of the principles of solar energy in the engineering context CO2] Illustrate the fundamentals of solar energy conversion. CO3] Explain the various devices for solar energy conversion							
Course Content:								
Module 1	Solar Energy Measurements	Assignment	Data Collection	15 Sessions				

Topics:

- Basic concepts related to solar radiation, the sun, spectral distribution, sun- earth relationship, extraterrestrial radiation, revolution of earth, seasons, position of sun in the sky, position of sun with respect to the center of the earth
- Concept of time, equation of time, solar time, standard time, Role of atmosphere on solar radiation, air mass, terrestrial spectrum, prediction of solar radiation
- Diffuse and direct radiation, derivation of the relationships between angles
- Sign conventions, angle of incidence o on a tilted plane, shading, sun-path diagram, overhangs, parallel rows of solar collectors, measurement of radiation
- Estimation of total irradiance on a tilted surface, radiation augmentation

Assignment: Determination of solar radiation data for all southern states at different location.

Module 2	Solar Collectors	Assignment	Data Collection/Excel	15 Sessions

Topics:

- Flat plate collector, thermal analysis, heat removal factor
- Air heaters, thermal analysis of air heaters, overview of other thermal collectors, testing procedure
- Single axis tracking, concentrating collectors, theoretical limit, classifications of concentrators
- Parabolic trough collector, thermal analysis, compound parabolic concentrators, parabolic dish collector, central receiver tower

Assignment: Study of solar collectors for Indian scenario

Module 3	Friction on Rigid bodies	Assignment	Design	15 Sessions

Topics:

- Non-thermal routes for solar energy conversion, Basics of photovoltaic effect, Electron-hole carrier

formation and motion

- Band bending, photovoltaic generation, P-N junction diode, forward Bias, reverse bias
- Dark current, light-generated current, IV characteristic curve for P-N junction diodes, efficiency, effect of temperature intensity and spectrum, Comparative discussion on different solar conversion technologies in the state of the art form and the future directions

Assignment: Design of PV system for one of the labs of Presidency University

Targeted Application & Tools that can be used:

Application in renewable energy industries

Professionally used software – Excel

Text Book

T1 - Solar Engineering of Thermal Processes, 4th Ed, Duffie and Beckman,Wiley

T2 - Solar Energy, 4th Ed, Sukhatme and Nayak, McGraw-Hill Education

T3 - Solar Photovoltaics, 3rd Ed, Solanki, PHI learning pvt. Ltd.

References

R1 - Solar Energy Engineering, 2nd Ed, Kalogirou, Academic Press

R2 - Solar Energy, 1st Revised ed, Garg- Prakash, McGraw-Hill Education

Weblinks:

https://presiuniv.knimbus.com/user#/searchresult?searchId=solar%20energy%20conversion&curPage=0&layout=list&sortFieldId=none&topresult=false&source_type_code=eBook

Topics relevant to "EMPLOYABILITY SKILLS": Flat plate collector, thermal analysis, Air heaters, Single axis tracking, concentrating collectors, Parabolic trough collector and central receiver tower for developing **EMPLOYABILITY SKILLS** through Participative Learning techniques. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	**Mr. Pranay Nimje**
Recommended by the Board of Studies on	15th BOS and the Date of BOS 22/07/22
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

<table>
<tr><td>Course Code: MEC3062</td><td colspan="3">Course Title: Hydraulics and Pneumatics
Type of Course: Discipline Elective</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">Automobiles, missiles, machine tools, aero planes etc. extensively use fluid power technology. This course deals with the fundamental aspects of hydraulics and pneumatics, the two fields of relevance to fluid power engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of “Hydraulics and Pneumatics” and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="8">On successful completion of the course the students shall be able to:
CO1] Describe the fundamentals of Hydraulic Power Pumps, Actuators and Motors.
CO2] Explain control components in Hydraulic Systems.
CO3] Solve the numerical problems related to hydraulic efficiency of motors.
CO4] Describe the fundamentals of pneumatic system, Actuators, Valves, Pneumatic circuits and logic circuits.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Introduction to Hydraulic System</td><td>Assignment</td><td colspan="3">Data collection</td><td colspan="3">10 sessions</td></tr>
<tr><td colspan="9">Topics: Introduction to Hydraulic Power and Pumps: Review of fluid mechanics, Pascal’s Law, structure of hydraulic control system. pumps: pumping theory, pump classification, gear pumps- external and internal type, vane pumps- simple, balanced, pressure compensated types, piston pumps- radial and axial (both swash plate and bent axis type), pump performances.
Hydraulic Actuators and Motors: Linear hydraulic actuators - single acting, double acting, tandem cylinder, telescopic rod cylinder, mechanics of hydraulic cylinder loading, cylinder cushioning, hydraulic rotary actuators, hydrostatic transmission – open and close circuit, performance of hydraulic motor.</td></tr>
<tr><td>Module 2</td><td>Energy transfer in hydraulic actuators and motors</td><td>Case study</td><td colspan="3">Identify various valves considering a hydraulic system.</td><td colspan="3">12 sessions</td></tr>
<tr><td colspan="9">Topics: Directional control valves (DCV), Constructional features, 2/2,3/2,4/2,4/3 DCV, Center configuration in 4/3 DCV- open, closed, tandem, regenerative, floating center configuration, Actuation of DCVs- manual, mechanical, solenoid, and indirect actuation, Relays for the solenoid operation, Check valve, Pilot check valve, Pressure control valves – Direct and Pilot operated types, Pressure reducing valve, Flow control valves- fixed throttle, and variable throttle, Throttle check valve, Pressure compensated flow control valve- relief and reducing types</td></tr>
<tr><td>Module 3</td><td>Introduction to Pneumatic System and its control</td><td>Assignment</td><td colspan="3">Data Collection</td><td colspan="3">12 sessions</td></tr>
</table>

Topics: Choice of working medium, Characteristics of compressed air, structure of pneumatic control system, supply, signal generators, signal processor, final control elements , actuators, production of compressed air – compressors - reciprocating and rotary type, preparation of compressed air – driers, filters, regulators, lubricators, distribution of compressed air – piping layout. Pneumatic memory valve, time delay valve. Pneumatic circuits and logic circuits: supply air and exhaust air throttling, will dependent circuits, travel dependent controls – types – construction – practical applications, cylinder sequencing circuits, travel step diagrams, practical examples involving two or three cylinders, use of logic functions in pneumatic manufacturing applications, practical examples involving the use of logic functions.				
Module 4	Electro-Pneumatic control	Assignment	Data Collection	11 sessions
Topics: Principles-signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple single cylinder applications.				
Targeted Application & Tools that can be used: This course finds applications mainly in automobile, space, defense, medical, consumer goods etc. *Job* titles might include Hydraulic or Pneumatic Design engineer, Maintenance engineer, Quality engineer, Service Engineer, Application engineer.				
Text Book T1: Fluid Power with applications, Anthony Esposito, Fifth edition Pearson education, Inc. 2000. T2: Pneumatics and Hydraulics, Andrew Parr. Jaico Publishing Co. 2000. T3: Hydraulics and Pneumatics, Dr.Niranjan Murthy and Dr.R.K.Hegde, Sapna Publications, 2013				
References R1: Oil Hydraulic Systems - Principles and Maintenance, S.R. Majumdar, Tata Mc Graw Hill Publishing company Ltd. 2001. R2: Pneumatic Systems, S.R. Majumdar, Tata Mc Graw Hill publishing Co., 1995. R3: Industrial Hydraulics, Pippenger, Hicks, McGraw Hill, New York, 2009				
Web Links: https://nptel.ac.in/courses/112/106/112106300/ W1: https://presiuniv.knimbus.com/user#/searchresult?searchId=hydraulics%20and%20pnumatics&_t=1656929386018 Hydraulics and Pnumatics				
Topics relevant to "EMPLOYABILITY SKILLS": Signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Mr. Basavaraj Devakki Assistant Professor, Department of Mechanical Engineering, Presidency University			
Recommended by the Board of Studies on	14th BoS held on 25/03/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

Course Code: MEC3059	**Course Title: Engineering Dynamics** **Type of Course: Discipline Elective & Theory only**	L-T-P-C	3	0	0	3
Version No.	2.0					
Course Pre-requisites	MEC2011					
Anti-requisites	NIL					
Course Description	This course is an introduction to the dynamics of lumped-parameter models of mechanical systems. After this course students will be able to evaluate free and forced response of linear multi-degree of freedom systems and matrix eigenvalue problems. The course also enhances the programming abilities through assignments.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Engineering Dynamics**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1] Solve problems on kinetics of systems of particles. CO2] Solve problems on kinetics of rigid bodies. CO3] Interpret solutions to linearized, second-order equations of motions. CO4) Analyze and comprehend free un damped and damped vibrations					
Course Content:						

Module 1	Dynamics of Particles and Systems of Particles	Assignment	Programming Task, Data Analysis task	10 sessions

Topics:

Kinematics: Position, velocity and acceleration of particles in the Cartesian, normal-tangential and polar coordinates. Kinetics: Force, mass and acceleration in Newton's second law of motion, work and energy, impulse and momentum for particles and systems of particles.

Module 2	Dynamics of Rigid Bodies	Quiz	Analytical thinking	12 Sessions

Topics:

Kinematics: Rotation, absolute motion, relative velocity, relative acceleration.

Kinetics: Force, mass and acceleration in Newton's second law of motion, work and energy, impulse and momentum for rigid bodies.

Module 3	Linearization and Solutions to Equations of Motions	Assignment	Data Collection and Analysis	10 Sessions

Topics:

Nonlinear and linear differential equations, linearization, solutions to second-order linear differential equations, interpretation of the solutions.

Module 4	Undamped and damped	Assignment	Data Collection and Analysis	12 Sessions

	vibrations			

Topics:

Vibrations. Undamped free vibrations. Damped free vibrations, equation for damped and un damped vibrations, basics of natural frequency and vibration measurement instruments.

Targeted Application & Tools that can be used:

Application Area is collision of vehicles, aerospace, automobile kinematics and dynamics, vibration of machines.
Professionally Used Software: MATLAB

Text Books

3. Meriam, J. L., and L. G. Kraige. *Engineering Mechanics: Dynamics*. 6th ed. New York,NY: Wiley, 2006. ISBN: 9780471739319.
4. J. R. Taylor, *Classical mechanics*, University Science Books, 2005.

References

1. Hibbeler, Russell C. *Engineering Mechanics: Dynamics*. 12th ed. Prentice Hall, 2009. ISBN:9780136077916.
2. Williams, J. *Fundamentals of Applied Dynamics*. John Wiley & Sons, 1995. ISBN:9780471109372.
3. Den Hartog, J. P. *Mechanics*. New York, NY: Dover, 1961. ISBN: 9780486607542.
4. The resources from the Engineering Dynamics Course from MIT OpenCourseWare from Fall,2011, are available here: Link.
5. The resources from the Engineering Mechanics Course from SWAYAM-NPTEL from

December, 2009 are available here: Link.

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609

Topics relevant to "EMPLOYABILITY SKILLS": Vibrations, Un-damped free vibrations. Damped free vibrations, equation for damped and un damped vibrations for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Mr. Kunwar Chandra Singh
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: MEC3007	**Course Title: Mechanical Vibrations & Design** **Type of Course: Discipline Elective Theory & Integrated Laboratory**		**L-T-P- C**	2	0	2	3
Version No.	2.0					
Course Pre-requisites	MEC2011					
Anti-requisites	NIL					
Course Description	This Course includes: governing equations of motions using Newton's laws of motion and energy principles, effective springs and masses, free and forced vibration with and without damping of linear systems with one and two degree of freedom, vibration isolation, modal analysis, and vibration problems in multi degrees of freedom systems.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1.Determine the natural frequencies vibration systems. CO2. Analyze forced vibration for single degree of freedom system. CO3. Discuss various vibration measuring techniques, signal analysis with condition monitoring. CO4. Relate to concepts discussed in Design of Machine Elements, Mechanical Vibrations & Dynamics of Machines courses. CO5. understand the working Principles of machine elements such as Governors, Gyroscopes and measure strain in various machine elements using strain gauges					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Mechanical Vibrations & Design**" and attain **EMPLOYABILITY SKILL** through Experiential learning techniques					
Course Content:						

Module 1	Free un-damped vibration of Single Degree of Freedom Systems	Assign ment	Mini Project	12 sessions
Topics: Introduction, Basic concepts of vibration, Classification of Vibration, Characteristics of Simple Harmonic motion. Fourier series. Single degree freedom system, Free Vibration of an Undamped Translational System, Free Vibration of an Undamped Torsional System.				
Module 2	Free damped Vibration of Single-Degree-of-Freedom Systems	Assign ment	Seminar	8 sessions
Topics: Types of damping, Free Vibration with Viscous Damping, Free Vibration with Coulomb Damping. Simple problems using MATLAB.				
Module 3	Vibration and Transmissibility	Assign ment	Experiment Conduction & Calculation	12 sessions

Topics:
Forced vibration behaviour in a simple spring mass system, Magnification factor in forced vibration, Transmissibility- force and motion transmissibility, whirling of shafts, Fourier series in forced vibrations.

Module 4	Multi degree of freedom Systems and Vibration Measurements and it's Applications	Assign ment	Analysis with software	13 sessions

Topics: Two-Degree-of-Freedom Systems, Continuous Systems - Longitudinal Vibration of a Bar, Stodola's method, Holzer's method and Dunkerley's method-. Simple problems using MATLAB
Vibration Measurements like Vibration Pickups, Signal Analysis, Machine-Condition Monitoring and Diagnosis.
Useful life estimation of asset, Accelerometer and vibrometer.

List of Laboratory Tasks:

Experiment N0 1: To Determine the Natural Frequency for simple Pendulum
Level 1: For the given Simple pendulum(bob, various length of the string) determine the Natural frequency [Provide the data required in the processed form]
Level 2: For the given rubber ball determine the Time Period and Natural Frequency [Provide the data required in the raw form]

Experiment No. 2: To find the radius of gyration 'k' of given compound pendulum

Level 1 : Discuss the physical meaning of the radius of gyration and give examples for it is importance from practical life [Provide the related apparatus like Vibration apparatus, Stop Watch and measuring tape.]
Level 2 : In this experiment, we use pendulums to find the gravitational acceleration. Design another experiment with different procedures for the same purpose.
Carry out the compound pendulum experiment for both Knife edge and circular pivot point [Provide the data for Centre of Gravity Distance 31.5CM]

Experiment No. 3: Undamped Free Vibration Of Equivalent Spring Mass System
Level 1 : To determine time period and natural frequency of undamped free vibrations of
equivalent spring mass system[Provide the related data]
Level 2:Determine the Natural frequency of various mass springs with different stiffness [Provide the Various Helical springs]

Experiment No. 4:Whirling speed for various sizes of the shaft Level
1 : Determine the Whirling speed for various sizes of the shaft [Provide the related data]

Targeted Application & Tools that can be used:

For all the Vibrations applications like automobile, space, defense, medical etc.
Tools used in profession: MATLAB

Text Books

1.Theory of Vibration with Application" - William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, 5th edition Pearson Education

References

[1] Shigley's Mechanical Engineering Design", Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015.

<table>
<tr><td colspan="2">[2] “Design of Machine Elements”, V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007.
[3] Mechanisms, Machines and Design Lab Manual, Prepared by Mechanical Engineering Department.
https://nptel.ac.in/courses/112/103/112103111/
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609</td></tr>
<tr><td colspan="2">Topics relevant to “EMPLOYABILITY SKILLS”: Determining the natural frequency of various mass springs with different stiffness for developing EMPLOYABILITY SKILLS through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td>Mr. Kunwar Chandra Singh</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td>BOS NO: 15th BOS held on 29/07/2022</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td>Academic Council Meeting No. 18, Dated 03/08/2022</td></tr>
</table>

<table>
<tr><td>Course Code:
MEC4010</td><td>Course Title: Product Lifecycle Management
Type of Course: Discipline elective & Lab Integrated course</td><td>L-T-P- C</td><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td></td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">This course introduces Product Lifecycle Management process and methods which aim to emphasize the importance of product data creation, processing, storage, transformation and reuse to aid in decision making process. The course covers wide range of industry oriented case studies on different aspects of product management to strengthen the belief of Product Lifecycle Management. The principal constituents of PLM covered are Product Lifecycle Process, Work flow, CPD, Engineering Change Management, Digital Manufacturing and PLM, PLM Strategy and Assessment. Entire course runs both on class room lectures and hands on training. This course is designed to give a holistic view on PLM. This course also incorporates training on PLM tool 'Teamcenter13'</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">On successful completion of this course the students shall be able to:
CO1] Describe different processes associated with Product Lifecycle.
CP2] Describe environment, drivers and PLM elements.
CO3] Deploy Engineering Change Management process.
CO4] Design Bill of Materials.
CO5] Deployment of Work flow on Team center.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "Product Lifecycle Management" and attain EMPLOYABILITY SKILL through Experiential learning techniques</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Introduction to Product Life Cycle Management (PLM)</td><td>Assign ment</td><td colspan="2">Data Collection and Analysis</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="7">Topics:
Lecture: Definition, PLM Lifecycle Model, Threads of PLM, Need for PLM, Opportunities and Benefits of PLM, Views, Components and Phases of PLM, PLM feasibility Study, PLM Visioning.
Hands-on: Introduction to Teamcenter13, Perspective, Views, Navigation Pane, Primary, Secondary, Configure applications, Perspective and Views customization.</td></tr>
<tr><td>Module 2</td><td>PLM Concepts, Processes and</td><td>Case Study</td><td colspan="2">data analysis task</td><td colspan="2">10 sessions</td></tr>
</table>

	Workflow			

Topics:
Characteristics of PLM, Environment Driving PLM, PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM.

Collaborative Product Development: Engineering Vaulting, Product Reuse, Smart Parts, Engineering Change Management**.**

Hands-on: My Teamcenter**:** Item creation, Item revision, Item configuration, Views of items, Item data reuse, Item data vaulting, Item data transformation.

Module 3	Collaborative Product Development	Assignment	Data Collection and Analysis	10 sessions

Topics:
Bill of Materials and Process Consistency, Design for Environment, Virtual Testing and Validation, Marketing Collateral.

Hands-on: Change Management: ECN, ECR

Structure Manager: BOM creation, BOM revision, Revision rules.

Workflow Designer: Design

Module 4	Digital Manufacturing – PLM	Assignment	Case study/Data Analysis	10 sessions

Topics: Digital Manufacturing, Benefits of Digital Manufacturing, Manufacturing the First-One, Ramp Up, Virtual Learning Curve, Manufacturing the Rest, Production Planning.

Hands-on: Query Builder, Organization, Access Manager, BMIDE, Architecture 2T & 4T

Module 5	Developing a PLM Strategy and Conducting a PLM Assessment	Assignment	Simulation/Data Analysis	05 sessions

Strategy, Impact of strategy, implementing a PLM strategy, PLM Initiatives to Support Corporate Objectives, Infrastructure Assessment, Assessment of Current Systems and Applications

Targeted Application & Tools that can be used:

Application Area is in all IT industries who provide services for Product Lifecycle Management,
Software Requirement: Team Center by Siemens.

Text book

T1. Product Lifecycle Management: Grieves, Michael, McGraw-Hill Publications, Edition 2013, ISBN: 978-0071452304.
T2. Product Lifecycle Management Volume I: Stark, John, Springer, 3rd Edition, 2016, ISBN: 978-3319174396.

References

R1.Fabio Guidice, Guido La Rosa, Product Design for the environment -A lifecycle approach, Taylor and Francis 2013, ISBN:978-1420001044 **R2**.Robert J.Thomas, "NDP: "Managing and forecasting for strategic processes", Wiley Publications, 2013 ISBN:978-0471572268 **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609**	
Topics relevant to "EMPLOYABILITY SKILLS": PLM software "TeamCentre" utilized to learn PLM concept for developing **EMPLOYABILITY SKILLS** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Mr. Kunwar Chandra Singh
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022

<table>
<tr><td>Course Code:
MEC3077</td><td colspan="2">Course Title: Flight Mechanics
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course is for anybody interested in learning more about how plan work, the physics of flying, or flight mechanics. It will be of particul interest to undergraduate students in aerospace engineering, trainees well as senior pilots, journalists, and professionals in the aeronauti sector.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Flight Mechanics" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of the course the students shall be able to:

CO1: Apply the basic concepts of aircraft performance, and stability.

CO2: Use static stability concepts and stability parameters.

CO3: Write the Equation of Motions for different Positions of the flight</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Flight Environment, Flight Forces and Steady Flight Performance</td><td>Assignment</td><td colspan="3"></td><td colspan="2">15 Sessions</td></tr>
<tr><td colspan="8">The atmosphere as flight environment. The International Standard Atmosphere Model. The Force and Moment Systems of an Aircraft. Steady state performance.</td></tr>
<tr><td>Module 2</td><td>Static Longitudinal Stability and Control-Stick free</td><td>Case Study</td><td colspan="3">Simulation and data analysis task</td><td colspan="2">15 Sessions</td></tr>
<tr><td colspan="8">Introduction, Hinge moment parameters, Control surface floating characteristics and aerodynamic balance, Estimation of hinge moment parameters, The trim tabs, Stick-free Neutral point, Stick force gradient in unaccelerated flight, Restriction on aft C.G.</td></tr>
<tr><td>Module 3</td><td>Static Directional and Lateral Stability and Control,Equations of Motions (EOMs)</td><td>Assignment</td><td colspan="3">Data Collection and Analysis</td><td colspan="2">15 Sessions</td></tr>
<tr><td colspan="8">Static directional stability rudder fixed, Contribution of airframe components, Directional control. Rudder power, Stick-free directional stability, Requirements for directional control, Rudder lock, Dorsal fin. One engine inoperative condition. Weather cocking effect. Static lateral stability. Estimation of dihedral effect. Effect of wing sweep, flaps, and power.</td></tr>
</table>

Derivation of rigid body equations of motion, Orientation and position of the airplane, gravitational and thrust forces, Small disturbance theory. Aerodynamic force and moment representation,
Targeted Application & Tools that can be used: Applications in Systems containing Multi-Force Members, Frames, Trusses, Machines, Cable Bridges etc. Professionally used software : #GTM_DesignSim: The Generic Transport Model
Text Book **T1.** Flight Stability and Automatic Control Nelson, R.C McGraw-Hill Book Co 2007
References R1. Introduction to flight John D. Anderson, Jr McGraw-Hill 2000 R2. The Principles of the Control and Stability of Aircraft W.J. Duncan Cambridge University Press 2016 Weblinks: https://archive.nptel.ac.in/courses/101/105/101105030/ https://www.cambridge.org/core/journals/biological-reviews/article/abs/mechanics-and-aerodynamics-of-insect-flight-control/B348BCEF23B1EEF9A8E60CD8AC3F8822 GRAHAM K. TAYLOR, Mechanics and aerodynamics of insect flight control, Published online by Cambridge University Press: 28 November 2001 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=BOOKYARDS_1_5255 Evaluating ship superstructure aerodynamics for maritime helicopter operations through CFD and flight simulation, Published online by Cambridge University Press: 04 July 2016J.S. Forrest,C.H. Kaaria and I. Owen
Topics relevant to "EMPLOYABILITY SKILLS": Flight Environment, Stress Analysis for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	**Dr. Yuvaraja Naik**
Recommended by the Board of Studies on	BOS NO: 12, BOS held on 03/08/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 16, Dated 29/08/22

<table>
<tr><td>Course Code: MEC3096</td><td colspan="2">Course Title: Product Design in RAC
Type of Course: Discipline Elective
Theory</td><td>L-T- P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course will lead to an understanding of refrigeration and air-conditioning products, the components within these products, familiarity with selection parameters for the components and an appreciation of environmental impact of design choices. The course includes a case study to illustrate the process of design leading to a successful product in market.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Product Design in RAC" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall able to
CO1] Analyse, evaluate and compare the performances of complex vapor compression
systems.
CO2] Evaluate the various sources of heat load on buildings and perform a heat load estimate.
CO3] Design summer and winter air conditioning systems.
CO4] analyses different AC system i.e. railways, telecom cooling system</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction</td><td>Assignment</td><td colspan="3">Mathematical</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction to the design process in general and for Ref. & AC in particular. Applied Thermodynamics as a design tool. Refrigerants and their properties, energy efficiency and
environmental considerations, Practical aspects
.</td></tr>
<tr><td>Module 2</td><td>Ref. system Components & their types</td><td>Assignment</td><td colspan="3">Mathematical</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Topics:
compressors, condensers, evaporators, expansion devices. Working principle of the components and unique feature</td></tr>
<tr><td>Module 3</td><td>Selection of components</td><td>Assignment</td><td colspan="3">Mathematical</td><td colspan="2">13 Sessions</td></tr>
<tr><td colspan="8">Topics:
election of components for an intended design. Balancing the diversity of design objectives
and optimization. Appreciation of the diverting in operating parameters in real applications and
incorporation of controls and safety components.</td></tr>
<tr><td>Module 4</td><td>Product design</td><td>Assignment</td><td colspan="3">Mathematical</td><td colspan="2">12</td></tr>
</table>

				Sessions
Topics: Product design - New product launch – Performance testing, reliability, safety, Case studies etc.				

Targeted Application & Tools that can be used:

Application Area is Refrigeration and Air Conditioning Industries, Aerospace, Data Center cooling.
Industries using above applications and tools –such as Carrier, Trane, LG, Samsung, Voltas, Blue star, Emerson, Danfoss etc.

Text Book

1. Dossat, R.J., Principles of refrigeration, Dorling Kingsley (2008).
2. Stoecker, W. F., Refrigeration and Air conditioning, McGraw Hill (1986).

References

3. Goshnay, W.B., Principles and Refrigeration, Cambridge University Press (1982).
4. Langley, B. C., Solid State Electronic Controls for HVACR, Prentice Hall (1989).
5. Arora, S. C. and Domkundwar, S., A Course in Refrigeration and Air Conditioning, DhanpatRai (1997).

Topics for Technology Enabled Learning:
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_1106

Topics relevant to "EMPLOYABILITY SKILLS": VCRS Pant Design, Cooling Tower Design for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout

Catalogue prepared by	Dr. Devendra Singh Dandotiya
Recommended by the Board of Studies on	15th BOS and the Date of BOS 29/07/22
Date of Approval by the Academic Council	PU/AC18.6/MEC15/MEC/2021-2025/2022

Course Code: MEC3025	**Course Title: Power Plant Engineering** **Type of Course: Discipline Elective & Theory Only**	**L-T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	MEC4001 Basic Thermodynamics					
Anti-requisites	NIL					
Course Description	The Course is designed with an objective of giving an overview of Power generation plant and its technicalities. The Course deals with the components and layout of; thermal, nuclear, hydroelectric power plants, Site selection for various power plants, combined cycle power plants, Magneto Hydro Dynamics (MHD) systems. This Course also includes the economics of power generation, economic loading of power stations and technical aspects such as load curve analysis, load factor, diversity factor, power plant instrumentation, and controls.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Power Plant Engineering**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1- Enlist the different types of load pattern such as industrial, urban traction load, power plants. CO2- Prepare a Heat Balance Sheet for the steam power plant. CO3- Analyze the steam cycles, reheat and regeneration cycles. CO4- Sketch the flow diagram and performance study of diesel power plant, gas turbine power plant and nuclear power plant.. CO5- Explain the Renewable energy resources, Photovoltaic cell, Solar power plant, Wind turbines for power producing sectors.					
Course Content:						

Module 1	Economics of Power Generation	Case Study	Data Collection	10 Sessions

Topics:
Introduction, load distribution curves, Load factor, plant factor, Average load, reverse and Diversity factor, Plant use factor, Different Load pattern for various power plant.

Case Study: Collect the data on any diesel engine power plant / home based electric system and perform load calculation.

Module 2	Steam power plant	Assignment	Report	12 Sessions

Topics:
Various types of steam generators, working principles of boiler, boiler plant, Water tube boiler and Fire tube boiler and their Accessories, boiler mountings, Economizers, Superheaters, Reheaters, and Air Preheaters, Working principle of steam power plant.

Assignment: Write a report on the various types of generator available for steam power production.

Module 3	Gas turbine and Diesel power plant	Assignment	Report	10 Sessions

Topics:

Working principle of GT power plant, open type and closed types, Components of GT Plants, Ideal gas turbine and actual gas turbine, Methods to improve the thermal efficiency of the plant

Assignment: Write a comparative report indicating differences in turbine design for gas and diesel power plant.

Module 4	Nuclear and Hydroelectric Power Plant	Assignment	Data Analysis	13 Sessions

Topics:

Basics, Fission reaction, flow diagram of the nuclear power plant, Parts of the nuclear power plant, working principle, Description of parts in the reactor, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR). Layout of Hydroelectric power plant, Types of Hydropower plants. Description of intake, penstock, trash rack, turbines, and generator.

Assignment: Collect the data from below website, clean the data, make a visualization using Excel / Tableau / Power BI and find the insights from it.
https://www.kaggle.com/code/jonathanbouchet/nuclear-power-plant-geo-data

Module 5	Solar power plant	Assignment	Programming	8 Sessions

Topics:

Solar Radiation: Physics of Solar radiation, Global Beam and diffuse radiation, Fundamentals of Solar Cell: Solar PV basics, Solar PV Module, Solar Cell technologies, Crystalline cell, solar photovoltaic modules, Concentrators and PV Modules. Balance of Solar PV Systems: Battery technology, Batteries for PV systems, DC –DC converters, Charge Controllers, DC–AC inverters, Single phase, three phase, MPPThttps://www.kaggle.com/datasets/anderas/car-consume

Targeted Application & Tools that can be used:

Application in power plant handling and its control

Professionally used software – SQL, Excel, Tableau and Power BI

Text Book

1. P K Nag, "*Power Plant Engineering*", Fourth Edition, McGraw Hill Publications. .
2. A Textbook of Power Plant Engineering: Rajput, R.K. Laxmi Publication**..**

Reference Books:

1. Black and Veatch, "*Power Plant Engineering*", First Edition, CBS Publishers and Distributors Pvt. Ltd.
2. Domkundwar, "*Power Plant Engineering*", Eight Edition, Dhanpat Rai & Co. (P) Limited.

E – Resources:

W1: Some Aspects of Power Plant Development* | The Aeronautical Journal | Cambridge Core

W2: NPTEL Course co-ordinated by IIT Roorkee Faculty Name: Prof. Ravi Kumar. Link: https://nptel.ac.in/courses/112/107/112107291/ Youtube link: https://www.youtube.com/watch?v=iWWyI8CZhUw **W3:**https://presiuniv.knimbus.com/user#/searchresult?searchId=power%20plant%20engineering&_t=1662523457576	
pics relevant to "EMPLOYABILITY SKILLS": Boiler Plant Design, Coal Power Plant for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout	
Catalogue prepared by	**Mr. Pranay Nimje**
Recommended by the Board of Studies on	15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

<table>
<tr><td>Course Code:
MEC3026</td><td colspan="3">Course Title: Turbomachinery
Type of Course: Discipline elective & Theory only</td><td>L-T- P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">MEC2011, MEC4001</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The Course is designed with an objective of giving an overview of different turbines and their applications. It deals with gas turbines, steam turbines, performance parameters, flow through cascades, different turbine stages, compounding of turbines, axial compressor stages, centrifugal compressor stages, axial fans and propellers, centrifugal fans and blowers, and wind turbines</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of “Turbomachinery” and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1. Describe basic concepts of turbomachines and visualize dimensional analysis.
CO2. Discuss various energy transformation involved in turbomachines
CO3. Describe the working of Pelton, Francis and Kaplan Turbine along their performance parameters.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Basic terms and Dimensionless parameters and their significance</td><td>Assignment</td><td colspan="2">Calculation of dimensionless number for various practical application.</td><td colspan="4">10 Sessions</td></tr>
<tr><td colspan="9">Topics:
Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies, Effect of various shape and size effects on model and prototype.</td></tr>
<tr><td>Module 2</td><td>Velocity Triangle and Energy Equation</td><td>Assignment</td><td colspan="2">Data collection for different types of turbomachines in different industry.</td><td colspan="4">12 Sessions</td></tr>
<tr><td colspan="9">Topics:
Euler’s energy equation, Alternate form of Euler’s energy equation, Components of energy transfer, Velocity triangle, Degree of Reaction, Velocity triangles for different values of degree of reaction, Isentropic efficiency, Effect of Isentropic efficiency in working of turbomachines.</td></tr>
<tr><td>Module 3</td><td>Hydraulic Turbines</td><td>Assignment</td><td colspan="2">Data Collection on use of different types of Hydraulic turbine in different application areas.</td><td colspan="4">10 Sessions</td></tr>
</table>

Topics: Hydraulic Turbines: Classification, various efficiencies. Pelton turbine – velocity triangles, design parameters, Maximum efficiency. Francis turbine - velocity triangles, design parameters, Draft tubes- Types and functions. External components- Types and functions. Darrius turbines – velocity triangles, design parameters.				
Module 4	Pumps	Assignment & Case study	Data collection for different types of pumps in different industry.	13 Sessions
Topics: Need and methods of compounding, expression for maximum utilization factor, Axial fans and propellers, centrifugal fans and blowers. Centrifugal Pumps: Classification and parts of centrifugal pump, Reciprocating Pumps: Classification and parts of reciprocating pump, different heads and efficiencies of reciprocating pump, Minimum speed for starting the flow, different head, Different types of efficiencies of reciprocating pump.				
Targeted Application & Tools that can be used: **Turbomachines is currently used in various areas like Wind turbine power plant, hydroelectric power plant Aviation sector.**				
Text books: 1. B.K.Venkanna., "*Fundamentals of Turbomachinery*", PHI, 4th edition, 2017.				
References 1. V. Kadambi, Manohar Prasad, "*An Introduction of Energy Conversion: Turbomachinery – Vol.III*",New Age International Private Limited. 2. Seppo A Korpela, "*Principles of Turbomachinery*", John Wiley and Sons. **Website link-**https://nptel.ac.in/courses/112106200/17 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=BOOKYARDS_1_5255				
Topics relevant to "EMPLOYABILITY SKILLS": Hydraulics turbines, Centrifugal Pump Design for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout				
Catalogue prepared by	Mr. Neeraj and Mr. Narendra Singh			
Recommended by the Board of Studies on	15th BOS held on 29/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022			

Course Code: MEC3036	Course Title: **Flexible Manufacturing Systems** Type of Course: **Discipline Elective & Theory only**	L-T-P-C	3	0	0	3
Version No.	2.0					
Course Pre-requisites	Nil					
Anti-requisites	NIL					
Course Description	The Course is designed with an objective of giving an overview on Computer Aided Design and Manufacturing (CAD/CAM) systems, Flexible Manufacturing Systems (FMS), system hardware and general functions, material handling system, work holding systems, cutting tools and tool management, physical planning of system, software structure functions and description, cleaning and automated inspection, communications and computer networks for manufacturing, quantification of flexibility, human factors in manufacturing, justification of FMS, planning and operation of FMS.					
Course objectives	The objective of the course is to familiarize the learners with the concepts of "Flexible Manufacturing Systems" and attain EMPLOYABILITY SKILL through Participative learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1] Analyze the Quantitative aspects of FMS. CO2] Explain the Machine cell design and part families. CO3] Outline the various production control issues and tool management. CO4] Analyze the economic aspects and justification of FMS. CO5] Explain the FMS development towards factories of the future					
Course Content:						

Module 1	Introduction to manufacturing systems, Part programming	Assign ment	Programming simple machined components	10 Sessions

Introduction:
Introduction to manufacturing system, Automation in production systems, types of automation, reason for automation, advantages and disadvantages, Costs involved in manufacturing, mathematical model of production performance, Computer controlled manufacturing systems, development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility

Module 2	Introduction to FMS, Group Technology and Cellular manufacturing	Assign ment	Solving numerical to form ideal cells	10 Sessions

Topics: Introduction to FMS, Group Technology and Cellular manufacturing
Flexibility, types of flexibility, types of FMS, FMS components, Quantitative analysis, advantages and disadvantages of FMS.
Group Technology, part family, cell formation, simple cell formation techniques such as array-based method, similarity coefficient methods, and simple examples, scheduling in

FMS.				
Module 3	Material Handling systems, Production Planning and Control in FMS	Assign ment	Justification of using FMS in manufacturing systems	10 Sessions
Topics: Material handling and Production planning and control in FMS Introduction to material handling, principles of material handling, different material handling equipment such as industrial truck, AGV, RGV, conveyors etc. Application and selection of material handling equipment's, economics justification, simple examples. Production planning and Control in FMS Need for different PPC methods in FMS environment, Scheduling and line balancing using similarity coefficient method. Simple examples.				
Module 4	Tooling and system planning in FMS	Case study	Control of cutting tools and its practices in Machine Shop Lab	8 Sessions
Introduction to tool management, Tool magazine, Tool management, Fault sensing, Tool strategies, control of cutting tools and its practices, design of flexible fixtures, modular fixtures, economics of fixtures System planning in FMS, supervisory control in FMS, software system in FMS Planning, preparation guidelines, Project team, supplier selection, system description and sizing, system definition and specification				
Module 5	Planning and implementation of FMS	Assign ment	Behavioral issues in implementing FMS	7 Sessions
Planning, integration, system configuration, FMS layout and implementation Organizational and behavioral issues in the implementation of FMS, economic justification of FMS Toyoto production systems, Lean manufacturing and Kanban system. Introduction to simulation of FMS and data base design for FMS. FMS application in machining, sheet metal fabrication, prismatic component production – aerospace application – FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future.				
Targeted Application & Tools that can be used: Application Area is manufacturing systems involved in shop floor, automobile assembly and manufacturing systems involving rapid product changes in design and variety (Toyota Production Systems, Bidadi) Professionally Used Software: For part programming, SEIMENS CNC PART PROGRAMMING.				
Text books: [1] Mikell P Groover, "Automation, Production systems and CIM", Pearson Education, Second edition 2016.				
References [1] Talavage J, "FMS in practice, Applications, Design and Simulation" Marcel Dekker Inc, 1988. [2] Nagendra Parashar B S, "Cellular Manufacturing System-An integrated Approach" PHI 2008, 2008. https://nptel.ac.in/courses/112/106/112106065/ W1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2123 "Flexible Manufacturing systems, Materials Engineering, Engineering and Technology, Science Direct," W2:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2315				

"Advance flexible manufacturing systems", Science Direct	
Topics relevant to "EMPLOYABILITY SKILLS": Planning Integration, group Technology for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.	
Catalogue prepared by	Dr. Satish Babu B
Recommended by the Board of Studies on	17th BoS held on 08/07/2023
Date of Approval by the Academic Council	21st Meeting of the Academic Council held on 06/09/2023

<table>
<tr><td>Course Code:
MEC3051</td><td colspan="2">Course Title:
Fracture Mechanics
Type of Course:
Discipline Elective & Theory only</td><td>L- T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">MEC2011 Mechanics of Solids</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The objective of this course is to introduce the mathematical and physical principles of fracture mechanics and their applications to engineering design to develop the ability in students to compute the stress intensity factor, strain energy release rate, and the stress and strain fields around a crack tip for linear and nonlinear materials. It will also expand the students' knowledge on experimental methods to determine the fracture toughness and develop the students understanding on the design principle of materials and structures using fracture mechanics approaches.</td></tr>
<tr><td>Course objectives</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Fracture Mechanics" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1. Identify the basic fracture and fatigue mechanisms
CO2. Understand crack resistance and energy release rate for crack criticality.
CO3. Apply Linear Elastic Fracture Mechanics on brittle materials.
CO4. Understand the relationship between crack tip opening displacement, SIF, ERR and application of such parameters for ductile and brittle materials
CO5. Determine the critical values of parameters at crack tip using experimental techniques</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction</td><td>Assignment</td><td colspan="4">Programming Task,</td><td>10 sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction to Fracture Mechanics: Stress-Strain Curve, Elements of dislocation theory, Historical perspective, Stress Concentration effect of flaws, Fracture Mechanics approach to design, Effect of material properties on fracture, Cleavage, Brittle and Ductile fracture, ductile brittle transition, modes of fracture failure, Fatigue and stress corrosion crack growth, Damage tolerance.</td></tr>
<tr><td>Module 2</td><td>Linear Elastic Fracture Mechanics</td><td>Case Study</td><td colspan="4">Simulation and data analysis task</td><td>10 sessions</td></tr>
<tr><td colspan="8">Topics:
An atomic view of fracture, Griffith Energy Balance, Energy release rate, instability and the R Curves, compliance, tearing modulus, Stress and Displacement field in isotropic elastic materials.</td></tr>
<tr><td>Module 3</td><td>Elastic-Plastic</td><td>Assignment</td><td colspan="4">Data Collection and Analysis</td><td>15 sessions</td></tr>
</table>

	Fracture Mechanics			
Topics: Crack tip deformation and plastic zone size, plane stress vs plane strain, effective crack length, Irwin plastic zone correction, Dugdale approach, effect of plate thickness. J Contour Integral: Relevance and scope, J as a path-independent line integral, J as a stress intensity parameter, Stress-Strain relations, J-Controlled fracture, Laboratory measurement of J, Crack Tip Opening Displacement (CTOD), Relationship between CTOD, K and G, Equivalence between CTOD and J, Determination CTOD from strip yield model, HRR Singularity				
Module 4	Fatigue Fracture	Assignment	Simulation/Data Analysis	10 sessions
Topics: Introduction to fatigue, factors affecting fatigue performance, fatigue loading, constant and variable amplitude loading, some characteristics of fatigue crack, Paris Law Numerical modelling by using k-e equations.				
Targeted Application & Tools that can be used: Application Area is Fracture Data collection, Automobile & Aerospace companies such as Boeing, Airbus, and Lockheed Martin etc. Professionally Used Software: Matlab, SolidWorks & Ansys.				
Text Book (s) : T1: Anderson T.L., Fracture Mechanics Fundamentals and Applications, CRC Press, Second edition, 1994 T2: Kumar Prashant, Elements of Fracture Mechanics, Wheelers Publishing Co. Ltd India, Second edition, 2010 **References(s)** R1: Kumar Prashant, Elements of Fracture Mechanics, Wheelers Publishing Co. Ltd India, Second edition, 2010 R2: Hertzberg Richard W., Deformation and Fracture Mechanics of Engineering Materials, Wiley India, Fourth Edition, 1996 Weblinks: https://nptel.ac.in/courses/112/106/112106065/ W1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2123 "**Engineering Fracture Mechanics,** Materials Engineering, Engineering and Technology, Science Direct," W2:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2315 **"Theoretical and Applied Fracture Mechanics",** Science Direct				
Topics relevant to "EMPLOYABILITY SKILLS": Crack Tip deformation, material characterization for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.				
Catalogue prepared by	**Mr. Prashanth S P**			
Recommended by the Board of Studies on	15th BoS held on 22/07/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

<table>
<tr><td>Course Code:
MEC3011</td><td>Course Title: Battery and Fuel Cell Technology
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The purpose of this course is to enable the students to appreciate the need for battery in automobiles and Charging of battery and testing, various types of batteries used in automobiles and also address the underlying concepts, methods and application of fuel cell technology. This course is both conceptual and analytical in nature and needs fair knowledge of principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries and charging System. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.</td></tr>
<tr><td>Course objectives</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of " Battery and Fuel Cell Technology" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">On successful completion of this course the students shall be able to:
CO1] Enable Skill development of student by using Participative Learning techniques.
CO2] Understand the functioning of charging System
CO3] Identify different areas of fuel cell technology.
CO4] Discuss the various Application of Fuel Cell Technology.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Battery used in Automobiles</td><td>Assignment</td><td colspan="2">Data Analysis task</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="7">Topics:
Different types of batteries - Lead acid- Nickel based-Sodium based-Lithium based-Battery Parameters-Power requirement of electric vehicles- Efficiency, Rating, Charging, Testing and Maintenance. Battery performance characteristics, Voltage to electro chemical impedance spectroscopy.- Programming Assignment</td></tr>
<tr><td>Module 2</td><td>Charging of Battery</td><td>Assignments</td><td colspan="2">data analysis task</td><td colspan="2">11 sessions</td></tr>
<tr><td colspan="7">Topics:
Traditional Battery Charging Methods, D.C. Generators and Alternators their Characteristics. Control cutout, Electrical, Electromechanical and electronic regulators. Regulations for charging. Battery charging index and rating.</td></tr>
<tr><td>Module 3</td><td>Introduction To Fuel Cells</td><td>Assignment</td><td colspan="2">Data Analysis</td><td colspan="2">12 sessions</td></tr>
<tr><td colspan="7">Topics:
Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells. Frequency response analyser for fuel cell. Fuel cell intoximeters.</td></tr>
</table>

Module 4	Fuel Cells For Automotive Applications	Assignment/Case study	Data collection and Analysis	12 sessions

Topics: Technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell.

Targeted Application & Tools that can be used:

Application Area is Battery used in Automobiles, Production of fuel Cells and Fuel Cells For Automotive industries.
Software : FC View and ZVIEW
It is a powerful utility for analyzing, graphing, and comparing data collected from Fuel Cell

Text Books

1. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London.
2 Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1- 86058 4233, 2004.

References

1. Vinal. G.W., Storage Batteries, John Wiley & Sons inc., New York.
2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.
3. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=iih&AN=144749894&site=ehost-live

Weblinks:
https://nptel.ac.in/courses/112/106/112106065/
W1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2123
"**Fuel cell Technology,** Materials Engineering, Engineering and Technology, Science Direct,"
W2:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2315

Topics relevant to "EMPLOYABILITY SKILLS": Fuel cells and Batteries' study for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Mr. Prashanth S P
Recommended by the Board of Studies on	15th BoS held on 22/07/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

<table>
<tr><td>Course Code: MEC3009</td><td colspan="2">Course Title: Nanotechnology
Type of Course: Discipline Elective/Theory Only Course</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The Course is designed with an objective of giving an overview of study of materials at molecular level and its properties. The Course will also discuss specific applications of nanotechnology in electronic devices, biomedical fields, environmental solutions, and energy production. It also gives fundamental knowledge of nanoscience, in understanding current applications of nanotechnology, and in learning about future prospects in this field.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Nanotechnology” and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7">On successful completion of the course the students shall be able to:
CO1. Recognize the basic properties of Nano materials.
CO2. Distinguish between various Nano material perspectives applicable to Nano technology.
CO3. Summarize the effect of Nano fluids on the boiling heat transfer.
CO4. Identify the processing techniques involved in investigation of Nano technology.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Nanotechnology and over view</td><td>Term paper</td><td colspan="3">Data Collection/any other such associated activity</td><td colspan="2">05 sessions</td></tr>
<tr><td colspan="8">Topics: Introduction to Nanoscience & Nanotechnology. History of Nano materials, Natural & Man-made nanomaterials. Benefits of nanotechnology. Applications – latest trends</td></tr>
<tr><td>Module 2</td><td>Structure & Synthesis of Nanomaterials</td><td>Term paper</td><td colspan="3">Data Collection/any other such associated activity</td><td colspan="2">14 sessions</td></tr>
<tr><td colspan="8">Topics: Material class structure, Nano scale and dimensions, Top down method: Lithography, High energy ball milling, Electrodeposition. Bottom up Method: Sol-Gel Process, CVD, PVD, Self Assembly etc,
Synthetic nanomaterials: Carbon nanotube, fullerene, quantum dots, Graphene, metal & ceramic nanomaterials, composite Nanomaterials</td></tr>
<tr><td>Module 3</td><td>Investigation techniques:</td><td>Term paper</td><td colspan="3">Data Collection/any other such associated activity</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="8">Topics: Scanning probe microscopes, Electron microscopes – SEM, TEM, Optical microscopes, x ray photoelectron spectroscopy, Energy dispersive spectroscopy.</td></tr>
<tr><td>Module 4</td><td>Properties of Nanomaterials</td><td>Assignment</td><td colspan="3">Data Collection/any other such associated activity</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="8"></td></tr>
</table>

Topics: Mechanical property, Electrical property, Chemical property, Magnetic properties, Characterization of Nano materials.				
Module 5	Nanofluids & Composites	Assignment /Case Study	Data Collection/any other such associated activity	06 sessions
Topics: Introduction to Micro and Nano fluids. Properties of Nano fluids. Heat transfer in Nano fluids. Advance cooling device development using Nano fluids, Nano added Composites & Applications.				

Targeted Application & Tools that can be used:
Material Characterization, Material Development etc

Text Book

1. T.Pradeep, "NANO: The Essentials: Understanding Nanoscience and Nanotechnology", McGraw HillEducation. (Not available in Library. Available online)

References

2. Charles P. Poole Jr, Frank J. Owens, "*Introduction to Nanotechnology",* Wiley and Sons.
3. Bharat Bhushan, "*Handbook of Nanotechnology",* Spinger.
4. Curtines, Dixon, "**Nanotechnology: Nanofabrication, Patterning, and Self Assembly",** **https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=340093&site=ehost-live**

Weblinks:
https://nptel.ac.in/courses/112/106/112106065/
W1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2123
"**Nano Applications,** Materials Engineering, Engineering and Technology, Science Direct,"
W2:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2315
"**Nano - The Begining",** Science Direct

Topics relevant to "EMPLOYABILITY SKILLS": Electron Microscope, Micro and macro fluids study for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Mr. Prashanth S P
Recommended by the Board of Studies on	14th BoS held on 25/03/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

<table>
<tr><td>Course Code:
MEC3086</td><td colspan="2">Course Title: Design of Machine Elements II
Type of Course: Program Core & Theory only</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">MEC3090 Design of Machine Elements I</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The Course is designed with an objective of giving an overview of designing appropriate machine transmission components and their applications.
Develops students' competence and self-confidence as design engineers. Emphasis on the creative design process bolstered by application of physical laws. Robustness and manufacturability are emphasized. Subject relies on active learning via a minor design-and-build project. Lecture topics include idea generation, estimation, concept selection, visual thinking, computer-aided design (CAD).</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Design of Machine Elements II” and attain SKILL DEVELOPMENT through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1. To explain and determine the stress developed in curved beam and power transmitting elements in various application.
CO2. To select and determine the material and stresses in various springs and its applications.
CO3. To familiarize , select and design of various materials for gear and types of gears, stresses and its proper applications
CO4. To design the components which involves human life at risk such as brakes, clutches,
CO5. To understand the different types bearing, and its application</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Belts & Ropes</td><td>Assignment</td><td colspan="3">Programming Task</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="8">Topics:
Curved Beams: Stresses in Curved Beams of Standard Cross Sections used in Crane Hook, Punching Presses & Clamps, Closed Rings and Links.
Belts Ropes and Chains: Flat Belts: Length & Cross Section, Selection of V-belts, Ropes and Chains for Different Applications.</td></tr>
<tr><td>Module 2</td><td>Springs</td><td>Case Study</td><td colspan="3">Simulation and data analysis task</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="8">Topics:
Springs: Types of springs - Stresses in Helical Coil Springs of Circular and Non-Circular Cross Sections. Tension and Compression Springs, springs under Fluctuating Loads, Leaf Springs: Stresses in Leaf Springs & Equalized Stresses.</td></tr>
<tr><td>Module 3</td><td>Bevel & Worm Gear</td><td>Assignment</td><td colspan="3">Simulation and data analysis task</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="8">Topics:
Spur & Helical Gears: Spur Gears: Definitions, Stresses in Gear Tooth: Lewis Equation and Form Factor, Design for Strength, Dynamic Load and Wear Load. Helical Gears: Definitions, Formative Number of Teeth, Design Based on Strength, Dynamic and Wear Loads</td></tr>
</table>

Module 4	Clutches & Brakes	Assignment	Simulation/Data Analysis	10 sessions

Topics:
Bevel Gear: Definitions, Formative Number of Teeth, Design Based on Strength, Dynamic and Wear Loads.

Worm Gears: Definitions, Design Based on Strength, Dynamic, Wear Load and Efficiency of Worm Gear Drives

Module 5	Lubrication and Bearings	Assignment	Simulation/Data Analysis	06 sessions

Topics:
Lubrication and Bearings: Lubricants and their properties, Mechanisms of Lubrication, Bearing Modulus, Coefficient of Friction, Minimum Oil Film Thickness, Heat Generated, Heat Dissipated, Bearing Materials, Examples of Journal Bearing and Thrust Bearing Design. Ball bearing, Roller bearing, angular contact bearing.

Targeted Application & Tools that can be used:
Contemporary issues: Knowledge of DME can help students in becoming Design engineer, CAD release engineer, Dimensional engineer where various employability opportunities are available at all automotive industries, OEM's, Tier 1 and Tier 2 organizations
Professionally Used Software: SolidWorks.

Textbooks:
V.B. Bhandari, Design of Machine elements, Tata Mc Graw Hill, 3rd Edition, 2010.

References

1.P.C.Sharma & D.K.Aggarwal, A Text Book of Machine Design, S.K.Kataria & Sons, New Delhi,12th edition, 2012.
2. Jack A.Collins, Henry Busby, George Staab, Mechanical Design of Machine Elements and Machines, 2nd Edition, Wiley India Pvt. Limited, 2011.
3. Steven R. Schmid, Bernard J. Hamrock, Bo. O. Jacobson, Fundamentals of Machine Elements, CRC Press, Third Edition, 2014.
4. Juvinal, R.C and Kurt M.Marshek, Machine component design, John Wiley, 2012.
5. Design Data – K. Lingaiah, 2012.
6. Web resourcehttps://nptel.ac.in/courses/112/105/112105125/
https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&_t=1656917902483

Topics relevant to "SKILL DEVELOPMENT":
Stresses in Helical Coil Springs of Circular and Non-Circular Cross Sections. Tension and Compression Springs, springs under Fluctuating Loads, Heat Generated, Heat Dissipated, Bearing Materials, Examples of Journal Bearing and Thrust Bearing Design for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Mr. Sandeep G M
Recommended by the Board of Studies on	9th BoS held on 04/05/2019
Date of Approval by the Academic Council	11th Meeting of the Academic Council held on 11th June, 2019

Course Code: MEC3048	**Course Title: Tribology and bearing design** **Type of Course: Discipline elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to appreciate the need for lubrication and bearings in mechanical power transmission system. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.					
Course objectives	The objective of the course is to familiarize the learners with the concepts of "**Tribology and bearing design**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1) Select different bearing suitable for particular application. CO2) Interpret Reynolds's equation for fluid film lubrication. CO3) Understand hydrodynamic lubrication in full film lubricated bearing. CO4) Select appropriate material and lubricant for bearing in particular application.					
Course Content:						

Module 1	Rolling contact Bearing	Quiz	Critical thinking task	10 sessions
Topics: Types of bearing, rolling contact bearing and sliding contact bearing, selection of rolling contact bearing from manufacturer's catalogue, load-life relationship, bearing failure causes and remedies.				
Module 2	Sliding contact bearing	Quiz	Critical thinking task	12 Sessions
Topics: Basic mode of lubrication, Petroff's equation, Mckee's investigation, Reynolds's equation for fluid film lubrication, hydrostatic step bearing, bearing design-selection of parameters.				
Module 3	Hydrodynamic journal bearing	Assignment	Computing and data interpretation task using MATLAB	10 Sessions
Topics: Derivation of Reynolds's equation, physical significance of each term of Reynolds's equation, standard reduced form of Reynolds's equation.				
Module 4	Bearing material and lubricants	Assignment	Data collection and Analysis	13 Sessions
Topics: Bearing materials: Introduction, material characteristics, metallic and non-metallic bearing materials, properties of common bearing material. Lubricants: Basic chemistry of lubricants, different types of lubricants, properties of lubricants.				
Targeted Application & Tools that can be used: Application Area is mechanical power transmission system, automobile sector, machine tool.				

Professionally Used Software: MATLAB	
Text book: 1. V B Bhandari, "Design of machine elements", Tata McGraw-Hill, Fourth Edition, 2011 2. Bernard J. Hamrock, Steven R. Schmid, Bo O. Jacobson, "Fundamentals of fluid film lubrication" Marcel Dekker, second edition, 2004	
References 1. Ming Qiu, Long Chen, Yingchun Li, Jiafei Yan, "Bearing tribology", Springer-Verlag Berlin Heidelberg, 1st Edition, 2017. 2. Michael M. Khonsari, E. Richard Booser, "Applied Tribology: Bearing Design and Lubrication: Bearing Design and Lubrication", third Edition, 2017 3. https://nptel.ac.in/courses/112/102/112102015/ 4. https://presiuniv.knimbus.com/openFullText.html?DP=http://www-sciencedirect-com-presiuniv.knimbus.com/science/journal/0301679X	
Topics relevant to "EMPLOYABILITY SKILLS": Reynolds equation, bearing design for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout	
Catalogue prepared by	Mr. Solanki Hiren K.
Catalogue updated by	Mr. Sandeep G M
Recommended by the Board of Studies on	15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

<table>
<tr><td>Course Code: MEC3020</td><td colspan="2">Course Title: Additive Manufacturing Machine and System
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The Course is designed with an objective of giving an overview of additive manufacturing and systems. The Course discusses about the generalized model of production systems, different techniques of AM and its systems.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Additive Manufacturing Machine and System" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1.Understand history, concepts and terminology of additive manufacturing
CO2. Apply the reverse engineering concepts for design development
CO3. Understand the variety of additive manufacturing techniques
CO4. Design and develop newer tooling models
CP5. Identify, analyze and solve problems related to Additive Manufacturing.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction AM</td><td>Quiz</td><td colspan="4">Impact of AM on product development</td><td>8 Sessions</td></tr>
<tr><td colspan="8">Topic: Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits Applications.</td></tr>
<tr><td>Module 2</td><td>Reverse engineering and cad modelling</td><td>Quiz</td><td colspan="4">Data processing</td><td>12 Sessions</td></tr>
<tr><td colspan="8">Topic: Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.</td></tr>
<tr><td>Module 3</td><td>Liquid based and solid based additive manufacturing systems</td><td>Quiz/Assignment</td><td colspan="4">SLA process</td><td>12 Sessions</td></tr>
<tr><td colspan="8">Topic: Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing</td></tr>
</table>

(LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.				
Module 4	Powder based additive manufacturing systems	Assignment	SLS types and techniques	12 Sessions
Topic: Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS-powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.				
Targeted Application & Tools that can be used: Application Area includes Automobile, aerospace, manufacturing, processing industries etc.,..				
Text Book 1. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010. 2. Gebhardt, A., "Rapid prototyping", Hanser Gardener Publications, 2003.				
References 1. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010. 2. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005. 14 3. Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006. 4. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2011. **Website:** 1.https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_1106 2.https://presiuniv.knimbus.com/user#/searchresult?searchId=additive%20manufacturing%20&_t=1656959283311				
Topics relevant to "EMPLOYABILITY SKILLS": Model Reconstruction, SLS Techniques, 3D modelling and Data Conversion for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.				
Catalogue prepared by	Mr. Aravinda T			
Recommended by the Board of Studies on	BOS NO: 15th BoS held on 22/07/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

<table>
<tr><td colspan="2">Course Code:
MEC3017</td><td colspan="3">Course Title: CAD for Additive Manufacturing
Type of Course: Discipline Elective</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="2">Version No.</td><td colspan="8">1.1</td></tr>
<tr><td colspan="2">Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td colspan="2">Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td colspan="2">Course Description</td><td colspan="8">The purpose of this course is to enable the students to appreciate the need for modelling and assembling the parts. Students will be introduced to the design modelling of the 3D parts, and will be motivated to understand computer based designs. The course also enhances the modelling and design abilities through assignments and project.</td></tr>
<tr><td colspan="2">Course objectives</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of "CAD for Additive Manufacturing" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td colspan="2">Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1. Understand basic concepts in model generation.
CO2. Understand conversion of part files to IGES and STEP
CO3. Apply Surface modelling methodologies in surface model generation
CO4. Apply the concepts of solid modelling in additive manufacturing</td></tr>
<tr><td colspan="2">Course Content:</td><td colspan="8"></td></tr>
<tr><td colspan="2">Module 1</td><td>CAD Process</td><td>Case Study</td><td colspan="3">Data analysis task</td><td colspan="3">10 sessions</td></tr>
<tr><td colspan="10">Topics:
Introduction, Modelling Plan, Part Creation, Coordinate Systems, Explicit and Implicit Equations, Intrinsic Equations, Parametric Equations.</td></tr>
<tr><td colspan="2">Module 2</td><td>Transformation</td><td>Case Study</td><td colspan="3">Data analysis task</td><td colspan="3">12 sessions</td></tr>
<tr><td colspan="10">Topics:
Transformation: Representation of points; Transformation matrix; Transformation of a point; Homogeneous coordinates; General transformation – rotation, reflexion, translation, scaling and sharing; Combined transformation; Solid body transformation</td></tr>
<tr><td colspan="2">Module 3</td><td>Surface Generation</td><td>Case Study</td><td colspan="3">Simulation and data analysis</td><td colspan="3">10 sessions</td></tr>
<tr><td colspan="10">Topics:
Fundamental of Surface Design, Reparametrization of a Surface patch, Sixteen point form, Four Curve Form, surfaces of revolution; Sweep surfaces; Ruled and developable surfaces</td></tr>
<tr><td colspan="2">Module 4</td><td>Solid Modeling:</td><td>Case Study</td><td colspan="3">Simulation and data analysis</td><td colspan="3">13 sessions</td></tr>
<tr><td colspan="10">Topics:
Topology and Geometry, Parametric Space of a Solid; Surface and Curves in a Solid, Regularized Boolean Operators, Construction Criteria, Instances and Parameterized Shapes</td></tr>
<tr><td colspan="10">Text Books
1. Mastering CAD/CAM theory and practice– Ibrahim Zeid- McGraw- Hill,Inc. – Newyork – Special Edition, 1991.</td></tr>
<tr><td colspan="10">References
1. Mastering SolidWorks, The Design Approach– Second Edition, Ibrahim Zeid- Pearson, and Publications- 2015.</td></tr>
</table>

2. Dimensioning and tolerancing for Quantity Production – Merhyle F Spotts –Inc. Englewood Cliffs - New Jersey - Prentice Hall, 5thedition. 3. Computer Aided Engineering Design, Anupam Saxena, Springer; 2005 edition 4. https://nptel.ac.in/courses/112/102/112102102/ 5. https://presiuniv.knimbus.com/user#/searchresult?searchId=CAD%20FOR%20ADDITIVE% 20MANUFACTURING&_t=1658761201421	
Topics relevant to "EMPLOYABILITY SKILLS": Surface Design, CAD Modelling for developing **EMPLOYABILITY SKILLS** through **Problem Solving Methodologies**. This is attained through the assessment component mentioned in course handout.	
Catalogue prepared by	Mr.Aravinda T
Recommended by the Board of Studies on	**BOS NO:** 15th BOS held on 27/08/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

<table>
<tr><td>Course Code:
MEC3008</td><td colspan="2">Course Title: Design and Analysis of Experiments
Type of Course: Discipline Elective</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The course explains in detail various designs that help the investigator to plan and carry out experiments efficiently. The experimental designs may be also used for eventual process optimization. Emphasis is placed on interpretation of the results from the Analysis of Variance (ANOVA) and analysis of residuals. Fitting of empirical models using linear regression techniques will also be explained.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Design and Analysis of Experiments" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1. Explain the fundamental principles of experimental design, including randomization, replication, and blocking.
CO2. Apply statistical tools such as hypothesis testing, ANOVA, and regression in the analysis of experimental data.
CO3. Design factorial experiments (full and fractional) and analyze their results for process optimization.
CO4. Evaluate the effects of process parameters using Taguchi methods and response surface methodology
CO5. Interpret experimental results to draw statistically valid conclusions and recommend improvements in engineering and manufacturing processes.
CO6. Formulate and conduct independent experiments and prepare detailed technical reports using standard formats.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Statistics Review</td><td>Case study</td><td colspan="2">Data analysis</td><td colspan="3">5 Sessions</td></tr>
<tr><td colspan="8">Topics:
Basic Statistics- overview, Concepts of random variable, probability, density function, cumulative distribution function. Sample and population, Hypothesis testing- test on single mean, test on two means, Illustration through Numerical examples.</td></tr>
<tr><td>Module 2</td><td>Fundamentals of Experimental Design</td><td>Assignment</td><td colspan="2">data analysis task</td><td colspan="3">7 Sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction, Need of statistically designed experiment, Basic Principles of Design – Replication, Randomization, Blocking, Terminology used in design of experiments, Steps in experimentation- selection of factors, levels and range, Selection of response variable, Selection of experimental design, Conduction the experiment</td></tr>
<tr><td>Module 3</td><td>Experimental Design</td><td>Assignment</td><td colspan="2">Simulation and data analysis task</td><td colspan="3">15 Sessions</td></tr>
<tr><td colspan="8">Topics:</td></tr>
</table>

Factorial Design – 2 and 3 factor experimental design, 2k factorial experiments – 22 and 23 factorial design, general 2k design, Blocking and Cofounding, Rules for degree of freedom and sum of squares Fractional Factorial design – one half fraction design, one quarter fraction of design Response surface method – Response Surface Design and Analysis				
Module 4	Taguchi Method	Assignment	Data Collection and Analysis	12 Sessions
Topics: Introduction, Taguchi Loss Function, Development of orthogonal design, Robust design – system design, parameter design, tolerance design, DOE using orthogonal array, SN Ratio, Data analysis for taguchi experiment - variable data and attribute data, Confidence intervals.				
Module 5	Analysis of Model	Case Study	Simulation/Data Analysis	6 Sessions
Topics: Measures of variability, ANOVA- one way and two ways, model checking, sample size, regression approach				
Targeted Application & Tools that can be used: Application area includes Power Plants (NTPC /BARC/NPCIL/BHEL), Automobile sector (Design – TATA/Hyundai/Bajaj etc.), Manufacturing Industries (Bosch/Irwin Tools/Casting Industries). Tools used: Matlab, Ansys				
Text Books: 1. K. Krishnaiah, p. Shahabudeen, applied design of experiments and taguchi methods, phi learning Pvt ltd.				
References: References 1. Douglas-C.-Montgomery-Design-and-Analysis-of-Experiments-Wiley-2012 2. https://onlinecourses.nptel.ac.in/noc21_mg48/preview https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609				
Topics relevant to "EMPLOYABILITY SKILLS": Factorial Design, ANOVA for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.				
Catalogue prepared by	Wasim Akram			
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/7/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

<table>
<tr><td>Course Code:
MEC3037</td><td colspan="2">Course Title: Industrial Engineering Techniques
Type of Course: Discipline Elective Theory</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course is designed to address the key industrial engineering issues in service and manufacturing organizations that have strategic as well as tactical implications. The course will give an overview of production management- production systems, scheduling forecasting techniques, line balancing, plant layout, CAPP, materials management- inventory models, purchase management, stores management, quality management- statistical quality control, control charts, quality assurance, computer applications, project management- Gantt chart, network techniques and analysis, CPM, PERT, computer applications, engineering economics- cost, inflation, depreciation, capital financing, cost engineering.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of ": Industrial Engineering Techniques" and attain EMPLOYABILITY SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">CO1: Select the inventory management tools for managing inventory.
CO2: Apply quality tools and control charts for quality management.
CO3: Prepare optimization models like CPM, PERT to improve decision –making and develop critical thinking and objective analysis of decision problems.
CO4: Summarize the basic concepts used to determine process cost and cost of production.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Inventory Management and Forecasting</td><td>Assignment</td><td colspan="2">Data collection</td><td colspan="3">11 Sessions</td></tr>
<tr><td colspan="8">Topics:

Inventory Management: Necessity for maintaining inventory, Inventory costs, Inventory control problem, Inventory models with deterministic demand, EOQ model (uniform demand rate and replenishment infinite), model 2 with uniform demand and finite production rate, Inventory model with probabilistic demand.
Forecasting: Forecasting levels, Components, Types of forecasting, Forecasting Metrics, Time series Analysis- Cumulative, Naïve, M Period moving average model, exponential smoothing, and Regression analysis.</td></tr>
<tr><td>Module 2</td><td>Quality Management</td><td>Assignment</td><td colspan="2">Mathematical</td><td colspan="3">10 Sessions</td></tr>
<tr><td colspan="8">Introduction and definition of quality, quality control, quality cost, seven quality control tools, control charts, process capability concept, Computer Application (Minitab, Excel)</td></tr>
<tr><td>Module 3</td><td>Project Management</td><td>Assignment</td><td colspan="2">Mathematical</td><td colspan="3">12 Sessions</td></tr>
</table>

Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, Completion time of project; crashing of simple projects.				
Module 4	Cost Accounting and Control	Assignment	Mathematical	12 Sessions
Topics: Introduction, Element of cost, prime cost. Overheads, factory costs, total cost, selling price, type of costs, process cost and cost of production, depreciation, Breakeven analysis, Breakeven chart.				

Targeted Application & Tools that can be used:

Application Area is Geophysical phenomenon, Hydrology, Aerospace, Aerodynamics, Microfluidics, Pipe network, Turbo-machinery.
Industries using above applications and tools – Siemens, Quest Global, Simulent consulting, Triveni Engineering, TATA, GE etc

Text Books:

1. O. P Khanna, "Industrial Engineering and Management", Dhanpat Rai & Co (P) Ltd.

2. Philip E. Hicks, "Industrial Engineering and Management: A New Perspective", McGraw-Hill, 1994

Reference Book(s):

1. D. S. Hira, "Operation Research" S Chand
2. Mahajan "Statistical Quality Control" 2010, Dhanpat Rai & Co (P) Ltd.

Web links:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_REDO_971

Topics relevant to "EMPLOYABILITY SKILLS":
Network Construction, Fullerkson Rule for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout

Catalogue prepared by	Mr. Wasim Akram
Recommended by the Board of Studies on	BOS NO: 13th BOS held on 29/7/2020.
Date of Approval by the Academic Council	Academic Council Meeting No. 15, Dated 03/08/2020.

<table>
<tr><td>Course Code:
MEC3057</td><td colspan="2">Course Title: Integrated Product Design and Development
Type of Course: Discipline Elective and Theory Only</td><td>L-T- P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The purpose of this course is to enable the students to appreciate the need for integrated design, decision making and to develop the basic acumen of modelling and analysis of the development phases of product. The course is both conceptual and analytical in nature and needs fair knowledge of kinematics and material process. The course develops the critical thinking, analytical skills and boosts creativity. The course also enhances the programming abilities through assignments and case studies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7"></td></tr>
<tr><td>Course Objectives:</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Integrated Product Design and Development” and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Content:</td><td colspan="7">On successful completion of the course the students shall be able to:
CO1 Explain the core concepts of the product life cycle and the principles of integrated, collaborative, and Design for Manufacturing/Assembly (DFM/DFA) methodologies.
CO2 Apply interactive simulation and virtual representation tools to support product design decisions and risk prevention throughout the product lifecycle.
CO3 Apply principles of quality engineering and advanced prototyping methods, such as virtual reality and rapid prototyping, to a given design process.
CO4 Analyze the phases of the product design process to support interactive decision-making from concept to manufacturing.
CO5 Analyze the role of information technology and human factors in global design and manufacturing environments, including the use of extended and virtual factories.
CO6 Analyze how collaborative tools, quality engineering principles, and virtual prototyping methods contribute to an integrated product design strategy.</td></tr>
<tr><td>Module 1</td><td>Integrated design and Manufacturing</td><td>Assignment</td><td colspan="2">Data Analysis task</td><td colspan="3">10 Sessions</td></tr>
<tr><td colspan="8">Topics:
Basic concepts of Process design and phases, Interactive support to decision making, Product life cycle management, Design for assembly and Design for Manufacturing, collaborative design and manufacturing. Data Collection Assignment</td></tr>
<tr><td>Module 2</td><td>Interactive Product design</td><td>Case Study</td><td colspan="2">Simulation and Data Collection</td><td colspan="3">12 Sessions</td></tr>
</table>

Topics: Interactive product design through life cycle, Interactive simulation for design, Interfaces for interactive design, Team and process Interactive management, Interactive virtual representation, Robust manufacturing , risk prevention. Simulation based Assignment.				
Module 3	Global design and Manufacturing	Assignment and Case Study	Data Collection and Analysis	13 Sessions
Topics: Global design tools and techniques, Extended and virtual Factory, Information Technology for Global design and Manufacturing, Human factor in virtual prototyping. Case study Assignment				
Module 4	Product and integrated design for future	Assignment	Simulation	10 Sessions
Topics: Advanced Prototyping for Design, Virtual and mixed reality for design, Advanced tool for early product design. Quality engineering, Rapid prototyping and free form fabrication. Simulation based Assignment.				
Targeted Application & Tools that can be used: Application area is in Research and Development in Aeronautical, system design, Profile design as a design Engineer in Automobile companies and Robotics. Professionally Used Software: Ansys, FTA, RoboDx.				
Text Book: T1] Edward B. Magrab, et. Al., "Integrated Product and Process Design and Development", CRC Press				
References: R1). Kevin Otto, Kristin Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", Pearson Education India. R2] Karl T. Ulrich, Steven D. Eppinger, "Product Design and Development", McGraw Hill Education India https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=214728&site=ehost-live https://presiuniv.knimbus.com/user#/viewDetail? searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609				
Topics relevant to "EMPLOYABILITY SKILLS": Advanced prototyping, Part design for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.				
Catalogue prepared by	Mr. Kunwar Chandra Singh			
Recommended by the Board of Studies on	15th BoS held on 22/07/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

<table>
<tr><td>Course Code:
MEC3043</td><td colspan="2">Course Title: Lasers in Manufacturing Technology
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">Manufacturers are increasingly utilizing machine tools that are self-aware – they perceive their own states and the state of the surrounding environment – and are able to make decisions related to machine activity processes. This is called intelligent machining, and through this course students will receive a primer on its background, tools and related terminology. Learn how the integration of smart sensors and controls are helping to improve productivity. You'll be exposed to various sensors and sensing techniques, process control strategies, and open architecture systems that can be leveraged to enable intelligent machining. This course will prepare you to contribute to the implementation of intelligent machining projects.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Lasers in Manufacturing Technology " and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1. To define intelligent manufacturing.
CO2. To describe different type of sensors with their application for different manufacturing process.
CO3. To list different process control strategies used for intelligent manufacturing and machining.
CO4. To discuss future direction in advanced machining.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction to Intelligent Machining</td><td colspan="3">Assignment</td><td colspan="3">12 Sessions</td></tr>
<tr><td colspan="8">Topics:Introduction to intelligent machining, machining basics, the evolution of intelligent machining, components of intelligent machining.Scope of machine intelligence in manufacturing systems - modelling and control of processes and machines.</td></tr>
<tr><td>Module 2</td><td>Sensors and Sensing Techniques</td><td colspan="3">Case Study</td><td colspan="3">15 Sessions</td></tr>
<tr><td colspan="8">Topics:Introduction of sensors, types of sensors, signal processing transforming data into information, practical uses of machine learning. Sensor-based Robotic systems for assembly, welding, machining etc. and mobile robots. Task level planning and path planning. Visuo-motor coordination and navigation problems. Intelligent structures. Behavioural approach and subsumption architecture for learning from environment</td></tr>
</table>

Module 3	Process Control Strategies	Assignment	12 Sessions
Topics: Programmable of logic controllers (PLC), Closed loop Process control systems, introduction to adaptive control, commercially available software. Neuro-Fuzzy-Expert systems for uncertain reasoning. Concept learning, associative memory and connectionist learning systems. Data abstraction in parallel distributed architectures.			
Module 4	Future Directions in Advanced Machining	Assignment	8 Sessions
Topics: Intelligent Machining and the future, roadmap to success.			
Targeted Application & Tools that can be used: 1. Creating intelligent factories where manufacturing technologies are upgraded and transformed by cyber-physical systems (CPSs), the Internet of Things (IoT), and cloud computing 2. To make manufacturing systems able to monitor physical processes, create a so-called "digital twin" (or "cyber twin") of the physical world, and make smart decisions through real-time communication and cooperation with humans, machines, sensors, and so forth. 3. Industry 4.0 combines embedded production system technologies with intelligent production processes to pave the way for a new technological age that will fundamentally transform industry value chains, production value chains, and business models. **Professionally Used Software:** • AI & Machine Learning: no-code visual workflows, • Python language.			
Text Book: 1. Turgul Ozel and J Paulo Davim, "Intelligent Machining: Modeling and Optimization of the Machining Processes and Systems" Willy, 2009. 2. C Prakash, S Singh, J P Davim, G Krolczyk, "Advances In Intelligent Manufacturing", Springer, 2019.			
References 1. Sunil Pathak ., "Intelligent Manufacturing, Springer". 2. R, Bick Lesser, " Intelligent Manufacturing" ,CRC Press, 2013. Website: www.pgcl.gov.in Web Resources https://presiuniv.knimbus.com/user#/searchresult?searchId=lasers%20in%20manufacturing&_t=1666258266265			
Topics relevant to "EMPLOYABILITY SKILLS": PLC, Behavioral Approach for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.			
Catalogue prepared by	Mr. Ajay Kumar Mishra		
Recommended by the Board of Studies on	BOS NO: 15th BoS held on 22/07/2022		
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022		

<table>
<tr><td>Course Code:
MEC2007</td><td colspan="2">Course Title: Fundamentals of Additive Manufacturing
Type of Course: Discipline Elective & Theory only</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">Students will be able to Understand the fundamentals of various Additive Manufacturing Technologies for application to various industrial needs. Able to convert part file into STL format. Able to understand the method of manufacturing of liquid based, powder based and solid based techniques. Understand the manufacturing procedure of a prototype using FDM technique.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Fundamentals of Additive Manufacturing " and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1] Understand the fundamentals of Manufacturing Processes.
CO2] Understand the classifications of Manufacturing Process and methodologies of manufacturing for industrial applications.
CO3] Understand the fundamentals of Additive Manufacturing and its importance in Industrial Applications.
CO] Understand the classifications of Additive Manufacturing and methodology of manufacturing the products using various technologies and study their applications, advantages and limitations.
CO5] Understand the methodology to manufacture the products using FDM technologies and study their applications, advantages and case studies.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction to Manufacturing Technology</td><td>Assignment</td><td colspan="3">Identify the Major manufacturing Technologies and report the manufacturing capabilities</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction to Manufacturing Technology: Introduction, Prototyping fundamentals, Historical development, Advantages of MT, Commonly used terms, process chain, modelling, Classification of Manufacturing process, Applications to various fields.</td></tr>
<tr><td>Module 2</td><td>Manufacturing Processes</td><td>Assignment</td><td colspan="3">Literature review</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="8">Topics:
Manufacturing Processes: Working methodologies of different Manufacturing processes like Casting Process, Machining process, Joining process, Forming process, Machine tools, Cutting tools, Material Specifications, applications, advantages and limitations.</td></tr>
<tr><td>Module 3</td><td>Introduction to Additive Manufacturing (AM)</td><td>Assignment</td><td colspan="3">Identify the Major manufactures in India for 3D printing and report the manufacturing capabilities</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction to Additive Manufacturing: Introduction, Prototyping fundamentals,</td></tr>
</table>

<table>
<tr><td colspan="5">Historical development, Advantages of AMT, Commonly used terms, process chain, 3D modelling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats</td></tr>
<tr><td>Module 4</td><td>AM processes and Software</td><td>Assignment</td><td>Decision Tree</td><td>11 Sessions</td></tr>
<tr><td colspan="5">Topics:
AM Processes: Classifications of Additive Manufacturing, Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, Cura Software, Slicing, DFAM ,applications, advantages and limitations.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Application Area is rapid prototyping, product design and development industries
Professionally Used Software: 3D Modeling software.</td></tr>
<tr><td colspan="5">Text Book;
1. Jing Zhang; Yeon-Gil Jung, "Additive manufacturing: materials, processes, quantifications and applications", Cambridge, Massachusetts: Elsevier, 2018.
2. Salvatore Brischetto, Paolo Maggiore and Carlo Giovanni Ferro (Eds.), "Additive Manufacturing Technologies and Applications" MDPI -2017</td></tr>
<tr><td colspan="5">References
1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
3. Ali K. Kamrani, Emand Abouel Nasr, "Rapid Prototyping: Theory & Practice", Springer, 2006
4. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001
Web Resources:
https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433</td></tr>
<tr><td colspan="5">Topics relevant to "EMPLOYABILITY SKILLS":3d modelling, Application of AM for developing EMPLOYABILITY SKILLS through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Priyanka S Umarji</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td colspan="4">BOS NO: 15th BOS held on 27/8/2022</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td colspan="4">Academic Council Meeting No. 18, Dated 03/08/2022.</td></tr>
</table>

Course Code: **MEC3019**	**Course Title: Additive manufacturing & Its Applications** **Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	Students will be able to decide between the various trade-offs when selecting AM processes, devices and materials to suit particular engineering requirements. Students will have in-depth knowledge in latest trends and opportunities in AM, including distributed and direct digital manufacturing, mass customization, and how to commercialize their ideas**.**					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Additive manufacturing & Its Applications**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1. Identify the different AM techniques. CO2. Explain the Design considerations in AM. CO3. Illustrate the post processing for AM parts. CO4. Summarize the AM process selection and its applications.					
Course Content:						
Module 1	Introduction to Manufacturing Process & Additive Manufacturing	Assignment	AM techniques	10 Sessions		
Topics: Introduction to Manufacturing Technology: Introduction, Prototyping fundamentals, Historical development, Advantages of MT, Commonly used terms, process chain, modelling, Classification of Manufacturing process, Applications to various fields. Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, AM process chain: Conceptualization, CAD, conversion to STL, Transfer to AM, STL file,Machine setup, build, removal and clean up, post processing. Classification of AM processes: Liquid polymer system, discrete particle system, molten material systems, and solid sheet system.						
Module 2	Design of AM	Case Study	Design Tools of AM	14 Sessions		
Topics: Motivation, DFMA concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM, Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of Undercuts and Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/ numbers etc.						
Module 3	Post Processing of AM parts	Assignment	Post processing of AM components	10 Sessions		
Topics: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern,						

Module 4	Processing selection of AM and Applications	Case Study	Future productions of AM	10 Sessions

Topics: Introduction, selection methods for a part, challenges of selection, example system for preliminary selection, production planning and control.AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries

Targeted Application & Tools that can be used:

Application Area include almost all manufacturing organizations (Automotive, Aerospace, Army, Medical equipment's etc.,)
Professionally Used Software: AutoCAD, Solid works

Text Book

1. Jing Zhang; Yeon-Gil Jung, "Additive manufacturing: materials, processes, quantifications and applications", Cambridge, Massachusetts: Elsevier, 2018.

References

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid
Prototyping to Direct Digital Manufacturing", Springer, 2010

3. Ali K. Kamrani, Emand Abouel Nasr, "Rapid Prototyping: Theory & Practice", Springer, 2006
4. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid
Prototyping and Rapid Tooling, Springer 2001.

Web-Resources:

W1. https://nptel.ac.in/courses/112103306
W2. A text book of Additive manufacturing Technologies, Second edition, Springer
https://www.google.co.in/books/edition/Additive_Manufacturing_Technologies/OPGbBQAAQBAJ?hl=en&gbpv=0

W3. https://kgut.ac.ir/useruploads/1523431958754buf.pdf
Web Resources:
https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433

Topics relevant to "EMPLOYABILITY SKILLS": Functional models, 3d Models for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Priyanka Umarji
Recommended by the Board of Studies on	15th BoS held on 22/07/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

<table>
<tr><td>Course Code: MEC3018</td><td colspan="2">Course Title: Additive Manufacturing in Medical Applications
Type of Course: Discipline Elective & Theory only</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">The purpose of this course is to enable the students to appreciate the need for additive manufacturing and to develop the basic abilities of 3 Dimensional Data Capture and Medical Scanning Technologies. The course is both conceptual and analytical in nature and needs fair knowledge of Medical Image Processing Software Systems. The course develops the critical thinking and Biomaterials. The course also enhances the knowledge on Virtual and Diagnostic Models in Medicine.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Additive Manufacturing in Medical Applications” and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1] Apply the concepts of medical imaging and 3D scanning for accurate 3D model reconstruction
CO2] Identify the errors during processing of medical image data and minimize them.
CO3] Select the suitable material for a given medical application.
CO4] Analyze and select an additive manufacturing technology for a given medical application
CO5] Design and fabricate customized implant for the given medical application</td></tr>
<tr><td>Course Content:</td><td colspan="7">Introduction to medical imaging, Human Anatomy, X-Ray technology, Computed Tomography (CT), Basic Components of CT, Different Types of CT Scanners, Magnetic Resonance Imaging (MRI), Ultrasound imaging, 3-D laser scanners, Industrial CT Scanners, 3D reconstruction and Reverse Engineering (RE). Processing of medical data from CT/MRI scan to 3D model in MIMICS, 3D-Doctor, Velocity2Pro, VoXim, SurgiGuide, SimPlant Software, MIMICS software modules, Importing data, thresholding, segmentation. Introduction to Biomaterials, Metallic Biomaterials, Ceramic Biomaterials, Polymeric Biomaterials, Composite Biomaterials, Biodegradable Polymeric Biomaterials, Tissue-derived Biomaterials. Surgical applications of virtual models in Cranio-maxillofacial biomodelling, Oral and Maxillofacial surgery.</td></tr>
<tr><td>Module 1</td><td>3 Dimensional Data Capture and Medical Scanning Technologies</td><td>Assignment</td><td colspan="3">Imaging and Scanning</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction to medical imaging, Human Anatomy, X-Ray technology, Computed Tomography (CT), Basic Components of CT, Different Types of CT Scanners, Magnetic Resonance Imaging (MRI), Ultrasound imaging, 3-D laser scanners, Industrial CT Scanners, 3D reconstruction and Reverse Engineering (RE), Image Reconstruction Procedure, Digital Communication in Medicine (DICOM) format, Types of Artifacts.</td></tr>
<tr><td>Module 2</td><td>Medical Image Processing Software</td><td>Case Study</td><td colspan="3">3D Visualization and Medical</td><td colspan="2">12 Sessions</td></tr>
</table>

	Systems		Modelling	
Topics: Processing of medical data from CT/MRI scan to 3D model in MIMICS, 3D-Doctor, Velocity2Pro, VoXim, SurgiGuide, SimPlant Software, MIMICS software modules, Importing data, thresholding, segmentation, Editing, region growing, volume reduction, 3D Visualization, surgical simulation, Meshing, Measurement tools, Smoothing tools, STL conversion , Morphological operations, Labelling, volume, RP file generation,				
Module 3	Biomaterials	Assignment	Data Collection and Analysis	10 Sessions
Topics: Introduction to Biomaterials, Metallic Biomaterials, Ceramic Biomaterials, Polymeric Biomaterials, Composite Biomaterials, Biodegradable Polymeric Biomaterials, Tissue-derived Biomaterials.				
Module 4	Design and Production of Medical Devices	Assignment	Design and Fabrication of prototypes	12 Sessions
Topics: Biopsy needle housing, Drug delivery devices, Masks for burnt victims, Functional prototypes help prove design value, Design and fabrication of non-implantable devices, Tools, Guides, Templates, etc.,				

Targeted Application & Tools that can be used:
X-Ray technology, CT Scanners , surgical simulation , Orthopedic biomodelling customized implant
Professionally Used Software: 3D model in MIMICS, 3D-Doctor, Velocity2Pro, VoXim, SurgiGuide

Books:
1. Richard Bibb, Dominic Eggbeer and Abby Paterson, Medical Modelling: The Application of Advanced Design and Rapid Prototyping Techniques in Medicine, Woodhead publishing, 2015.
2. Ian Gibson, Advanced Manufacturing Technology for Medical Applications, John Wiley, 2005.

References
1. Chua Chee Kai and Yeong Wai Yee, Bio-Printing: Principles and Applications, World Scientific Publishing, 2015.
2. Paulo Bartolo and Bopaya Bidanda, Bio-materials and Prototyping Applications in Medicine, Springer, 2008.
3. Joseph D. Bronzino, The Biomedical Engineering Hand Book, 3rd Edition, CRC Press, 2006.

Web Resources:
https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433

Topics relevant to "EMPLOYABILITY SKILLS":CT/MRI Scan, Biomodelling for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Priyanka S Umarji
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 27/8/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: **MEC3002**	**Course Title:** **Introduction to Additive Manufacturing and Its Applications** **Type of Course:** **Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3

Version No.	1.0			
Course Pre-requisites	NIL			
Anti-requisites	NIL			
Course Description	Students will be able to decide between the various trade-offs when selecting AM processes, devices and materials to suit particular engineering requirements. Students will have in-depth knowledge in latest trends and opportunities in AM, including distributed and direct digital manufacturing, mass customization, and how to commercialize their ideas.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Introduction to Additive Manufacturing and Its Applications**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.			
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1] Identify the different AM techniques. CO2] Explain the Design considerations in AM. CO3] Illustrate the post processing. CO4] Summarize the AM process selection and its applications			
Course Content:				
Module 1	Introduction to Additive Manufacturing (AM)	Assignment	Identify the Major manufactures in India for 3D printing and report the manufacturing capabilities	15 Sessions
Topics: Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, AM process chain: Conceptualization, CAD, conversion to STL, Transfer to AM, STL file, manipulation, Machine setup, build , removal and clean up, post processing. Classification of AM processes: Liquid polymer system, discrete particle system, molten material systems, and solid sheet system.				
Module 2	Design for AM & Post processing of AM parts	Case Study	Design comparison of a component	15 Sessions
Topics: Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of Undercuts and Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.				
Module 3	Process Selection and AM application	Case Study	Process selection	15 Sessions
Topics:				

Introduction, selection methods for a part, challenges of selection, example system for preliminary selection, production planning and control. AM Applications: Functional models, Pattern for investment and vacuum casting, art models, Engineering analysis models, new materials development. Application examples for Aerospace, automobile, Bio-medical and general engineering industries	
Targeted Application & Tools that can be used: Application Area is rapid prototyping, product design and development industries Professionally Used Software: 3D Modeling software,Cura.	
Text Book: 1. Jing Zhang; Yeon-Gil Jung, "Additive manufacturing: materials, processes, quantifications and applications", Cambridge, Massachusetts: Elsevier, 2018. 2. Salvatore Brischetto, Paolo Maggiore and Carlo Giovanni Ferro (Eds.), "Additive Manufacturing Technologies and Applications" MDPI -2017	
References 1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003. 2. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010 3. Ali K. Kamrani, Emand Abouel Nasr, "Rapid Prototyping: Theory & Practice", Springer, 2006 4. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001 WebResources:https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433	
Topics relevant to "EMPLOYABILITY SKILLS": Interlocking Features and Assembling for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in course handout	
Catalogue prepared by	Priyanka S Umarji
Recommended by the Board of Studies on	BOS NO: 12th BoS held on 06/08/2021
Date of Approval by the Academic Council	16th Meeting of the Academic Council held on 23rd October, 2021

<table>
<tr><td>Course Code:
MEC3022</td><td>Course Title: Rapid Prototyping Laboratory
Type of Course:
1] Discipline Elective
2] Laboratory only</td><td>L-T-P-C</td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Version No.</td><td colspan="6">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The Rapid Prototyping laboratory is intended to provide the students with an active learning environment for fabricating three dimensional (3D) models directly from the computer aided design (CAD) data. Students use the laboratory to model and fabricate complex shaped objected that are used in the engineering and medical applications.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "Rapid Prototyping Laboratory" and attain EMPLOYABILITY SKILL through Experiential learning techniques</td></tr>
<tr><td>Course Out Comes</td><td colspan="6">On successful completion of the course the students shall be able to:
CO1] Develop STL file for CAD models with appropriate support structures and orientation
CO2] Build complex engineering assemblies in plastic material with minimum build-time
CO3] Evaluate the process parameters of RP Machines to improve the quality of the prototype
CO4] Model and fabricate the final prototype</td></tr>
<tr><td>Course Content:</td><td colspan="6">List of Laboratory tasks to be conducted
Task 01: Generation of STL Files
Level No 01: Working with STL files
Level No. 02: Generation of STL file from CAD model
Task 02: Modeling Creative Designs in CAD Software
Level No 01: Understanding the design aspects
Level No. 02: Modelling the design in CAD
Task 03: Processing the CAD data
Level No 01: Processing the CAD data in Catalyst.
Level No. 02: Processing the CAD data in CURA software
Task 04: Simulation in Catalyst Software
Level No 01: Simulation for Optimizing build-time
Level No. 02: Simulation for optimizing material consumption
Task 05: Sending the tool path data for fabricating the physical part on RP machine
Level No 01: Understanding the key concepts
Level No. 02: Sending the data for fabrication on RP Machine
Task 06: Removing the supports & post processing (cleaning the surfaces)
Level No 01: Removing the supports for post processing
Level No. 02: Cleaning the surfaces
Task 07: Evaluating the quality of the fabricated part.
Level No 01: Evaluation in terms of surface finish
Level No. 02: Evaluation in terms of dimensional accuracy
Task 08: Evaluating the fabricated part .
Level No 01: Understanding the need for the part for a given</td></tr>
</table>

	application Level No. 02: Evaluating the suitability of the part for a given application.
Targeted Application & Tools that can be used: Application area in all manufacturing related companies and Industries. Professionally Used Softwares: Catalyst, CURA, RP Machine	
Text Book 1) Rapid Prototyping Lab Manual	
References 1. Chua Chee Kai., Leong Kah Fai., Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010. 2. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=926197&site=ehost-live **WebResources:** https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433	
Topics relevant to "EMPLOYABILITY SKILLS": Fabrication and 3d modelling for developing **EMPLOYABILITY SKILLS** through **Experiential Learning techniques**. This is attained through the assessment component mentioned in course handout	
Catalogue prepared by	Priyanka S Umarji
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 27/8/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: MEC3099	**Course Title: Autonomous Mobile Robots** **Type of Course: Discipline Elective**			**L-T-P-C**	3	0	0	3
Version No.	1.0							
Course Pre-requisites	NIL							
Anti-requisites	NIL							
Course Description	This course provides an introduction to the fundamentals of mobile robotics, examining the basic principles of locomotion, kinematics, sensing, perception, and cognition that are key to the development of autonomous mobile robots. The course will give students an opportunity to design and fabricate a mobile robotic platform and program it to apply learned theoretical concepts.							
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Autonomous Mobile Robots**" and attain **EMPLOYABILITY SKILL** through Problem solving methodologies.							
Course Out Comes	On successful completion of the course the students shall be able to: CO1] Describe the fundamentals of mobile robots. CO2] Identify the different principles of locomotion and kinematics. CO3] Describe the different types sensing elements and perceptions. CO4] Describe the cognition system to develop autonomous mobile robots.							
Course Content:								
Module 1	Robot locomotion and Kinematics and Dynamics	Assignment	Data Collection					10 Sessions
Topics: Types of locomotion, hopping robots, legged robots, wheeled robots, stability, maneuverability, controllability; Mobile robot kinematics and dynamics: Forward and inverse kinematics, holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots.								
Module 2	Perception	Case Study	Data collection					12 Sessions
Topics: Proprioceptive/Exteroceptive and passive/active sensors, performance measures of sensors, sensors for mobile robots like global positioning system (GPS), Doppler effect-based sensors, vision based sensors, uncertainty in sensing, filtering.								
Module 3	Localization	Case Study	Data collection					13 Sessions
Topics: Odometric position estimation, belief representation, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, positioning beacon systems								
Module 4	Introduction to planning and navigation	Assignment	Data Collection					10 sessions
Topics: path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision								

Processes (MDP), stochastic dynamic programming (SDP)	
Targeted Application & Tools that can be used: Automation mobile robot is relevant in various industries including Automotive, Aerospace, Medical, Building, Consumer Goods and Packaging.	
Text Book Autonomous Mobile Robots, by Siegwart and Nourbakhsh, MIT Press, 2004.	
References 1. Melgar, E. R., Diez, C. C., Arduino and Kinect Projects: Design, Build, Blow Their Minds, 2012. 2. H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun, Principles of Robot Motion: Theory, Algorithms and Implementations, PHI Ltd., 2005. 3. https://nptel.ac.in/courses/112106298 Weblinks:https://presiuniv.knimbus.com/user#/searchresult?searchId=autonomous%20mobile%20robots&_t=1688458579290	
Topics relevant to "EMPLOYABILITY SKILLS": Path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP) for developing **EMPLOYABILITY SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr.Arpitha G R
Recommended by the Board of Studies on	BOS 17, held on 08/07/2023
Date of Approval by the Academic Council	21st Academic council meeting held on 06/09/2023

Course Code: **MEC3076**	**Course Title:** **Human Robot Interaction** **Type of Course:** **Discipline Elective & Theory Only**	**L-T-P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	This course on Human-Robot Interaction (HRI) explores the interdisciplinary foundation and practical aspects of how humans and robots communicate and collaborate. It begins with an overview of robot types, components, and the evolving robotics market, introducing essential hardware like sensors and actuators used in interactive systems. The course delves into both verbal and nonverbal modes of interaction, covering speech recognition, dialogue systems, and the perception and generation of nonverbal cues such as gestures, gaze, and posture. Students will also examine various application domains of HRI, including service robotics, education, healthcare, entertainment, personal assistance, and autonomous systems. Designed with a focus on foundational understanding and practical application, the course equips learners with the knowledge to comprehend and contribute to the growing field of human-centered robotics.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **"Human Robot Interaction"** and attain **EMPLOYABILITY SKILLS** through **Participative Learning techniques.**					
Course Out Comes	**On successful completion of the course the students shall be able to:** CO1. Explain the fundamental concepts of Human Robot Interaction (HRI) CO2. Summarize the sensors, actuators and hardwares used in HRI CO3. Illustarte the principles and processes of verbal communication between humans and robots. CO4. Differentiate various forms of nonverbal communication in HRI. CO5. Apply Human-Robot Interaction principles to design and implement robotic solutions for diverse sector specific applications CO6. Analyze real-world HRI scenarios to evaluate the effectiveness of robot deployment across diverse sectors.					
Course Content:						

Module 1	Human Robot Interaction	Assignment	Data Collection	**13 Sessions**

Topics:
Definition of Robot, types of robots, Robotics market and the future prospects, Asimov's laws, HRI as an interdisciplinary endeavor, evolution of HRI, Robot Anatomy, Robot configurations: Polar, Cartesian, cylindrical and Jointed-arm configuration. Robot motions, Joints, Work volume. Sensors used in HRI, Audio, Video, Robot Vision System.

Module 2	Verbal Interaction	Assignment	Data Collection	**12 Sessions**

Topics:
Verbal Interaction: Human-human verbal interaction, components of speech, Written text versus spoken language, Speech recognition by the Robot, Basic principles of speech recognition, Practice in HRI, Voice-activity detection in HRI, Language understanding in HRI, Dialogue management, Basic principle, Practice in HRI, Speech production, TTS engines, Chat bots.

Module 3	Non Verbal Interaction	Assignment	Data collection and Analysis	**10 Sessions**
Nonverbal Interaction- Functions of non-verbal cues in interaction, Types of nonverbal interaction, Gaze and eye movement, Gesture, Mimicry and Imitation, Touch, Posture and movement, Interaction rhythm and timing. Nonverbal interaction in robots, Robot perception of nonverbal cues, generating nonverbal cues in robots.				
Module 4	Applications	Case Study	Data collection and analysis	**10 Sessions**
Applications of Human Robot Interaction- Service robots, Robots for learning, Robots for entertainment, Robots in Health care and therapy, Robots as personal assistants, Collaborative robots, robots in self driving cars, remotely operated robots, problems for robots applications.				
Targeted Application & Tools that can be used: Industrial applications of robots: Medical sector, Military Unit, Industries, Domestic Sector etc. Automation in industries.				
Text Book: 1. Christoph Bartneck, Tony Belpaeme, Friederike Eyssel, Takayuki Kanda, Merel Keijsers, Selma Šabanović, "Human Robot Interaction", Cambridge University Press, 2020. 2. Cynthia Breazeal "Designing Sociable Robots", MIT Press, 2002.				
References: 1. Dieter Vanderelst, "Human-Robot Interaction: An Introduction", 2019. 2. Fang Chen "Designing Human Interface in Speech Technology", Springer, 2021. **Web links:** 2. https://presiuniv.knimbus.com/user#/searchresult?searchId=Introduction%20to%20robotics%20and%20automation&_t=1655968277251 3. https://www.edx.org/learn/human-robot-interaction 4. https://onlinecourses.nptel.ac.in/noc22_me77/preview				
Topics relevant to "EMPLOYABILITY SKILLS": The sensing and digitizing function in non verbal interaction, Machine vision, Image processing and analysis, Training and Vision systems **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	**Mr. Basavaraj Devakki**			
Recommended by the Board of Studies on	28/6/2024			
Date of Approval by the Academic Council	21st Academic Council Meeting held on 6th Sep 2023			

<table>
<tr><td>Course Code:
MEC3040</td><td>Course Title: Modern Manufacturing Processes
Type of Course: Discipline Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">2</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">This course is intended to provide an overview of various Modern Manufacturing Processes such as Advanced Machining Processes, Advanced Casting Processes, Advanced Welding Processes, Advanced Metal Forming Processes, Lean Manufacturing, Industry 4.0 and related group technologies used in Industries. Also how these processes are used in smart manufacturing.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of " Modern Manufacturing Processes" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">On successful completion of this course the students shall be able to:
CO1. Explain the importance, classification, and selection of manufacturing processes, along with types of production, plant layouts, and automation systems
CO2. Apply knowledge of advanced machining processes (AJM, USM, WJM, CHM, ECM, PAM, EDM, EBM, LBM) and CNC programming for turning and milling operations.
CO3. Compare different advanced casting processes and evaluate their suitability for specific engineering applications
CO4. Describe advanced welding techniques and their advantages over conventional methods for precision and specialized applications
CO5. Analyze advanced metal forming processes, including HERF, electromagnetic, explosive, and electro-hydraulic forming, to select suitable methods for desired shapes and properties
CO6. Apply lean manufacturing principles and Industry 4.0 concepts to improve productivity, quality, and sustainability in manufacturing systems.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Introduction to Manufacturing</td><td>Assignment</td><td colspan="4">10 Sessions</td></tr>
<tr><td colspan="7">Topics:
Introduction, Importance of Manufacturing Process, Manufacturing Process and 5 M's, Classification of Manufacturing Processes, Selection of Manufacturing Process, Types of Production, Functions In Manufacturing, Organization and Information Processing In Manufacturing, Plant Layout. Types of Automation, Automated Assembly Systems, Designs For Automated Assembly, Types Of Automated Assembly Systems.</td></tr>
<tr><td>Module 2</td><td>Advanced Machining & Casting Processes</td><td>Case Study</td><td colspan="4">15 Sessions</td></tr>
</table>

Topics: Advanced Machining Processes: Abrasive Jet Machining (AJM), Ultrasonic Machining (USM), Water Jet Machining (WJM), Chemical Machining (CHM), Electro-Chemical Machining (ECM), Plasma Arc Machining (PAM), Electrical Discharge Machining (EDM), Electron Beam Machining (EBM), Laser Beam Machining (LBM). CNC Turining & Milling: The Machine Control Unit for CNC, CNC Words, CNC Part Program, Numerical examples Advanced Casting Processes: Metal mould casting, Continuous casting, Squeeze casting, Vacuum mould casting, Evaporative pattern casting, Ceramic shell casting			
Module 3	Advanced Welding & Metal Forming Processes	Assignmen t	12 Sessions
Topics: Advanced Welding Processes: Details of electron beam welding (EBW), laser beam welding (LBW), ultrasonic welding (USW) Advanced Metal Forming Processes: Details of high energy rate forming (HERF) process, Electro-magnetic forming, explosive forming Electro-hydraulic forming, Stretch forming, Contour roll forming.			
Module 4	Lean Manufacturing & Industry 4.O	Assignmen t	8 Sessions
Topics: Lean Manufacturing: Introduction. Toyota Production System, What is Lean? 3M's of Lean 5S's of Lean, Lean Manufacturing Principles. Lean Manufacturing Tools. Industry 4.O: Introduction, Technologies of Industry 4.0, Application of Industry 4.O, Impact of Industry 4.O			
Targeted Application & Tools that can be used: 1. Creating smart factories where manufacturing technologies are upgraded and transformed by cyber-physical systems (CPSs), the Internet of Things (IoT), and cloud computing 2. Industry 4.0 combines embedded production system technologies with intelligent production processes to pave the way for a new technological age that will fundamentally transform industry value chains, production value chains, and business models.			
Text Book: 1. P N Rao, "Manufacturing Technology – Vol. 1 & 2", McGraw Hill Education .			
References 1. Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation". 2. Krar S. F. and Gill A. – 'Exploring Advanced Manufacturing Technologies' -Industrial Press – 2003 Dr. Ramachandra C G, "Lean Manufacturing", ISBN: 978-620-2-67580-2, LAP LAMBERT Academic Publishing, International Book Market Service Ltd., Member of Omni Scriptum Publishing Group, 17 Meldrum Street, Beau Bassin 71504, Mauritius, 2020 **Web links:**https://archive.nptel.ac.in/courses/112/107/112107078/ https://presiuniv.knimbus.com/user#/searchresult?searchId=advanced%20Manufacturing%20systems&_t=1674632488677			
Topics relevant to "EMPLOYABILITY SKILLS":PLC, Modern Manufacturing Processes for developing **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.			
Catalogue prepared by	Dr. Ramachandra C G		
Recommended by the Board of	BOS NO: 15th BOS held on 27/8/2022		

Studies on	
Date of Approval by the Academic Council	ademic Council Meeting No. 18, Dated 03/08/2022

Course Code: MEC3440	**Course Title:** Fixed Equipment in Oil and Gas Industry **Type of Course:** Discipline Elective		**L-T-P- C**	3	0	0	3
Version No.	1.0						
Course Pre-requisites	**NIL**						
Anti-requisites	**NIL**						
Course Description	This course introduces engineering students and professionals to the core concepts and practices surrounding fixed equipment used in the Oil & Gas industry. With a focus on pressure vessels, columns, heat exchangers, and valves, the course combines fundamentals with industrial standards like ASME, API, and TEMA. Learners will gain hands-on exposure to equipment safety, design basis, metallurgy, and inspection methodologies. Emphasis is placed on safety relief mechanisms, industrial damage assessment, welding, and fabrication. Training is designed to enhance familiarity with the lifecycle performance of static equipment and instill confidence in code-based evaluation and troubleshooting techniques.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Fixed Equipment in Oil & Gas Industry**" and attain **EMPLOYABILITY SKILLS** through **Problem solving methodologies**						
Course Outcomes	**On successful completion of this course the students shall be able to:** **CO1:** Explain the function of static equipment and apply basic design criteria relevant to oil and gas operations. **CO2:** Apply international codes and standards to static equipment design for different process conditions. **CO3:** Evaluate the safety measures and protection mechanisms for static pressure equipment in Oil and Gas Industry. **CO4:** Analyze fabrication methods and assess common damage mechanisms in static equipment. **CO5:** Identify, classify and select valves for static systems based on application and performance specifications. **CO6:** Interpret code-based calculation methods and verify compliance in static equipment design						
Course Content:							
Module 1	Introduction to the Oil & Gas Industry and Static Equipment	Data interpretation	Descriptive				8 sessions
Topics: Introduction to upstream and downstream operations in oil & gas industry – Types and roles of static equipment – Functional classification of pressure vessels, columns, and heat exchangers – Industry applications and significance – Safety standards and operational context – Overview of equipment lifecycle in refinery and petrochemical plants Shell & tube heat exchanger and Counter & Parallel flow heat exchanger (Activity)							
Module 2	Codes and Standards in Design	Data interpretation	Descriptive				12 sessions
Topics:							

Pressure vessel and heat exchanger classifications – Internal pressure design using UG-27 – External pressure and vacuum design – Nozzle opening and reinforcement calculations – Saddle, skirt, and support design formulas – Application of ASME Section VIII Div 1 & 2 – Design margins and allowable stress limits – Use of mandatory appendices for alternative design approaches				
Module 3	Protection and Safety in Static Equipment	Case Study	Descriptive	10 sessions
Topics: Overview of ASME B31.3, API 660, and TEMA – Design criteria for internal and external pressure – Load combinations and design temperature effects – Material selection and stress limits per code – Structural thickness evaluation for piping – thin & thick cylinders – Bending equation – Flexibility and stress analysis basics – Span deflection and piping support requirements – Integration of code clauses in equipment design				
Module 4	Fabrication, Testing, and Failure Mechanisms	Case Study	Descriptive	10 sessions
Topics: Fabrication Techniques and Weld Evaluation Arc Welding, TIG Welding, MIG Welding, Spot Welding & Gas Welding (Activity) Basics of Industrial Damage Mechanisms (API 571): CUI, Wet H2S, Amine Corrosion Corrosion evaluation through Electro-chemical workstation (Activity)				
Module 5	Valves and Flow Control Components	Case Study	Descriptive	5 sessions
Topics: Introduction to API 571 damage mechanisms – Corrosion Under Insulation (CUI) – Wet H2S cracking – Amine stress corrosion – Overview of valve types and functions – API 598 valve inspection and testing standards – Valve selection for process applications – Maintenance and reliability of valves in oil & gas systems				
Targeted Application & Tools that can be used: • **Equipment Design & Inspection** • **Oil & Gas EPC Projects** • **Plant Maintenance & Safety Engineering** • **Fabrication & QA/QC** • **Asset Integrity Management**				
Textbook's 5. **Process Equipment Design – M.V. Joshi & V.V. Mahajani, Macmillan** 6. **Pressure Vessel Design Manual – Dennis R. Moss, Gulf Publishing**				
References 1. **ASME Sec VIII Div 1 & 2 – Boiler and Pressure Vessel Code** 2. **API 660, API 598, API 571 – American Petroleum Institute Standards** 3. **TEMA Standards – Tubular Exchanger Manufacturers Association** 4. **Maintenance and Reliability Best Practices – Ramesh Gulati, Industrial Press**				
Topics relevant to "Skill Development" focus on building practical competency in the design, safety, and maintenance of static equipment used in oil and gas facilities. Emphasis is placed on interpreting design codes, evaluating fabrication techniques, identifying failure modes, and selecting appropriate safety and flow control devices. Skill development is fostered through hands-on analysis, design calculation exercises, standards-based evaluations (ASME/API), and case-based learning methods, ensuring that learners are industry-ready to contribute effectively to equipment integrity, operational				

safety, and reliability programs.	
Catalogue prepared by	Dr. Sandeep G M
Recommended by the Board of Studies on	BOS Meeting No: 21, Dated: 6th July 2025
Date of Approval by the Academic Council	Academic Council Meeting No. 26, Dated 25/07/2025

<table>
<tr><td>Course Code:
MEC3441</td><td colspan="2">Course Title: Reliability and Maintenance in Oil and Gas Industry
Type of Course: Discipline Elective Course</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course introduces the principles and practices of reliability and maintenance engineering, specifically tailored for the oil and gas industry. Students will learn how to enhance asset performance, ensure operational safety, and minimize downtime through proactive maintenance strategies. The course emphasizes tools such as Reliability-Centered Maintenance (RCM), Failure Modes and Effects Analysis (FMEA), Risk-Based Inspection (RBI), and Condition-Based Monitoring (CBM). Key topics include asset integrity management, lifecycle cost optimization, and the application of digital technologies like predictive analytics and IoT in maintenance. Through practical case studies and hands-on exercises, students will gain the skills to implement effective maintenance programs that improve equipment reliability and operational efficiency in oil and gas environments.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Reliability and maintenance in Oil and Gas Industry” and attain Employability skill through participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:

CO1: Explain the fundamental concepts of reliability engineering and maintenance strategies such as RCM, RBI, FMEA, and CBM applied in the oil and gas industry.
CO2: Explain NDE techniques (DPT, MPT, UT) and interpret their results to identify damage in components based on relevant acceptance criteria and design codes.
CO3: Illustrate the failure patterns and root causes of equipment breakdowns using tools like RCM, risk matrix, and failure modes analysis for static and rotating equipment.
CO4: Compare the effectiveness of maintenance programs by using performance indicators, CMMS tools (SAP, Oracle Primavera), and real-time analytics to optimize downtime and inventory.
CO5: Analyze customized preventive, predictive, and condition-based maintenance programs integrating modern digital tools and industry standards (ISO 14224, API, PAS 55).
CO6: Assess continuous improvement methodologies such as 5S, Kaizen, SMED, and Kanban to improve reliability, reduce setup times, and enhance plant performance.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>NDEs and it's applications</td><td>Assignment</td><td colspan="4">Descriptive</td><td>8 sessions</td></tr>
</table>

Topics:
Various NDEs used for in-service inspection with emphasis on what kind of data/ observation each technique yields and a brief discussion on selecting the right technique for each component based on expected damage. Acceptance criteria and evaluation of results - overview and linkage to various deign codes.
Die Penetrant Test, Magnetic Crack Detector Test, Ultrasonic Test (to be conducted as activity in lab)

Module 2	Reliability - Static and Rotating Equipment	Assignment	Descriptive	16 sessions

Equipment Criticality, Reliability Cantered Maintenance, RCM methodology- Function / Functional failure / Failure modes/ Failure effects / Failure Consequence / Mitigation Strategies / Upgrade or Redesign, Failure patterns (Bathtub / wear out - Age related and Random failures), Risk Matrix (Consequence / Probability of failure), Static and rotating Equipment Strategy development.
Whirling of shafts experiment, Gyroscope, balancing of rotating of masses, single rotor and double rotor systems, Porter governor, Watt governor and Journal bearing experiments to be conducted as activity

Module 3	Planning and scheduling for outages (planned & unplanned)/ inventory planning - only concepts	Assignment	Descriptive	15 sessions

Topics:
5S System: Sort, Set in Order, Shine, Standardize, Sustain, Kaizen for Continuous Improvement, Introduction to Kanban: Pull System for Inventory Management, SMED (Single-Minute Exchange of Die) for Reducing Setup Times, Standard Work and Standard Operating Procedures (SOPs), Jidoka (Autonomation) and Quality at the Source, TPM (Total Productive Maintenance) for Reliability and Efficiency.

Module 4	Tool Knowledge	Assignment	Descriptive	6 sessions

Topics:
Primavera -
Importance of digital platforms in maintenance, scheduling, and asset lifecycle
Introduction to Enterprise Asset Management (EAM) and Project Management tools
Overview of SAP P4, SAP HANA, and Oracle Primavera
Comparison of legacy systems vs modern integrated platforms (Cloud/IoT integration)
Structure of SAP for Plant Maintenance (PM)
Functional Locations, Equipment Master, Task Lists
SAP P4 vs SAP HANA (architecture and speed)
Maintenance Planning & Execution in SAP:
Notification → Work Order → Execution → Confirmation
Real-time analytics with SAP HANA for downtime analysis & spare parts tracking
(Primavera tool to be used)

Targeted Application & Tools that can be used:
Application

- Asset Performance and Equipment Uptime Optimization
- Just-in-Time (JIT) Maintenance Execution
- Quality Control and Continuous Improvement in Maintenance Practices
- Reliability-Driven program

Tools

- 5W
- Kaizen
- Kanban and Primavera

Text Book's

7. **Maintenance and Reliability Best Practices**
   Author: Ramesh Gulati
   Edition: 3rd Edition
   Publisher: Industrial Press, Inc.
   ISBN: 978-0831135811
8. **Managing Maintenance Shutdowns and Outages**
   Author: Joel Levitt
   Publisher: Industrial Press
   ISBN: 978-0831135330

References

5. **SAP Plant Maintenance (SAP PM): Configuration Guide**
   Author: Karl Liebstückel
   Publisher: SAP Press
   ISBN: 978-1493215890

6. **Project Planning, Scheduling, and Control Using Primavera P6**
   Author: Paul Eastwood Harris
   Publisher: Eastwood Harris Pty Ltd
   ISBN: 978-1925185782

Topics relevant to **"Skill Development"** focus on enhancing **reliability and maintenance practices** by strengthening communication across maintenance and operations teams, reducing equipment downtime, and optimizing spare parts and asset utilization through structured approaches such as **Preventive Maintenance, RCM, and Kanban-based planning**. Skill development is fostered through participative learning techniques, with hands-on assessments and case-based evaluations as outlined in the course handout.

Catalogue prepared by	Dr. Prashanth S P
Recommended by the Board of Studies on	BOS Meeting No: 21, Dated: 6th July 2025
Date of Approval by the Academic Council	Academic Council Meeting No. 26, Dated 25/07/2025

23. Open Elective Course Catalogues

Course Code: MEC3070	**Course Title: Electronics Waste Management** **Type of Course: Open Elective & Theory Only**	**L-T- P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The present course on E-waste management will highlight the scenario of E-Waste management in India and its comparison with other countries. In Indian context, the role of various stakeholder in E-Waste management will be discussed followed by its effect on human health, environment and society will also be presented. Finally, the available option of extraction of Rare-Earth materials from the E-waste will also be discussed to throw some light on opportunities link with E-waste recycling.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of " **Electronics Waste Management**" and attain **ENTREPRENEURIAL SKILL** through Participative learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1. Understand the present scenario of E-waste generation in India. CO2. Understand the effect of E-Waste elements on environment and public health. CO3. Classify the different existing recycling technique of E-Waste.					
Course Content:						

Module 1	Introduction to E-Waste and its Management	Assignment	Data collection on consumption of Electronic products in last 10 years in India.	12 Sessions
Topics: Present scenario of E-Waste, Definition to E-waste, Composition of E-Waste, Sources of E-Waste, E-Waste in India and global perspective (growth trend), Elements of Concern in E-Waste, Harmful Effects of E-Waste elements, Quantification of E-Waste, Case study of E- Waste (for a specific city), Economic assessment of E- Waste.				
Module 2	Environment and health concern	Assignment	Data collection on amount of different pollutants from top 10 consumer electronic in India.	13 Sessions
Topics: Classification of E-Waste, Hazardous elements present in E-Waste, Toxicity concern of elements such as flame retardants, lead, mercury etc. on environment and public health. Exposure of E-Waste to mankind, Introduction to risk assessment, steps in risk assessment, Numerical problems on risk assessment.				
Module 3	Recycling of E-Waste	Assignment & Case study	Data Collection on amount of material recovered from different E-Waste in 2019.	10 Sessions

Topics: Introduction to recycling of E-Waste, steps in recycling, existing E-Waste recycling technique, case study of CRT recycling, Glass to glass recycling, glass to lead recycling, metal recovery, pyro metallurgical process, Hydrometallurgical process, Leaching technique and its mechanism, Bio metallurgical process.				
Module 4	Environmentally sound E- Waste management	Assignment & Case study	Study different types of E-Waste Management starts-up	10 Sessions
Topics: Emerging recycling and recovery technologies, Guidelines for environmentally sound management of e- waste, Environmentally sound treatment technology for e- waste, Guidelines for establishment of integrated e-waste recycling and treatment facility, Case studies and unique initiatives from around the world.				
Targeted Application & Tools that can be used: The growing concern of E-waste and the presence of precious metals attracts different E-Waste recycling plant in the country. The python (Pandas) will be used to analyze the data already existing to draw some insights of the trends in the E-Waste handling.				
Text books: T1. Gev Eduljee, R M Harrison Electronic Waste Management: Edition 2				
References R1. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website. R2. MSW Management Rules 2016, Govt. of India, available online at CPCB website. R3. Peyton L Sawyer, "Electronic Waste Management and Recycling Issues of Old Computers and Electronics", Nova Science Publication, 2010, E resource https://presiuniv.knimbus.com/openFullText.html?DP=https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/00400910910960740/pdfplus/html				
Topics relevant to "ENTREPRENEURIAL SKILLS": Classification of E-Waste, Hazardous elements present in E-Waste, Toxicity concern of elements such as flame retardants, lead, mercury for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through assessment component as mentioned in the course handout.				
Catalogue prepared by	**Dr. Ashish Srivastava**			
Recommended by the Board of Studies on	15 BOS, Dated 29/07/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

<table>
<tr><td>Course Code:
MEC2002</td><td colspan="3">Course Title: Operations Research and Management
Type of Course: Open Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The Course is designed with an objective of giving an overview of role of operations research in decision-making, applications in industry. The Course includes Linear Programming, Deterministic Model, Waiting Line Models, Project Line Models, Transportation model and its variants, Inventory models, Decision making under certainty, risk, and uncertainty. The course is both conceptual and analytical in nature and develops the critical thinking and analytical skills through assignments.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of " Operations Research and Management" and attain ENTREPRENEURIAL SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1]Translate the verbal description of the real system to linear programming mathematical models.
CO2] Apply the concept of transportation and assignment problems to minimize the cost and time.
CO3] Influence the decision-making processes of other individuals and groups.
CO4] Solve waiting line problems for M/M/1 and M/M/C models.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Linear Programming</td><td>Assignment</td><td colspan="2">Data collection and Analysis</td><td colspan="4">12 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction: Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR, Mathematical formulation of L.P. Problems, Graphical solution methods, Analytical solution methods - Simplex method, Two phase method, Dual simplex method.</td></tr>
<tr><td>Module 2</td><td>Transportation model</td><td>Assignment</td><td colspan="2">Data collection and Analysis</td><td colspan="4">13 Sessions</td></tr>
<tr><td colspan="9">Topics:
Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases.
Assignment Problem: Formulation, types, application to maximization cases and travelling salesman problem.</td></tr>
<tr><td>Module 3</td><td>Decision Making</td><td>Assignment</td><td colspan="2">Decision making Analysis</td><td colspan="4">10 Sessions</td></tr>
<tr><td colspan="9">Topics:
Decision theory: Decision making under certainty, risk and uncertainty, game theory- concept of minimax and maximin (saddle point), dominance rule and graphical method.</td></tr>
<tr><td>Module 4</td><td>Waiting Line model</td><td>Assignment</td><td colspan="2">Steady State Performance Analysis</td><td colspan="4">10 Sessions</td></tr>
<tr><td colspan="9">Topics:</td></tr>
</table>

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models (no derivations) and their steady state performance analysis.	
Targeted Application & Tools that can be used: Application Area is Optimization of process parameters in decision making. Professionally Used Software: MATLAB.	
Textbook: T1. S.D. Sharma, "Operations Research ", Ledarnath Ramanath & Co, 2016. T2: Gupta, R. K. Operations research. Krishna Prakashan Media, 1992.	
References: R1. P. Iyer, "Operations Research," McGraw Hill Education. R2. Taha H. A, "Operations Research and Introduction", Pearson Education edition. R3. R.Panneerselvam,"Operation Research" PHI Learning Pvt Ltd. Weblinks: https://orc.mit.edu/ https://www.coursera.org/learn/operations-research-modeling Handbooks in Operations Research and Management Science, Elsevier https://presiuniv.knimbus.com/openFullText.html?DP=https://www-sciencedirect-com-presiuniv.knimbus.com/science/journal/09270507 Surveys in Operations Research and Management Science, Elsevier https://www-sciencedirect-com-presiuniv.knimbus.com/journal/surveys-in-operations-research-and-management-science	
Topics relevant to "ENTREPRENEURIAL SKILLS": Decision theory: Decision making under certainty, risk and uncertainty, game theory- concept of minimax and maximin (saddle point), dominance rule and graphical method for developing **ENTREPRENEURIAL SKILLS** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Prof. Shashi Kiran G
Recommended by the Board of Studies on	BOS NO: 11th BOS held on 05/09/2020
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 24/12/2022.

<table>
<tr><td>Course Code: MEC2003</td><td colspan="3">Course Title: Supply Chain Management
Type of Course: Open Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The purpose of this course is to enable the students to understand components of supply chain management, operational challenges in managing global supply chains and to develop the basic abilities in modelling supply chain. The course is both conceptual and analytical in nature. The course develops the analytical, critical thinking, and decision making skills. The course also enhances the problem solving abilities through assignments.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of " Supply Chain Management" and attain ENTREPRENEURIAL SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1] Summarize the drivers and their role in the performance of Supply Chain.
CO2] Construct Supply Chain Network according to the requirement of any particular type of product.
CO3] Solve forecasting and inventory related issues in Supply Chain in practice.
CO4] Estimate transportation requirements of global product in real life.
CO5] Interpret the impact of future technologies in Supply Chain Management.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Introduction to SCM</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td colspan="4">10 Sessions</td></tr>
<tr><td colspan="9">Topics: Understanding Supply Chain – Objectives, Importance and Decision phases in Supply Chain, Process and Cycle view, Examples of Supply Chain., Supply Chain Drivers – Various drivers, Framework for structuring drivers, Supply Chain Performance – Achieving strategic fit.</td></tr>
<tr><td>Module 2</td><td>Designing the Supply chain Network</td><td>Case Study</td><td colspan="2">Simulation and data analysis task</td><td colspan="4">10 Sessions</td></tr>
<tr><td colspan="9">Topics: Designing distribution network – The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design. Network Design In The Supply Chain - The Role of Network Design in the Supply Chain, Framework for Network Design Decisions and Making Network Design Decisions in Practice. Designing Global Supply Chain Networks.</td></tr>
<tr><td>Module 3</td><td>Planning and Coordinating Demand and Supply</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td colspan="4">10 Sessions</td></tr>
<tr><td colspan="9">Topics: Demand forecasting, Aggregate Planning in Supply Chain, Coordination in Supply Chain. Managing economies of scale in a supply chain: Cycle inventory,</td></tr>
</table>

Managing Uncertainty In A Supply Chain: Safety Inventory, Determining The Optimal Level of Product Availability.				
Module 4	Designing and Planning Transportation Networks	Case Study	Data collection and Programming	8 Sessions
Topics: Transportation In a Supply Chain - The Role of Transportation in a Supply Chain, Modes of Transportation and Their Performance, The Role of IT in Transportation. The Role of Sourcing in a Supply Chain, Third- and Fourth-Party Logistics Providers, Supplier Selection—Auctions and Negotiations**.**				
Module 5	Future Technologies in Supply Chain	Assignment	Simulation and Analysis	7 Sessions
Topics: Information Technology In a Supply Chain, The Supply Chain IT Framework. The Future Technologies in the Supply Chain – AI, Additive Manufacturing, Driverless Vehicles, IoT, Block Chain Technologies, Wearable Devices.				
Targeted Application & Tools that can be used: Application Area include almost all manufacturing organizations (Automotive – Hyundai, KIA, Ford etc.,) Processing industries (Petroleum – Reliance, Shell, HP etc.,), service industries like Banking, Hospital, etc. and E-commerce platforms like Amazon, Flipkart etc. Professionally Used Software: SAP SCM, E2Open, Oracle SCM				
Text Book 1. Chopra, S., & Meindl, P., "Supply Chain Management: Strategy, Planning, and Operation.". Pearson Bostan, Fifth Edition, 2013.				
References 1. Hugos, M., "Essentials of Supply Chain Management", John Wiley & Sons, Inc., Third Edition, 2011. 2. Christopher. M., "Logistics & Supply Chain Management ", Prentice Hall., New Delhi, Fourth Edition, 2011. Website: https://www.ascm.org Supply Chain Management - New Perspectives by Sanda Renko , IntechOpen, 2011 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2610 Supply Chain Management - Applications and Simulations, Md. Mamun Habib IntechOpen, 2011. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609				
Topics relevant to "ENTREPRENEURIAL SKILLS": The Future Technologies in the Supply Chain – AI, Additive Manufacturing, Driverless Vehicles, IoT, Block Chain Technologies for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. R. Jothi Basu			
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 29/7/2022			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.			

<table>
<tr><td>Course Code:
MEC3010</td><td colspan="2">Course Title: Automotive Engineering
Type of Course: Open Elective & Theory only</td><td>L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This Course has been designed to make the students familiar with the automotive vehicle components. The Course emphasizes on internal combustion engines used in automotive vehicles, vehicle performance, analysis and design of various components of automotive vehicles, the Course also includes experimental or theoretical investigation of problems selected from the field of automotive vehicles. The Course also discusses lubrication systems, Clutches, Gear Boxes, propeller shafts, Universal Joint, Brakes, steering systems, Brake wheels and Ignition and starting systems.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of " Automotive Engineering" and attain ENTREPRENEURIAL SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Student will be able to
CO1. Identify the different parts of an automobile and it's working
CO2. Understand the working of transmission and braking systems
CO3. Comprehend the working of steering and suspension systems
CO4. Learn various types of fuels and injection systems</td></tr>
<tr><td>Course Content:</td><td colspan="7">Vehicle structure and engines, variable valve timing, vehicle aerodynamics, engine auxiliary systems, unit injector system, rotary distributor type and common rail direct injection system, turbo chargers. Transmission systems. clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel, torque converter, steering geometry and types of steering gear box-power steering, alternative energy sources.</td></tr>
<tr><td>Module 1</td><td>VEHICLE STRUCTURE AND ENGINES</td><td>Assignment</td><td colspan="3">SI and CI engines</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="8">Topics:
Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines – components functions and materials, variable valve timing (VVT).Engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements. Superchargers And Turbochargers</td></tr>
<tr><td>Module 2</td><td>ENGINE AUXILIARY SYSTEMS</td><td>Case Study</td><td colspan="3">Ignition system</td><td colspan="2">13 Sessions</td></tr>
<tr><td colspan="8">Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT),</td></tr>
<tr><td>Module 3</td><td>TRANSMISSION SYSTEMS</td><td>Assignment</td><td colspan="3">Systems of gear box</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Topics</td></tr>
</table>

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle,				
Module 4	ALTERNATIVE ENERGY SOURCES	Assignment	Types of energy sources	10 Sessions
Topics: Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note:				
Targeted Application & Tools that can be used: "Linkage X3" software for suspension design, "LightWave 3D"				
Books: 1 Jain K.K. and Asthana. R. B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002. 2. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 13th Edition 2014.				
References: 1. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998. 2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999. **Weblink:** **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER4_2141**				
Topics relevant to "ENTREPRENEURIAL SKILLS": Combustion and Emission Characteristics of SI and CI engines with alternate fuels - Electric and Hybrid Vehicles, Fuel Cell for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Madhusudhan M			
Recommended by the Board of Studies on	BOS NO: 15^{th} BOS held on 29/7/22			
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 3/8/22			

<table>
<tr><td colspan="2">Course Code:
MEC2004</td><td colspan="2">Course Title: Six Sigma for Professionals
Type of Course: Open Elective & Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="2">Version No.</td><td colspan="7">2</td></tr>
<tr><td colspan="2">Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td colspan="2">Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td colspan="2">Course Description</td><td colspan="7">Six Sigma is a methodology of implementing a highly successful project, or producing a high-quality product or service, using techniques and principles that ensure excellence. The Six Sigma methodology incorporates many years of studying best practices in business and its goal is ultimately the creation of a nearly error-free business environment. This course will give a complete overview of the Six Sigma process and prepare to be a Six Sigma team member.</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of " Six Sigma for Professionals" and attain ENTREPRENEURIAL SKILL through Participative learning techniques.</td></tr>
<tr><td colspan="2">Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1] Define the problem statement through customer analysis in terms of time, budget, and resource requirements.
CO2] Summarize a detailed process map by gathering baseline data.
CO3] Complete a root cause verification analysis by the help of inferential statistics and hypothesis testing.
CO4] Devise a preliminary implementation plan, update standard work procedures and write an action plan.</td></tr>
<tr><td colspan="2">Course Content:</td><td colspan="7"></td></tr>
<tr><td colspan="2">Module 1</td><td>Define Phase</td><td>Assignment</td><td colspan="3">Data Collection</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="9">Topics:
Define Phase: The Basics of Six Sigma, The Fundamentals of Six Sigma, Selecting Six Sigma Projects.</td></tr>
<tr><td colspan="2">Module 2</td><td>Measure Phase</td><td>Case Study</td><td colspan="3">Data Analysis</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="9">Topics:
Measure Phase: Process Definition, Six Sigma Statistics, Measurement System Analysis, Process Capability.</td></tr>
<tr><td colspan="2">Module 3</td><td>Analyze Phase</td><td>Assignment</td><td colspan="3">Data Analysis</td><td colspan="2">13 Sessions</td></tr>
<tr><td colspan="9">Topics:
Analyze Phase: Patterns of Variation, Inferential Statistics, Hypothesis Testing, Hypothesis Testing with Normal Data, Hypothesis Testing with Non-Normal Data.</td></tr>
<tr><td colspan="2">Module 4</td><td>Improve & Control Phase</td><td>Case Study</td><td colspan="3">Data Analysis</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="9">Topics:
Improve and Control Phase: Simple Linear Regression, Multiple Regression Analysis, Statistical Process Control (SPC), Six Sigma Control Plans.</td></tr>
</table>

Targeted Application & Tools that can be used: Application Area: Employ Six Sigma skills to lead a successful process improvement project to deliver meaningful results to the organization. Professionally Used Software: MINITAB/STATISTICA	
Textbook: 1. John Morgan, "Lean Six Sigma for Dummies ", A Wiley Brand, 3rd Edition 2015.	
References: 1. Michael George, David Rowlands, Mark Price, John Maxey, "The Lean Six Sigma Pocket Toolbook", The McGraw Hill Companies. 2. The council for six sigma certification, "SIX SIGMA, A Complete Step by Step Guide". W1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3610	
Topics relevant to "ENTREPRENEURIAL SKILLS": Improve and Control Phase: Simple Linear Regression, Multiple Regression Analysis, Statistical Process Control (SPC), Six Sigma Control Plans for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Prof. Shashi Kiran G
Recommended by the Board of Studies on	BOS NO: 15TH BOS HELD ON 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No.18,Dated 03/08/2022

Course Code: MEC3069	**Course Title: Engineering Optimization** **Type of Course: Open Elective**			**L-T-P- C**	3	0	0	3
Version No.	1.0							
Course Pre-requisites	MAT1001, MAT1002							
Anti-requisites	NIL							
Course Description	This Course is designed to impart the fundamental knowledge of linear programming, dynamic programming, classical optimization techniques, numerical methods in optimization. This course also concentrates on imparting basic programming knowledge and ways to use it to solve various optimization problems. Course has a section which mainly concentrates on the use of R-Programming to solve various optimization problems. Knowledge of calculus and familiarity with a medium-level programming language is assumed. The class will have several programming and homework assignments, and a final project.							
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Engineering Optimization**" and attain **ENTREPRENEURIAL SKILL** through Participative learning techniques.							
Course Content:								
Module 1	Introduction To Optimization	Case Study	Programming	12 sessions				
Topics: Modern methods in optimization, Application of optimization, Statement of optimization problem, Classification of Optimization problems, Optimization techniques. **R – Programming** : Introduction to R, Installation of R & R Studio, Data types in R, Lists, Matrices, mathematical operands, vector generation, R- Markdown, sequence generation, simple exercises.								
Module 2	Linear Programming	Case Study	Data collection. Programming & Data Analysis	10 sessions				
Topics: Introduction to Linear Programming**,** Simplex Method**,** Transportation Problem, Quadratic Programming. Simple numerical. **R – Programming:** Introduction to tidyverse, dplyr, tidyr, ggplot, Use of IPSOLVE for simplex problems.								
Module 3	Non Linear Programming 1-D Minimization	Case Study	Data collection. Programming & Data Analysis.	13 sessions				
Topics: Elimination Methods: Golden Section, Fibonacci, Exhaustive Search, Interpolation Methods: Newton Method, Secant Method. **R- Programming:** Use of R for EM and IM methods.								
Module 4	Non Linear Programming	Case Study	Data collection. Programming & Data	10 sessions				

	Unconstrained Optimization		Analysis	

Topics:
Direct Search Methods: Univariate, Random, Grid, Indirect Search Methods: Steepest Descent, Fletcher Reeves, Newton's Method.
R- Programming: Use of R for Direct Search and Indirect Search methods.

Targeted Application & Tools that can be used:
Application

- Automation and Robotics
- Decision Support Systems
- Investment and Trading
- Automotive Systems and Manufacturing

Tools

- MATLAB
- Python
- R Programming

Text Book's
1. Singiresu. S. Rao , "Engineering Optimization", Wiley, Fourth Edition, 2019.

References
1. Engineering Optimization by R. Russell Reinhart, Wiley Publishing.
2. Optimization Concepts and Applications in Engineering by Ashok D Belegundu & Thirupathi R, 3rd Edition, Cambridge University Press.

Web link
https://presiuniv.knimbus.com/openFullText.html?DP=https://www.cambridge.org/core/books/making-search-work/CFD78C770FBCBEF10E1F49F8969E92F4

Topics relevant to "ENTREPRENEURIAL SKILLS": R-programme for linear, non-linear, direct and indirect method usage for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	**Mr. ARUN AROGYASWAMY G**
Recommended by the Board of Studies on	15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, dated 03/08/2022

Course Code: **MEC3072**	**Course Title**: **Thermal Management of Electronic Appliances** **Type of Course: Open Elective**	**L-T- P- C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This Course is designed to impart the fundamental knowledge of Conduction, Convection modes of heat transfer and its application to various electronic appliances used in modern day computing systems. This course also concentrates on imparting practical knowledge on the necessary thermal concepts applied during the development of various microelectronic chips, heat sinks and heat pipes. Course has a section which mainly concentrates on the use of R/ Python Programming to solve thermal problems. Knowledge of calculus and familiarity with a medium-level programming language is assumed. The class will have several programming and homework assignments, and a final project.					
Course Objectives:	The objective of the course is to familiarize the learners with the concepts of "**Thermal Management of Electronic Appliances**" and attain **ENTREPRENEURIAL SKILL** through Participative learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1] Summarize the basics concepts of heat transfer. CO2] Employ thermal resistance concepts to develop micro electronic packages. CO3] Analyze the heat transfer mechanism through heat sinks used in microprocessors. CO4] Apply advanced cooling techniques to cool down micro electronic chips.					
Course Content:						

Module 1	Introduction to heat transfer	Case Study	Data collection. Programming & Data Analysis	10 sessions
Topics: Theory: Basic definitions, Conduction, Convection, Laws governing, Thermal conductivity, Thermal Resistance, Composite Walls, Extended Surfaces.				

<table>
<tr><td>Module 2</td><td>micro-electronic packaging & heat sinks</td><td>Case Study</td><td>Data collection. Programming & Data Analysis</td><td>10 sessions</td></tr>
<tr><td colspan="5">Topics:
Theory: Thermal Resistance network, series arrangement, parallel arrangement, thermal contact resistance, Thermal resistance of PCB's, General Resistance network, Thermal Interface Materials. Application: Importance of Packaging, Packaging Types, Package thermal resistance network, Package material parameters, Fins and Heat Sink equations, Fin thermal resistance, Effectiveness, Efficiency, Fins with varying Cross section, Heat sink manufacturing process.</td></tr>
<tr><td>Module 3</td><td>Cooling fans & pumps</td><td>Case Study</td><td>Data collection. Programming & Data Analysis.</td><td>12 sessions</td></tr>
<tr><td colspan="5">Topics:
Theory: Forced Convection, Mean velocity, Mean Temperature, Laminar and turbulent, Pumping
Power, Velocity profile and friction factor correlations,
Application: Types of fans & pumps, fan curve and system impedance curve, fan selection, plate –</td></tr>
<tr><td>Module 4</td><td>Heat pipe design and development</td><td>Case Study</td><td>Data Programming & Analy</td><td>13 sessions</td></tr>
<tr><td colspan="5">Topic
Theory: Types and applications, operating principles, working fluids, wick structures, control techniques, pressure balance, maximum capillary pressure, liquid and vapor pressure drops, Heat pipe design – fluid selection, wick selection, material selection, preliminary design considerations
Application: Heat pipe design procedure, determination of heat pipe diameter, design of heat pipe
containers, wick design, entertainment and boiling limitations,
design problems</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Application
1. Advanced Computing Systems
2. Design and Development of Microprocessors and Microcontrollers
3. Design and Development of Cooling processor fans
4. Design and Development of micro liquid cooling systems for PCB's
Tools
1. MATLAB
2. Python
3. R Programming</td></tr>
<tr><td colspan="5">Text Book's
1. Younes Shabany , "Heat Transfer – Thermal Management of Electronics", CPC Press, Taylor's & Francis,
2010.</td></tr>
</table>

References

1. Younus. A. Cengel, “Heat Transfer – A Practical Approach”, McGraw Hill, Second Edition, 2002

2. John. H. Lienhard, “A Heat Transfer Text Book”, MIT Press, 5th Edition, 2020

Weblinks:

W1 - The impact of improper cooling of electronic devices.
https://presiuniv.knimbus.com/user#/searchresult?searchId=AUTOMOBILE&curPage=0&layout=list&sortFieldId=none&topresult=false

W2- Essentials of thermal management of electronic devices.

https://presiuniv.knimbus.com/user#/searchresult?searchId=AUTOMOBILE&curPage=0&layout=list&sortFieldId=none&topresult=false

Topics relevant to “ENTREPRENEURIAL SKILLS”: Heat pipe design procedure, determination of heat pipe diameter, design of heat pipe Containers and wick design for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Mr. ARUN AROGYASWAMY G
Recommended by the Board of	15th BOS held on 29/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

<table>
<tr><td>Course Code:
MEC1002</td><td colspan="3">Course Title: Introduction to MATLAB and SIMULINK
Type of Course: Open elective & Theory only</td><td>L- T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The present course provides a general introduction to the MATLAB computing environment and is intended for beginner user. It is designed to give students a basic understanding of MATLAB including toolbox used in various areas of research such as Artificial Intelligence, Robotics, Image processing, Wireless communication, Machine learning and Data analytics.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
CO1. Identify the features of MATLAB development environment.
CO2. Write simple programme in MATLAB to solve scientific problem.
CO3. Understand the application of SIMULINK to solve engineering problem.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of “Introduction to MATLAB and SIMULINK” and attain ENTREPRENEURIAL SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>MATLAB fundamental</td><td>Assignment</td><td>Assignment on different features of MATLAB</td><td colspan="5">13 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction to MATLAB, Installation of MATLAB, command window, workspace, command history, Basic commands, Assigning variables, operation with variables, character and strings, array and vectors, BODMAS rule, arithmetic operations, matrix operation, trigonometric functions, real number and complex number.</td></tr>
<tr><td>Module 2</td><td>Plotting with MATLAB</td><td>Assignment</td><td>MATLAB Graph plotting on COVID-19 cases.</td><td colspan="5">10 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction to script file, Writing and executing script files, Plotting in MATLAB and editing the various features like labelling, specifying line style, Figure windows displaying, creating 3-D plot and highlighting the associated features. Introduction to GUI and its important component.</td></tr>
<tr><td>Module 3</td><td>Looping and conditional statement in MATLAB</td><td>Assignment & Case study</td><td>Numerical solving involves looping and conditional features.</td><td colspan="5">12 Sessions</td></tr>
<tr><td colspan="9">Topics:
Writing programs with logic and flow control, writing function control statement, programming conditional statement, conditional flow control- if, else, switch. Loop control- for, while, continue, break, and programme termination and return. Defining a</td></tr>
</table>

function, built in function, calling a function and their return types				
Module 4	Applications of MATLAB in Heat Transfer	Assignment & Case study	Problem solving using toolbox	10 Sessions
Topics: Create a special thermal model container for a steady-state or transient thermal model, solving thermal models in MATLAB and SIMULINK,				
Targeted Application & Tools that can be used: MATLAB including toolbox can be used in various areas of research such as Artificial Intelligence, Robotics, Image processing, Wireless communication, Machine learning and Data analytics.				
Text books: T1: William J. Palm, Introduction to MATLAB for Engineers. Third Edition.				
References: R1**:** http://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart.pdf				
Web Links: https://nptel.ac.in/courses/108102044 W1: https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=BOOKBOON_1_459 An Introduction to Matlab				
Topics relevant to "ENTREPRENEURIAL SKILLS ": Create a special thermal model container for a steady-state or transient thermal model, solving thermal models in MATLAB and SIMULINK for developing **ENTREPRENEURIAL SKILLS** through **Problem Solving techniques.** This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Mr. Basavaraj Devakki			
Recommended by the Board of Studies on	15th BoS held on 22/07/2022			
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022			

<table>
<tr><td>Course Code:
MEC2006</td><td>Course Title: Safety Engineering
Type of Course: Open Elective/
Theory Only Course</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The Course is designed with an objective of giving an overview of study of Industrial Safety followed in industries such as various safety terms used, Fire Safety, Mechanical Safety, Electrical Safety, Chemical Safety followed by case studies to understand the industrial safety in detail.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of " Safety Engineering" and attain ENTREPRENEURIAL SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="6">On successful completion of the course the students shall be able to:
CO1. Understand the basic safety terms and international standards.
CO2. Identify the hazards and risk analysis around the work environment and industries.
CO3. Use the safe measures while performing work in and around the work area of the available laboratories. Able to recognize the sign boards and its application
CO4. Recognize the types of fires extinguishers and to demonstrate the portable extinguishers used for different classes of fires.
CO5. Report the case studies by sharing experience of the employees working in housekeeping, laboratories etc.
CO6. Recognize the chemical and electrical hazards for its prevention and control.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Introduction to Safety</td><td>Case Study</td><td colspan="2">Data Collection</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="7">Topics: Terms used: accident, safety, hazard, safe, safety devices, safety guard, security, precaution, caution, appliance, slip, trip, fall. Ladders and scaffolding. Unsafe acts, reason for accidents, MSDS (material safety data sheet), OSHA, WHO. Lockout and tag out procedures. Safe material handling and storage.
Case studies: Student should identify the unsafe acts near their surroundings like housekeeping, lab as well as industrial layouts, road safety, campus layout, safety signs.</td></tr>
<tr><td>Module 2</td><td>Fire Safety</td><td>Term paper</td><td colspan="2">Data Collection</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="7">Topics: Introduction, Class A, B, C, D and E fire. Fire triangle, Fire extinguishers, Fire hazard and analysis, prevention of fire. Fire protection and loss prevention, steps after occurrence of fire. Notice-first aid for burns, Portable fire extinguishers. Fire detection, fire alarm and firefighting systems. Safety sign boards, instruction on portable fire extinguishers. Case studies: demonstration of fire extinguishers, visit to local firefighting stations. Visit to fire accident sites to analyze the cause of fire and its prevention for future.</td></tr>
<tr><td>Module 3</td><td>Mechanical Safety</td><td>Case Study</td><td colspan="2">Data Collection</td><td colspan="2">10 sessions</td></tr>
</table>

<table>
<tr><td colspan="5">Topics: PPE, safety guards, safety while working with machine tools like lathe, drill press, power and band saws, grinding machines, safety during welding, forging and pressing. Safety while handling material, compressed gas cylinders, corrosive substance, waste drum and containers.

Case studies: Visit to machine shop, workshops, foundry lab and local industries to record the practical observation and report the same with relevant figures and comments.</td></tr>
<tr><td>Module 4</td><td>Electrical Safety</td><td>Assignment</td><td>Data Collection</td><td>08 sessions</td></tr>
<tr><td colspan="5">Topics: Introduction to electrical safety, Indian standards on electrical safety, Electric hazards, effect of electric current on human body, causes of electrical accidents, prevention of electric accidents, PPE used. Electric shock. Primary and secondary electric shocks, AC and DC current shocks. Safety precautions against shocks. Safety precautions in small and residential building installations. Safety procedures in electric plant.</td></tr>
<tr><td>Module 5</td><td>Chemical Safety</td><td>Case Study</td><td>Data Collection</td><td>07 sessions</td></tr>
<tr><td colspan="5">Topics: Introduction to Chemical safety, Labeling of chemicals, acid hoods. Handling of acids, eye ashers and showers. Safety thinking, accident investigation, safety policy of the company, safety, loss prevention and control, check list for LPG installations, safety precautions using CNG, fire prevention and safety audit, confined space entry, risk assessment.
Case studies: To visit chemical laboratory of the college and other chemical industries like LPG, CNG facilities and report.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Job profiles like Safety Engineer etc</td></tr>
<tr><td colspan="5">Text Book
1. L M deshmukh, "Industrial Safety & Management". McGraw Hill Education (India) Private Limited, ISBN-13:978-0-07-061768-1.
2. S Rao, R K Jain & Sauja, "Electrical Safety, fire safety & safety management", Khanna Publishers, ISBN:978-81-7409-306-6.</td></tr>
<tr><td colspan="5">References
1. A M Sarma, "Industrial Health & Safety Management", Himalaya Publishing House.
2. K S N Raju, "Chemical Process Industrial Safety", McGraw Hill Education (India) Private Limited, ISBN-13:978-93-329-0278-7
Web Links
1. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=960146&site=ehost-live
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NAP_1_1600</td></tr>
<tr><td colspan="5">Topics relevant to "ENTREPRENEURIAL SKILLS": Safety practices and handling of fire extinguisher, for mechanical, safety precautions using CNG, fire prevention and safety audit and Safety precautions against shocks for developing ENTREPRENEURIAL SKILLS through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Mr. Basavaraj Devakki</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td colspan="4">11th BoS held on 05/09/2020</td></tr>
</table>

Date of Approval by the Academic Council	14th Meeting of the Academic Council held on 24/12/2020

Course Code: **MEC3071**	**Course Title: Hybrid Electric Vehicle Design** **Type of Course: Open Elective & Theory only**		**L-T-P-C**	3-0-0-3
Version No.	2.0			
Course Pre-requisites	NIL			
Anti-requisites	NIL			
Course Description	This course introduces the fundamental concepts, principles, analysis and design of hybrid and electric vehicles.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Hybrid Electric Vehicle Design**" and attain **ENTREPRENEURIAL SKILL** through Participative learning techniques.			
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1. Understand the basic concepts of Electric vehicles CO2. Outline the features of Hybrid Electric drive trains CO3. Summarize the concepts of energy storage solution CO4, Identify various energy management strategies			
Course Content:				
Module 1	Introduction to Hybrid Electric Vehicles	Assignment	Demonstration through videos	10 sessions
Topics: History of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basics of vehicle performance, vehicle power transmission characteristics.				
Module 2	Hybrid Electri Drive-trains	Assignment	Simulation	10 sessions
Topics: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.				
Module 3	Energy Storage Solution	Assignment	Seminar	12 sessions
Topics: Cell Types (Lead Acid/Li/NiMH), Battery charging and discharging, calculation, Cell Selection and sizing, Battery lay outing design, Battery Pack Configuration, Battery Pack Construction, Battery selection criteria.				
Module 4	Energy Management Strategies	Assignment	Simulation	13 Session
Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, implementation issues of energy management strategies.				
Targeted Application & Tools that can be used: Automobile Sectors and tools like MATLAB and Simulink can be used for demonstration				
Text Books 1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.				
References/Online contents 1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.				

2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004. 3. NPTEL courses on Electric Vehicles **https://nptel.ac.in/courses/108/106/108106170/** **E-Resources** **https://presiuniv.knimbus.com/user#/searchresult?searchId=hybrid%20electric%20vehicle%20design&_t=1657768967629**	
Topics relevant to "ENTREPRENEURIAL SKILLS": Energy Storage, Energy management Solution for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.	
Catalogue prepared by	Dr. Madhusudhan M
Recommended by the Board of Studies on	13th BoS held on 29/12/2021
Date of Approval by the Academic Council	17th Meeting of the Academic Council held on 11th December, 2021

<table>
<tr><td>Course Code:
MEC1001</td><td colspan="2">Course Title:
Fundamentals of Automobile Engineering
Type of Course: Open Elective & Theory only</td><td>L-T- P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of " Fundamentals of Automobile Engineering" and attain ENTREPRENEURIAL SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Description</td><td colspan="7">This course provides a fundamental understanding of the various systems of a typical automobile. At the end of this course, the participant acquire fundamental knowledge of the various systems of an automobile and associate the functions of each system with its design and layout, depict the various systems using simple schematics, and apply concepts learnt in the field of automobile engineering.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Student will be able to
CO1. Identify the different parts of an automobile and it's working
CO2. Understand the working of transmission and braking systems
CO3. Comprehend the working of steering and suspension systems</td></tr>
<tr><td>Course Content:</td><td colspan="7">Engine components and it's principle parts, cooling and lubrication, various lubrication system used in I C engines transmission systems and brakes, types of braking system based on medium used to brake , suspension systems, functions of steering system, superchargers and turbochargers, fuels, fuel supply systems for si and ci engines, automotive emission control systems.</td></tr>
<tr><td>Module 1</td><td>Engine components and it's principle parts</td><td>Assignment</td><td colspan="3">SI and CI engines</td><td colspan="2">08 Sessions</td></tr>
<tr><td colspan="8">Topics:Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams.</td></tr>
<tr><td>Module 2</td><td>Transmission System</td><td>Case Study</td><td colspan="3">Suspension system</td><td colspan="2">08 Sessions</td></tr>
<tr><td colspan="8">Transmission system: Definition and layout of Transmission System, requirements of transmission system, types of transmission system, units of transmission system, clutch and its types, gear box, propeller shaft, universal joints, axles and differentials, types of drives.</td></tr>
<tr><td>Module 3</td><td>Cooling, and Lubrication System</td><td>Assignment</td><td colspan="3">Systems of lubrication</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">Topics
Cooling system: Definition and objective, types of cooling systems, working of water cooling system, methods of circulation of water: Thermo-syphon cooling, forced or pump cooling, thermostatic regulator cooling, pressurized water cooling, evaporative cooling.
Lubrication system: Definition and objective, various lubrication system used in I C engines, wet sump lubrication system, dry sump lubrication system, mist lubrication system.</td></tr>
</table>

Module 4	Braking and Steering System	Assignment	Design and Fabrication of steering	9 Sessions

Topics
Braking and Steering system: Requirements of Braking system. Types of braking system. Working principle of Disk and Drum brake, Hydraulic brake, Power brake and Air brake.
Purpose of a steering system, functions of steering system, layout of steering system, types of steering gears: Steering mechanisms, Davis steering mechanisms, and Ackermann steering mechanism**.** Power steering**,** types of power steering.

Module 5	Ignition and suspension system	Assignment	Design and Fabrication of Suspension system	10 Sessions

Ignition System: Mechanical timed ignition system, Battery coil ignition system, Electronic Ignition.
Suspension System: Introduction to Suspension, functions of suspension system**,** elements of suspension system, Telescopic suspension system, Mcpherson system, Shock absorbers**.**

Targeted Application & Tools that can be used:
Design and fabrication of power steering.

Text Books:
1. R K Rajput "The text book of Automobile engineering", Lakshmi publication https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2228704&site=ehost-live
2. Kirpal Singh, "Automobile Engineering, Standard publisher's distributors

References
1. Joseph Heitner, Automotive mechanics, EW press Pvt. Ltd.
2. William course, Donald angling, "Automotive mechanics", McGraw Hill Education

Weblinks:
W1 - The impact of TQM practices on organizational learning case study: automobile part manufacturing and suppliers of Iran
https://presiuniv.knimbus.com/user#/searchresult?searchId=AUTOMOBILE&curPage=0&layout=list&sortFieldId=none&topresult=false
W2- The automobile repair industry.
https://presiuniv.knimbus.com/user#/searchresult?searchId=AUTOMOBILE&curPage=0&layout=list&sortFieldId=none&topresult=false

Topics relevant to "ENTREPRENEURIAL SKILLS": Ignition System, Braking System of Automobiles for developing **ENTREPRENEURIAL SKILLS** through **Problem-Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Mr. Prashanth S P
Recommended by the Board of Studies on	15th BoS held on 22/07/2022
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

Course Code: MEC2001	**Course Title: Renewable Energy Systems** **Type of Course: Open Elective - Theory**		**L-T-P-C**	3	0	0	3
Version No.	1.1						
Course Pre-requisites	Nil						
Anti-requisites	NIL						
Course Description	The Course is designed with an objective of giving an overview of Different kinds of renewable energy sources and their applications. It covers Introduction of renewable energy sources, their advantages, potential, status of development, broad details of different renewable energy systems such as solar, wind, biomass, hydrogen etc; Renewable energy development policy, Renewable energy industries and future thrust areas in renewable energy development.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **: Renewable Energy Systems**" and attain **ENTREPRENEURIAL SKILL** through Problem solving methodologies.						
Course Outcomes	**On successful completion of the course students shall be able to:** **CO1.** Identify the different types of non-conventional energy sources and compare with various conventional energy systems, their prospects and limitations. **CO2.** Describe the use of solar energy and the various components used in the energy production with respect to applications. **CO3.** Appreciate the need of Wind Energy and the various Biomass Energy sources and know their classifications with applications. **CO4.** Acquire the knowledge of fuel cells, with emphasis on hydrogen energy.						
Course Content:							

Module 1	Introduction	Assignment	Data collection & Analysis	10 Session

Topics:
Introduction to Energy Sources General, World Energy Futures, Energy consumption, Renewable Energy Sources, Renewable Energy Resources, Advantages, Prospects of Renewable Energy Sources.

Module 2	Solar energy	Assignment	Data collection and data analysis /Case Study	20 Session

Topic:

Solar Radiation and its Measurement: Definition Solar Constant, Beam and Diffused Radiation, Sun at Zenith, Air Mass, Solar Radiation Geometry, Different Solar angles, Day length, Local Solar Time, Solar radiation Measurements, Estimation of Average Solar Radiation.**Solar Energy Collectors:** Physical Principles of the conversion of Solar Radiation into Heat, Flat Plate Collectors, Collector Efficiency, Concentrating Collector, Focusing type, Advantages and Disadvantages of both Flat plate and Concentrating type collectors.

Solar Energy Storage: Solar Energy Storage systems, Solar Pond,

Applications of Solar Energy: Solar Water Heating, Solar Thermal Electric Conversion,

Solar Distillation, and Solar Cooking, Solar PV Systems, Solar PV application.				
Module 3	Wind And Biomass Energy	Assignment	Data collection	15 Sessions

Topics:
Wind Energy: Origin of Winds, Nature of Winds, Basic Principles of Wind Energy Conversion, Basics Components of a WECS, Classification, Advantages and Disadvantages, Applications of Wind Energy.
Biomass Energy: Biomass Conversion Technologies, Bio gas generation, Classification of Biogas plants, Biomass as a source of Energy, Methods of obtaining Energy from Biomass.

Targeted Application & Tools that can be used:
Application Area is Alternate energy resources – NTPC, ReNew , Tata Power, Suzlon, Acme Solar, Adani, Greenko.
Professionally Used Software: Ms- Excel, /Python FOR data collection, analysis and design of system

Text Books:

1. T1. Rai G D, "Non-Conventional Energy Sources", Fourth Edition, Khanna Publishers, New Delhi, Feb. 2000
2. SOLAR ENERGY BY S P SUKHATME, 1988 Tata McGraw-Hill Education
3. Principles of Thermal Collection and Storage by S P Sukhatme,J K Nayak. Tata McGraw-Hill Education, 1988

Reference Book(s):

4. R1. Khan B H, "Non-Conventional Energy sources", Third edition, Tata Mc Graw Hill, New Delhi, 2015.
5. Tiwari G N & M K Ghosal, "Renewable Energy Res ources"; Narosa Publishers, 2005

E-Resources:
W1:
https://presiuniv.knimbus.com/user#/searchresult?searchId=renewable%20energy%20&_t=1662529543766

Topics relevant to "ENTREPRENEURIAL SKILLS": Solar Energy System, Bio gas Plant for developing **ENTREPRENEURIAL SKILLS** through **Problem-Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by	Mr. Pranay Nimje
Recommended by the Board of Studies on	BOS NO: 15th BOS held on 27/08/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

<table>
<tr><td>Course Code:
MEC1003</td><td>Course Title: Engineering Drawing
Type of Course: Open Elective & lab based</td><td>L-T-P-C</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">MEC1006</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The course is designed with the objective of giving an overview of engineering drawing with the help of software tools. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings with computerized drafting tools. Computerized drafting provides accurate and easily modifiable graphic entities, easy data storage, easy retrieval facility and it enhances creativity. It will expose students to the concept of engineering drawing and teach them to draw different views of planes and solids in different orientations. The course will teach students to use AutoCAD to produce engineering drawings. They will learn to create drawing layouts, dimensioning, the theory of projection, orthographic projection of points, lines, planes and solids, isometric projection and be introduced to the development of surfaces.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "Engineering Drawing" and attain ENTREPRENEURIAL SKILL through Experiential learning techniques .</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">On successful completion of this course the students shall be able to:
CO1) Demonstrate competency using AutoCAD graphics software as per BIS conventions and standards.
CO2) Comprehend the theory of projection for drawing projections of Points, Lines and Planes under different conditions.
CO3) Prepare multiview orthographic projections of Solids by visualizing them in different positions.
CO4) Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions.</td></tr>
<tr><td colspan="7">Course Content</td></tr>
<tr><td>Module 1</td><td>Introduction to Drawing</td><td colspan="2">Assignment</td><td colspan="2">Standard technical drawing</td><td>2 Sessions</td></tr>
<tr><td colspan="7">Topics:
Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Line conventions, dimensioning, Selection of drawing sheet size and scale.</td></tr>
<tr><td>Module 2</td><td>Orthographic projections of Points, Straight Lines and Plane Surfaces</td><td colspan="2">Assignment</td><td colspan="2">Projection methods Analysis</td><td>10 Sessions</td></tr>
<tr><td colspan="7">Topics:
Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points in all 4 quadrants.
Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems).
Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only.</td></tr>
<tr><td>Module 3</td><td>Orthographic Projections of Solids</td><td colspan="2">Assignment</td><td colspan="2">Multi-view drawing Analysis</td><td>10 Sessions</td></tr>
</table>

Topics: Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection).				
Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	8 Sessions
Topics: Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects.				
Targeted Application & Tools that can be used: Application Area is in understanding and interpreting an object in various positions and converting it into a technical drawing which can be universally accepted. Professionally Used Software: AutoCAD				
Text Book: 1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.				
References: 1. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore. 2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall. 3. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill. 4. Engineering Graphics Manual provided by Instructor incharge. **Webresources :** Knimbus - Your Library. Anywhere, Anytime.				
Topics relevant to "ENTREPRENEURIAL SKILLS ": Projection in First and third angle, Orthographic Projection for developing **ENTREPRENEURIAL SKILLS** through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.				
Catalogue prepared by	Mr. Yeshwanth D			
Recommended by the Board of Studies on	BOS NO: 12th BoS held on 06/08/2021			
Date of Approval by the Academic Council	16th Meeting of the Academic Council held on 23rd October, 2021			

<table>
<tr><td>Course Code:
MEC2005</td><td colspan="2">Course Title: Fundamentals of Aerospace Engineering
Type of Course: Open Elective & Theory only</td><td colspan="2">L-T-P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">The purpose of this course is to give an overview of the fundamentals of aerospace engineering. It will give an overview of the aircraft industry, discuss the different components of and different types of aircrafts, go into the mechanical, electrical, electronic and auxiliary systems in aircrafts, discuss aircraft engines, pressurization, cover the basic principles of flight and space flight, and discuss various aircraft maneuvers.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of " Fundamentals of Aerospace Engineering" and attain ENTREPRENEURIAL SKILL through Problem solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of the course the students shall be able to:
CO1: Solve problems based on the concepts of flowing gases and the standard atmosphere
CO2: Apply the principles of basic aerodynamics to airfoils
CO 3: Determine the thrust and power requirements for level, unccelerated flight of an aircraft
CO4: Explain the criteria for longitudinal static stability for an airplane
CO5: Apply the basics of space vehicle trajectories to simple missions
CO6: Determine some propulsive characteristics of aircraft and rocket engines</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Introduction</td><td>Assignment</td><td></td><td colspan="3">Data Analysis task</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction, early developments, Sir George Cayley, Otto Lilienthal, Wilbur and Orville Wright. fundamental physical quantities of flowing gas, the source of all aerodynamic forces, equation of state for a perfect gas, anatomy of the airplane and a space vehicle, definition of altitude, the hydrostatic equation, geopotential and geometric altitudes, definition of the standard atmosphere, pressure, temperature and density altitudes.</td></tr>
<tr><td>Module 2</td><td>Basic Aerodynamics</td><td>Assignment</td><td></td><td colspan="3">Programming task and simulation</td><td colspan="2">15 Sessions</td></tr>
<tr><td colspan="9">Topics:
The continuity equation, incompressible and compressible flow, momentum equation, elementary
thermodynamics, isentropic flow, energy equation, speed of sound, low-speed subsonic wind tunnels, introduction to airfoils, airfoil nomenclature, lift, drag and moment coefficients, airfoil data, infinite versus finite wings, pressure coefficient, obtaining lift coefficient from the pressure coefficient.</td></tr>
<tr><td>Module 3</td><td>Airplane Performance, Stability and Control</td><td>Assignment</td><td></td><td colspan="3">Data Collection and Analysis</td><td colspan="2">10 Sessions</td></tr>
</table>

Topics: The drag polar, equations of motion, thrust and power requirements for level, unaccelerated flight, thrust available and maximum velocity, power available and maximum velocity, definitions of stability and control, moments on the airplane, absolute angle of attack, criteria for longitudinal static stability.					
Module 4	Propulsion	Assignment		Data Collection and Analysis	10 Sessions
Topics: Introduction, propeller, reciprocating engine, jet propulsion, turbojet engine, turbofan engine, ramjet engine, rocket engine, rocket propellants, rocket equation, rocket staging and propellant requirements for spacecraft trajectory maneuvers.					
Targeted Application & Tools that can be used: Application Area is Indian Space Research Organization (ISRO), Hindustan Aeronautics Limited (HAL), DRDO, General Electric(GE), Bombardier and many others Professionally Used Software: XFLR, Aeolus.					
Textbooks T1 A. C. Kermode, Flight Without Formulae, Pearson Education, 10th Edition T2 A. C. Kermode, Mechanics of Flight, Pearson Education, 5th Edition					
References R1 Shevell, Fundamentals of Flight, Pearson Education, 2nd Edition R2 Dave Anderson, Introduction to Flight R3 I. Moir, A. Seabridge, Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Wiley					
Web Resources: 1. Knimbus - Your Library. Anywhere, Anytime.					
Topics relevant to "ENTREPRENEURIAL SKILLS": Aerodynamic forces Equation, propellers equation for developing ENTREPRENEURIAL SKILLS through Problem-Solving methodologies. This is attained through the assessment component mentioned in the course handout.					
Catalogue prepared by	Mr. Yeshwanth D				
Recommended by the Board of Studies on	12th BoS held on 06/08/2021				
Date of Approval by the Academic Council	16th Meeting of the Academic Council held on 23rd October, 2021				

Course Code: **MEC3201**	**Course Title: Industry 4.0** **Type of Course: Open Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course provides students with an introduction to Industry 4.0, its building blocks, its applications and advantages compared to conventional production techniques. Learners get a deep insight into how intelligent processes, big data, and artificial intelligence can be used to build up the production of the future. Also enabling design principles that support companies in identifying and implementing various Industry 4.0 scenarios and the key technologies for smart factories. The course also discusses the Impact of Industry 4.0 on Society: Impact on Business, Government, People etc & also future framework of Industry 4.0.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **"Industry 4.0"** and attain **ENTREPRENEURIAL SKILL** through Participative learning techniques					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1) Understand the basic concepts of Industry 4.0 and scope for Indian Industry CO2) Demonstrate conceptual framework and road map of Industry 4.0 CO3) Apply Industry 4.0 for various fields of application CO4) Understand the Impact to Industry 4.0 for various fields of application					
Course Content:						

Module 1	Introduction to Industry 4.0	Assignment	Case Study	12 classes
Topics: Introduction, History, core idea of Industry 4.0,origin concept of industry 4.0,Industry 4.0 production system, current state of industry 4.0, Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality , How is India preparing for Industry 4.0				
Module 2	Conceptual Framework for Industry 4.0	Case Study	Simulation and data analysis task	12 classes
Topics: Introduction, Main Concepts and Components of Industry 4.0, The Basic Characteristics				

of Industry 4.0, General framework, The Industry 4.0 Model Framework				
Module 3	Applications of Industry 4.0	Assignment	Data Collection and Analysis	10 classes
Topics: Manufacturing – Healthcare – Education – Aerospace and Defense – Agriculture – Transportation and Logistics **.**				
Module 4	Impact of Industry 4.0	Assignment	Case Study	11 classes
Topics: Impact of Industry 4.0 on Society: Impact on Business, Government, People.Education 4.0 – Curriculum 4.0 – Faculty 4.0 – Skills required for Future - Framework for aligning Education with Industry 4.0 – Framework for achieving next ten years vision – Challenges				
Targeted Application & Tools that can be used: Application Area are wearables (Samsung, Apple), health (GE Healthcare), traffic monitoring (Waze, google maps), fleet management, smart grid and energy saving (PowerGrid), agriculture, hospitality etc. Professionally Used Software: Kinoma, Arduino, Device Hive, Riot etc.				
References 1. Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation". 2. Bartodziej, Christoph Jan,"The Concept Industry 4.0". 3. Klaus Schwab,"The Fourth Industrial Revolution". 4. Christian Schröder ,"The Challenges of Industry 4.0 for Small and Medium-sized Enterprises". E Resource https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_2964				
Topics relevant to "ENTREPRENEURIAL SKILLS": Industry 4.0 technologies, Big Data, Artificial Intelligence (AI), Industrial Internet of Things (IoT), Cyber Security , Cloud and Augmented Reality for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Ramachandra C G			
Recommended by the Board of Studies on	17th BOS, dated 08/07/2023			
Date of Approval by the Academic Council	21st Academic Council meeting held on 06/09/2023			

Course Code: **MEC3200**	**Course Title: Sustainable Technologies and Practices** **Type of Course: Open Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This open elective course aims to provide students with a comprehensive understanding of sustainability principles and their applications in the fields of computer science, mechanical engineering, and electronics. The course explores the challenges and opportunities associated with sustainability, equipping students with the knowledge and skills to develop and implement sustainable technologies and practices in their respective engineering disciplines. Through a combination of theoretical learning, case studies, and hands-on projects, students will gain a multidisciplinary perspective on sustainability and its relevance to the rapidly evolving technological landscape.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **"Sustainable Technologies and Practices"** and attain **ENTREPRENEURIAL SKILL** through Participative learning techniques					
Course Outcomes	On successful completion of this course the students shall be able to: CO1. Introduce students to the fundamental concepts and principles of sustainability and their significance in engineering disciplines. CO2. Familiarize students with the latest sustainable technologies and practices in science and engineering. CO3. Enable students to analyse the environmental, social, and economic impacts of engineering projects and propose sustainable alternatives. CO4. Cultivate critical thinking and problem-solving skills to address sustainability challenges in engineering through project-based learning.					
Course Content:						
Module 1	Introduction to Sustainability	Assignment		10 sessions		
Topics: Definition of sustainability and its relevance to engineering, Global environmental challenges and the role of technology in addressing these, Ethical considerations and the social dimension of sustainability, Life cycle assessment (LCA) methodologies,						

Carbon footprint analysis and reduction strategies				
Module 2	Sustainable Computing	Case Study	Simulation and data analysis task	09 sessions
Topics: Green computing and energy-efficient algorithms, Data center optimization and energy management				
Module 3	Sustainable Mechanical Engineering	Assignment	Simulation and data analysis task	10 sessions
Topics: Renewable energy systems and their integration, Energy-efficient design principles, Sustainable manufacturing processes				
Module 4	Sustainable Electronics engineering	Assignment	Simulation	10 sessions
Topics: Energy-efficient electronic devices and components, Energy harvesting and power management, Responsible electronic waste management				
Module 5	Sustainable Project Management	Assignment	Simulation/Data Analysis	06 sessions
Topics: Sustainability assessment frameworks and tools, Sustainability project planning and decision making				
Targeted Application & Tools that can be used: Contemporary issues: One contemporary issue in this course is the growing concern over e-waste management and the need for responsible disposal and recycling of electronic devices. Another issue is the increasing demand for energy-efficient computing systems and the development of green computing strategies to reduce the environmental impact of data centers and algorithms. Professionally Used Software: SimaPro, GaBi, EnergyPlus				
Textbooks: 1. R L Rag, L D Ramesh. "Introduction to Sustainable Engineering", PHI publication. 2. David T Allen, David R Shonnard. "Sustainable Engineering- Concepts, Design and Case Studies, Pearson 3. Munier, Nolberto. Introduction to sustainability. Amsterdam, The Netherlands: Springer, 2005.				
References 1. Portney, Kent E. Sustainability. MIT Press, 2015. 2. Green IT Strategies and Applications Using Environmental Intelligence By Bhuvan Unhelkar 1st Edition, Pub. Location Boca Raton, CRC Pres. 3. Kim, Jae H., and Myung J. Lee, eds. Green IT: technologies and applications. Vol. 26. No. 11. Berlin: Springer, 2011. 4. Graedel, Thomas E., and Braden R. Allenby. "Industrial ecology and sustainable engineering." (No Title) (2010). 5.Bakshi, Bhavik R. Sustainable engineering: principles and practice. Cambridge University Press, 2019.				

Topics relevant to "ENTREPRENEURIAL SKILLS": Data center optimization, Energy-efficient electronic devices and components, Green computing and energy-efficient algorithms for developing **ENTREPRENEURIAL SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout	
Catalogue prepared by	Dr. Devendra Singh Dandotiya, Dr. Udaya Ravi M
Recommended by the Board of Studies on	17th BOS, 08/07/2023
Date of Approval by the Academic Council	21st Academic council meeting held on 06/09/2023

Course Catalogues (Courses Offered by other Departments)

<table>
<tr><td>Course Code:
EEE1001</td><td colspan="2">Course Title: Fundamentals of Electrical and Electronics Engineering
Type of Course: School Core Theory and Integrated lab.</td><td>L-T-P- C</td><td>3</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td>Version No.</td><td colspan="7">3.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">Basic Knowledge about various principles and laws, Simple mathematical calculations, identification of different electrical tools and accessories.</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">Nil</td></tr>
<tr><td>Course Description</td><td colspan="7">This is a fundamental Course which is designed to know the use of basic of electrical engineering principles occurs in different occupation. The content will betaught and implemented with the aim of developing different types of skills in using different types of electrical testing and measuring instruments. This course also develops a competence of trouble shooting by applying the knowledge gained in the laboratory.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of Fundamentals of Electrical and Electronics Engineering and attain Skill Development through Experiential Learning techniques.</td></tr>
<tr><td>Course OutComes</td><td colspan="7">On successful completion of the course the students shall be able to:
CO1. Discuss the basic concepts of DC and AC circuits.
CO2. Explain the basic theory and operation of DC and AC Machines.
CO3. Associate the use electrical measurements and Instruments.
CO4. Discuss the basic electronic components and its applications.
CO5. Verify the basic laws of Electrical Engineering.
CO6. Compute the various parameters in electrical and electronic circuits.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction to DC and AC Circuits</td><td colspan="2">Simulation</td><td colspan="4">15 Session</td></tr>
<tr><td colspan="8">Basic Terminology and classification of elements, Series and Parallel Circuits, KVL and KCL. AC Circuits: Different Terminologies and AC Generation, AC through pure Resistive, Inductive and Capacitive circuits. Series R-L Circuit with AC excitation.</td></tr>
<tr><td>Module 2</td><td>Fundamentals of Electrical Machines</td><td colspan="2">Experimental based learning</td><td colspan="4">15 Sessions</td></tr>
<tr><td colspan="8">Topics: Electrical Machines:
Working principle, operation and application of DC Generator, DC motor, Transformer, Induction motor and Alternator.</td></tr>
<tr><td>Module 3</td><td>Electrical Measurements and Instrumentation</td><td colspan="2">Experimental based learning</td><td colspan="4">15 Sessions</td></tr>
<tr><td colspan="8">Topics: Electrical Measurements and Instrumentation:
Concept of true value, measured value, types of errors and computation of errors, Energy meter, Types</td></tr>
</table>

of sensors and transducers, Introduction to virtual Instrumentation. Electrical Installation: Electrical Wiring Accessories, Electrical wiring in residence, Lamp Circuits, Different protective devices. Earthing system. Energy Consumption calculations.			
Module 4	**Electronics**	Case study	15 Sessions
Electronics: PN junction diode, forward and reverse bias, diode approximation – Rectifiers, BJT, Introduction to Operational amplifiers			

List of Laboratory Tasks:

Experiment No 1: Measurement of voltage, current in a circuit.

Level 1: Consider a simple circuit of your choice and perform the wiring & testing of voltage and current in the series combination & parallel combination of resistors on bread board set-up.

Level 2: For the same circuit considered in level 1, perform the simulation using ORCAD/Multisim/MATLAB.

Experiment No 2: Measurement of -Voltage Calculate the Power & Power Factor of the Circuit **Level 1**: Measure and calculate the electrical parameters by a bread board set up of a simple AC series R-L circuit at your choice.

Level 2: For the same circuit considered in level 1, perform the simulation using ORCAD/Multisim/MATLAB.

Experiment No 3: Testing a DC Generator under different loading conditions.

Level 1: Observe the voltage build up process of self-excited DC shunt generator

Level 2: Observe the fact that the shunt generator is having a fairly constant output voltage with variation in load.

Experiment No 4: Measurement of resistance in DC Circuits.

Level 1: Perform the measurement of resistance in a simple DC Circuit using a Multimeter. Level 2: Perform the measurement of resistance in a simple DC Circuit using NI Lab View. **Experiment No 5**: Practice of simple Lamp Circuits

Level 1:Make a circuit with One lamp controlled by one switch with PVC surface conduit system and a provision of 2/3 Pin socket.

Level 2: Make a circuit for ceiling fan with regulator.

Experiment No 6: Load test on DC shunt motor

Level 1: Conduct load test on DC shunt motor and calculate the efficiency. **Level 2**: Obtain the various characteristics of DC shunt motor **Experiment No 7**: VI characteristics of PN junction and Zener diode Level 1: Obtain the VI characteristics of PN junction and Zener diode

Level 2: To find cut-in voltage, static and dynamic resistances in both forward and reverse biased conditions for zener diode

Experiment No 8: Characteristics of JFET in Common source Configuration

Level 1:Obtain the Drain Characteristics and Transfer Characteristics of a Junction Field Effect Transistor (JFET).

Level 2: Measure drain resistance, trans-conductance and amplification factor.

Experiment No 9: Half Wave and Full Wave Rectifier.

Level 1: To study the operation of Half wave and Full wave rectifier without filter and obtain Ripple Factor, Efficiency and Percentage Regulation

Level 2: To study the operation of Half wave and Full wave rectifier with filter.

Experiment No 10: Demonstration on physical installation on Earthing.

Level 1: Demonstration on physical installation on Pipe Earthing.

Level 2: Demonstration on physical installation on Plate Earthing.

Targeted Application & Tools that can be used:

Troubleshooting various electrical appliances & ORCAD, Multisim, MATLAB.

Text Book

1. **Theraja** B.L. and Theraja A.K., "A Textbook of Electrical Technology: Basic Electrical Engineering" in S.I. System of Units, 23rd ed., New Delhi: S. Chand, 2002.
2. A. P. Malvino, Electronic Principles, 7th Edition, Tata McGraw Hill, 2007

References

1. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation.
2. K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" I K International publishing house Pvt.Ltd.
3. John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson, 2011
4. Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.

Online resources:

1. https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
2. Case study: https://nptel.ac.in/courses/108/102/108102146/ "Introduction to Electrical Machines"
3. Seminar Topic: https://nptel.ac.in/courses/108/105/108105153/ "Electrical Measurements"
4. Ebook: https://puniversity.informaticsglobal.com

Topics relevant to "SKILL DEVELOPMENT": All the experiments which are listed for **Skill Development** through **Experiential Learning Techniques**. This is attained through the assessment component mentioned in course handout.

Catalogue prepared by	Dr. Snehaprabha T V Dr. Jisha L K Mr. Bishakh Paul
Recommended by the Boardof Studies on	16th BoS held on 26/12/2022
Date of Approval by the Academic Council	20th Academic Council meeting held on 15/02/2023

<table>
<tr><td>Course Code: MAT1001</td><td>Course Title: Calculus and Linear Algebra

Type of Course:1] School Core Lab Integrated</td><td>L-T-P-C</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Version No.</td><td colspan="6">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">Basic Concepts of Limits, Differentiation, Integration</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The course focuses on the concepts of calculus and linear algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature.</td></tr>
<tr><td>Course Objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of "CALCULUS AND LINEAR ALGEBRA" and attain <u>Skill Development</u> through problem solving techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="6">On successful completion of the course the students shall be able to:
CO1) Comprehend the knowledge of applications of matrix principles.
CO2) Understand the concept of partial derivatives and their applications.
CO3) Apply the principles of integral calculus to evaluate integrals.
CO4) Adopt the various analytical methods to solve differential equations.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td>Linear Algebra</td><td></td><td></td><td></td><td colspan="2">16 Sessions</td></tr>
<tr><td colspan="7">Review: Types of matrices, elementary transformations,
Linear Algebra:
Echelon form, rank of a matrix, consistency and solution of system of linear equations - Gauss elimination method, Gauss-Jordan method.

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.
Engineering Applications of Linear Algebra.</td></tr>
<tr><td>Module 2</td><td>Partial Derivatives</td><td></td><td></td><td></td><td colspan="2">14 Sessions</td></tr>
<tr><td colspan="7">Review: Differential calculus with single variable.

Differential Calculus:
Partial differentiation, Homogeneous functions and Euler's theorem, Total derivative, Change of variables, Jacobians, Partial differentiation of implicit functions, Taylor's series for functions of two variables, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.

Engineering Applications of partial derivatives.</td></tr>
<tr><td>Module 3</td><td>Integral calculus</td><td></td><td></td><td></td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="7">Review: Integral calculus for single integrals.

Integral calculus:
Multiple Integrals- Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates.</td></tr>
</table>

Beta and Gamma functions–inter-relation-evaluation of integrals using gamma and beta functions. Evaluate double & triple integrals.					
Module 4	ifferential Equations	Assignment		ogramming	16 Sessions

Definition, types of differential equations, order and degree, Linear Differential Equations, Bernoulli's Differential Equation, Exact and Non - Exact Differential Equations.
Higher order Differential Equation with constant coefficients and with right hand side of the form eax, sinax, cosax, eaxf(x), xnf(x) etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, Method of Variation of Parameters.
Engineering applications of differential equations.

Targeted Application & Tools that can be used:
The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design.

Tools Used: Python.

Assignment:

1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using C Programming/Python.
2. Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable.

Text Book

1. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.
2. Walter Ledermann, Multiple integrals, Springer, 1st edition
3. Lay, Linear Algebra ansd its applications, 3rd Ed., 2002, Pearson Education India.
4. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
5. MatLab usage manual

E-resources/ Web links:

1. https://nptel.ac.in/courses/109104124
2. https://nptel.ac.in/courses/111106051
3. https://nptel.ac.in/courses/111102137
4. https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/
5. https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus
6. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/
7. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
8. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and linear algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature. The lab sessions associated with the course are concerned with acquiring an ability to use the MATLAB software. for **Skill Development through** Experiential Learning **methodologies.** This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr Veeresh A Sajjanara and Dr V Nagendramma

Recommended by the Board of Studies on	th BOS held on 04/01/2025
Date of Approval by the Academic Council	th ACM held in 3rd August 2024

Course Code: MAT1003	**Course Title: Applied Statistics (Only Theory 3 hours)** **Type of Course: School Core**	**L-T- P- C**	1	0	2	2
Version No.	3.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of** "Applied Statistics" and attain **Skill Development Through Problem Solving techniques**.					
Expected Outcome	At the end of this course, students will be in a position to CO1. Apply the techniques of descriptive statistics effectively CO2. Interpret the ideas of probability and conditional probability CO3. Demonstrate the knowledge of probability distributions CO4. Compute statistical parameters, correlation and regression, probability and sampling distributions using R software.					

Module 1	Descriptive Statistics	Assignment	Coding needed	10 Sessions
Introduction to Statistics, Data and statistical thinking, review of basic statistical parameters, Covariance, Correlation, Types of Measures of Correlation - Karl Pearson's Correlation Coefficient, Spearman Rank Correlation, linear regression, Multi linear regression .				
Module 2	Probability			6 Sessions
roduction to Probability, Probability of an event, Addition Principle, Multiplication law, Conditional Probability, Total Probability and Baye's theorem with examples				
Module 3	Random Variables and Probability Distributions		Coding needed	14 Sessions
Introduction to Random variables, Discrete Random Variables and Continuous Random Variables, Probability Distributions, Probability Mass Function and Probability Density Function, Various Probability distributions, Binomial, Negative Binominal (Self Study), Poisson, Normal and Exponential distributions				
Module 4	Sampling Theory		Coding needed	15 Sessions
Introduction to Sampling Theory, Population, Statistic, Parameter, Sampling Distribution, Standard Error. Testing of Hypothesis, Types of Errors, Critical Region, level of Significance. Difference between Parametric and Non-parametric Tests, Large Sample Tests: Z-Test for Single Mean and Difference of Means (Self Study), Small Sample Tests: Student's t-Test for Single Mean and Difference of Means, F-Test, Chi-Square Test.				
Targeted Application & Tools that can be used:				

The objective of the course is to familiarize students with the theoretical concepts of probability and statistics and to equip them with basic statistical tools to tackle engineering and real-life problems. Tools used: R Software / MS-Excel
Text Book 1. Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying E Ye, Probability and Statistics for Engineers and Scientists, Pearson Education, 2016.
References 1. James T. McClave, P. George Benson and Terry Sincich, Statistics for Business and Economics, 2018. 2. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Modern Business Statistics with Microsoft Excel, 2020. 3. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Statistics for Business and Economics, 2019. 4. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2018. 5. Richard A. Johnson, Miller and Freund's Probability and Statistics for Engineers, 2018. 6. Kishor S Trivedi, Probability and Statistics with reliability, Queuing and Computer Science Applications, John Wiley & Sons, 2008.
Topics relevant to SKILL DEVELOPMENT: The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions for **Skill Development through Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Sathish S and Dr. Juliet Raja
Recommended by the Board of Studies on	13th BOS held on 04/01/2025
Date of Approval by the Academic Council	24th ACM held in 3rd August 2024

Course Code: **MAT2003**	**Course Title:** **NUMERICAL METHODS FOR ENGINEERS** **Type of Course:** **School Core**	**L-T- P-C**	1	0	2	2
Version No.	1.0					
Course Pre-requisites	MAT1002 – Transform Techniques, Partial Differential Equations and TheirApplications					
Anti-requisites						
Course Description	The course focuses on formulating and solving problems concerning real-world engineering applications numerically as well as statistically. This course provides an introduction to basic numerical methods to deal with algebraic and transcendental equations, system of equations, interpolation, differentiation and integration. This course also deals with numerical solution of ordinary differential equations by means of Taylor's series method, modified Euler's method and Runge-Kutta methods.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of " NUMERICAL METHODS FOR ENGINEERS" and attain Skill Development Through Problem Solving.**					
Course Outcomes	On successful completion of the course the students shall be able to: CO1] Solve algebraic and transcendental equations numerically. CO2] Adopt numerical techniques to differentiate and integrate functions. CO3] Apply numerical methods to solve ordinary differential equations.					
Course Content:						

Module 1	Numerical solution of Algebraic and Transcendental Equations			15 Sessions
Algebraic and Transcendental Equations, Regula - Falsi method, Bisection method (Self study), Secant method, Newton-Raphson method, and NR method for non-linear Equations, Fixed-point iteration method. System of Linear Equations: Introduction, LU decomposition method, Gauss-Jacobi method, Gauss-Seidel iteration method, Largest Eigen value and corresponding Eigen vector by Power method & Jacobi Method.				
Module 2	Numerical Interpolation, differentiation and Integration			15 Sessions
Numerical Interpolation: Newton's forward and backward interpolation method, Newton's divided difference method, Lagrange's method, numerical differentiation. Numerical integration: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's Rule. Area between the two curves.				
Module 3	Numerical solution of ODEs and PDEs			15 Sessions
Solution of ordinary differential equations: Initial Value problems: Taylor's series method, Picard's method, Euler's Method, Modified Euler's method, Runge-Kutta method, Milne's predictor-corrector formula. Adams -Bashforth method**,** Boundary value problems - Finite difference methods for ODE. Numerical solution for LCR & damped forced oscillatory equations.Solution of partial differential equations: Schmidt Explicit Formula for Heat Equation, Crank-Nicolson method. Numerical solution to Wave, Laplace & Heat Equation.				
Targeted Application & Tools that can be used: The objective of the course is to familiarize students with a variety of numerical techniques and				

the theoretical concepts of probability and statistics so as to equip them with the necessary numerical approaches and basic statistical tools to tackle engineering and real-life problems.

Assignment:

1. Gauss-Jacobi iteration method.
2. Numerical differentiation.
3. Gaussian quadrature rule for numerical integration.
4. Taylor series method for ODEs.
5. Implicit and explicit schemes for PDEs.

Text Books

T1: M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computations, 6th Edition, New age Publishing House, 2015.

T2: Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley& Sons (India), 2014.

References:

R1: B.S. Grewal, Numerical methods in engineering and science, 10th Edition, Khanna publishers, 2016.

R2: B.S. Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers.

R3: Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., McGraw-Hill Edition, 2015.

R4: C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill, 2012.

Topics relevant to SKILL DEVELOPMENT: This course focuses on formulating and solving problems concerning real-world engineering applications numerically as well as statistically. This course provides an introduction to basic numerical methods to deal with algebraic and transcendental equations, system of equations, interpolation, differentiation and integration with numerical solution of ordinary differential equations by means of Taylor's series method, modified Euler's method and Runge-Kutta methods for **Skill Development through Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Shilpa
Recommended by the Board of Studies on	13th BOS held on 04/01/2025
Date of Approval by the Academic Council	24th ACM held in 3rd August 2024

<table>
<tr><td>Course Code:
CHE1018</td><td colspan="2">Course Title:
Environmental Science
Type of Course:
School Core- Theory and Lab</td><td>L-T-P- C</td><td>1</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course emphasizes the need to conserve biodiversity and adopt a more sustainable lifestyle by utilizing resources in a responsible way. Topics covered include basic principles of ecosystem functions; biodiversity and its conservation; human population growth; water resources, pollution; climate change; energy resources, and sustainability; Sustaining human societies, policies, and education.
This course is designed to cater to Environment and Sustainability</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Environmental Science” and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1. Appreciate the historical context of human interactions with the environment and the need for eco-balance.
CO2. Describe basic knowledge about global climate change with particular reference to the Indian context.
CO3. Understand biodiversity and its conservation
CO4. Develop an understanding on types of pollution and ways to protect the environment
CO5. Learn about various strategies on Global environmental management systems</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Humans and the Environment</td><td colspan="3">Assignment
Data Collection</td><td colspan="3">1 Sessions</td></tr>
<tr><td colspan="8">Topics: The man-environment interaction: Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment.

Self-learning topics: Humans as hunter-gatherers; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism.</td></tr>
<tr><td>Module 2</td><td colspan="2">Natural Resources and Sustainable Development</td><td colspan="3">Assignment</td><td colspan="2">03 Sessions</td></tr>
<tr><td colspan="8">Topics:
Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. Water resources: Types of water resources- fresh water and marine resources;
Soil and mineral resources: Important minerals; Mineral exploitation Soil as a resource and its degradation.
Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Advantages and disadvantages.</td></tr>
</table>

Self- learning topics: Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges.; Environmental problems due to extraction of minerals and use; Sustainable Development Goals (SDGs)- targets, indicators, and challenges for SDGs.				
Module 3	Environmental Issues: Local, Regional and Global	Case study		)2 Session
Topics: Environmental Pollution: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans-boundary air pollution; Acid rain; Smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Global change: Ozone layer depletion; Climate change *Self -learning topics:* Environmental issues and scales				
Module 4	Conservation of Biodiversity and Ecosystems	Assignment		02 Session
Topics: Biodiversity-Introduction, types, Species interactions, Extinct, endemic, endangered and rare species, Threats to biodiversity: Natural and anthropogenic activities. Self-learning topics: Mega-biodiversity, Hot-spots, Major conservation policies. Biodiversity loss: past and current trends, impact.				
Module 5	Environmental Pollution and Health	Case study		03 Session
Topics: Pollution, Definition, point and nonpoint sources of pollution, **Air pollution**- sources, major air pollutants, health impacts of air pollution. **Water pollution**– Pollution sources, adverse health impacts on human and aquatic life and mitigation, Water quality parameters and standards. **Soil pollution and solid waste**- Soil pollutants and their sources, solid and hazardous waste, Impact on human health. **Self-learning topics:** Noise pollution, Thermal and radioactive pollution.				
Module 6	**Climate Change: Impacts, Adaptation and Mitigation**	Assignment/case		02 Session
Topics: **Understanding climate change**: Natural variations in climate; Projections of global climate change with special reference to temperature, rainfall and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Impacts **Vulnerability and adaptation to climate change**: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Indigenous knowledge for adaptation to climate change. **Self-learning topics:** Mitigation of climate change: Synergies between adaptation and mitigation measures; National and international policy instruments for mitigation.				
Module 7	**vironmental Management**	Case study	ata analysis	**2** Session
Topics: Environmental management system: ISO 14001; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability.				

Self-learning topics: Environmental audit and impact assessment; Eco labeling /Eco mark scheme

	Module 8	vironmental Treaties and Legislation	Case study	ata analysis	01 Session

Topics:
Major International Environmental Agreements: Convention on Biological Diversity (CBD), Major Indian Environmental Legislations: Environmental Protection Act, Forest Conservation Act, Public awareness.

Self-learning topics: Paris Agreement, Conference of the Parties (COP), India's status as a party to major conventions: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act.

List of laboratory tasks : Any eight experiments will be conducted

1. Determination of total alkalinity of a water sample (knowledge)
2. Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)
3. Estimation of copper from industrial effluents by colorimetric method (Comprehensive)
4. Estimation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive)
5. Estimation of nickel from industrial effluents by titrimetric method (Comprehensive)
6. Estimation of chloride in drinking water by titrimetric method (Comprehensive)
7. Estimation of fluoride in ground water by colorimetric method (Comprehensive)
8. Determination of calcium in aqueous solution (Comprehensive)
9. Determination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)
10. Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)
11. Biological oxygen demand of waste water sample (Comprehensive)
12. Determination of dissolved oxygen of an industrial effluent (Comprehensive)
13. Quality monitoring analysis of a soil sample (knowledge)
14. Flame photometric estimation of Sodium and potassium (Application)
15. Gas Chromatographic analysis of volatile organic compounds (Application)

Targeted Application & Tools that can be used:
Application areas are Energy, Environment and sustainability
Tools: Statistical analysis of environmental pollutants using excel, origin etc.

Project work/Assignment:

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing the digital resource.)
- Lab evaluation/Assignment
- End Term Exam
- Self-learning

Assignment 1: Write a Statement of Environment report of your town/city/state/country
Assignment 2: Individual students will carry out the analyses of polluted solid, liquid, and gaseous samples and propose suitable mitigation measures. A detailed and in-depth report needs to be submitted for each case. This may include preparation of reagents, sample preparation (extraction), chemical analysis carried out, instruments and tools used, data collected and processed, inferences made and conclusions arrived at. Necessary support is given in the form of lab manual and reference links to e-books.

Text Book

1. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA

2. Krishnamurthy, K.V. (2003) Text book of Biodiversity, Science Publishers, Plymouth, UK.
3. Jackson, A.R. & Jackson, J.M. (2000), Environmental Science: The natural environment and human impact, Pearson Education.

Reference Books

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. William P. Cunningham and Mary Ann Cunningham (2017), Principles of Environmental Science: Inquiry & Applications, 8^{th} Edition, McGraw-Hill Education, USA.
3. Sinha N., (2020) Wild and Wilful. Harper Collins, India.
4. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/
5. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
6. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

E-resources:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_18126
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_8761
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAJ_1_02082022_3333
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3063
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_20719
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_16824
7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3954
8. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_491
9. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488
10. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583
11. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER_INDEST_1_171
12. https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=1687427221129
13. https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=1687427279979
14. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_395&xIndex=4
15. https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf

Topics relevant to Skill Development:

Industrial revolution and its impact on the environment, Environmental impact of over-exploitation of water resources, pollution and ill effects, lab experiments for Skills development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

All topics in theory component are relevant to Environment and Sustainability.

Catalog prepared by	Faculties of Department of Chemistry
Recommended by the Board of Studies on	PU/SOE/CHE/BOS-07/2022-23 BOS held on 10/07/23
Date of Approval by the Academic Council	21st Academic council dated: 6th September 2023

Course Code: **CHE1017**	**Course Title: Applied Chemistry** **Type of Course: Program Core- Lab embedded theory course**	**L-T-P- C**	1	0	2	2
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The primary objective of the course is to emphasize the concepts and applications of chemistry in Engineering. The course also aims to enhance the knowledge of chemical composition and properties of chemical molecules. The course cultivates an ability to identify chemistry in each and every piece of smart engineered products used in households and industry. It targets to strengthen the fundamental concepts of chemistry and then builds an interface with their industrial applications. **This course is designed to cater to Environment and Sustainability**					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **'Applied Chemistry'** and attain **'SKILL DEVELOPMENT'** through **EXPERIENTIAL LEARNING** techniques**.**					
Course Outcomes	On successful completion of this course the students shall be able to: CO1. Identify the suitable polymers to replace the conventional materials CO2. Summarize the importance of various electrochemical sources in energy systems CO3. Describe the knowledge of electrochemistry principles for protection of different metals from corrosion. CO4. Explain the fundamental principles in water treatment					

Course Content:

Module 1	Polymers	Case study	Data Collection and analysis	4 Session
Polymers: Introduction, Types of Polymerization, Thermoplastics & Thermosetting Polymers. Preparation, Properties, and Applications of the Teflon, PVC, Nylon and Phenol Formaldehyde; Elastomers: Classification; Natural Rubber, Vulcanization of Rubber, Synthetic Rubber and Inorganic Rubbers, Polymer Composites- Properties and Advantages, Synthesis and Applications of Kevlar, Conducting Polymers				
Module 2	Battery Technology	Assignment	Data Collection	3 Session
Basics of Electrochemical Energy Systems, Construction, Working Mechanism and Applications of Primary (Dry Cell) and Secondary (Lead-Acid) Batteries, Lithium Batteries: Primary and Secondary. Fuel Cells: Hydrogen-Oxygen, Methanol-Oxygen: Principle, Working and Their Applications				
Module 3	Corrosion and its Control	Case study	Data analysis	3 Session
Definition, Dry and Wet Corrosion, Electrochemical Theory of Corrosion, Types of Wet Corrosion –Differential Aeration, Galvanic, and Stress Corrosion Cracking. Factors that Enhance Corrosion and Choice of Parameters to Mitigate Corrosion. Corrosion Control – Anodic and Cathodic Coating, Cathodic Protection- Sacrificial Anodic Protection, Electro Plating of Chromium, Electroless Plating of Copper on PCBs				

Module 4	Water Technology	Case study	Data analysis	4 Session
Degree of Hardness, Numerical Problems on Hardness Domestic Treatment, Desalination Techniques, Boiler Feed Water, External and Internal Treatments, Waste Water Treatment, Rain Water Harvesting				

Laboratory experiments:

1. Estimation of Fe (II) in Mohr's salt using Std. Potassium permanganate solution.
2. Estimation of Calcium in cement solution sample by rapid EDTA method.
3. Estimation of Copper by Iodometry.
4. Determination of Acid number of an oil.
5. Synthesis of polyaniline.
6. Determination of pKa value of weak acid using pH meter
7. Potentiometric estimation of FAS using Std. Potassium dichromate solution
8. Estimation of strength of acid mixture by conductometric titration
9. Estimation of Copper by colorimetric method
10. Determination of Viscosity co-efficient of a liquid using Ostwald's viscometer.

Targeted Application & Tools that can be used:

Application areas are Polymer, oil and gas, Boiler, automotive and mechanical industries

Tools: Statistical analysis of Corrosion in materials using tools like Design expert software (ANOVA, RSM, etc.)

Project work/Assignment:

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

Assignment: 1: Report writing on recycling plastic waste into plastic lumber

Assignment 2: Identify a corrosion problem encountered in your immediate surroundings and discuss your choice of mitigation

Text Book

4. Wiley, "Engineering Chemistry", Wiley.

Reference Books

1. Engineering Chemistry, Jain and Jain (18th Edition) Dhanpat Rai Publishing Company
2. Engineering Chemistry, Shika Agrawal (2018), Cambridge University Press

E resources

1. https://presiuniv.knimbus.com/user#/searchresult?searchId=Polymers%20from%20Renewable%20Resources&_t=1660212823387
2. https://presiuniv.knimbus.com/user#/searchresult?searchId=fuel%20an%20ecocritical%20history&_t=1660213039873
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=BOOKYARDS_1_13487
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=E

CATALOGUE_BASED&unique_id=DOAB_1_6676 5. https://nptel.ac.in/courses/113108051 6. https://www.youtube.com/watch?v=XuLT8i4g4Yw 7. https://www.youtube.com/watch?v=3QjwRqnquxA 8. https://www.youtube.com/watch?v=VxMM4g2Sk8U
The topics related to Skill Development antifying alkalinity in water sample, concentration of acid, pKa of acid, viscosity co-efficient, amount of Ca in cement solution for **Skill Development through Experiential Learning Techniques.** This is attained through assessment component as mentioned in course handout.

Catalogue prepared by	Department of Chemistry, SOE
Recommended by the Board of Studies on	BoS on 25 July 2022
Date of Approval by the Academic Council	th BOS meeting held on 3rd August 2022

<table>
<tr><td>Course Code: ENG2001</td><td colspan="2">Course name: Advanced English</td><td>L-T P-C</td><td>1</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">ENG1002 Technical English</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course is designed to equip students to enhance their communication abilities in Listening, Speaking, Reading, and Writing. The curriculum covers interpersonal communication principles, the art of speech writing and delivery (including impromptu speaking), strategic approaches to critical reading, the identification of logical fallacies, and persuasive writing. Furthermore, the course will introduce students to the potential of AI tools and the techniques of prompt engineering to elevate their communication skills in the digital age. Upon course completion, students will be well-prepared to communicate effectively and critically in both academic and professional environments.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of the course the students shall be able to:
CO1. Recognize the elements of interpersonal and cross-cultural communication to address communication challenges effectively.
CO2. Demonstrate the ability to deliver structured and impromptu speeches using effective speaking techniques.
CO3. Interpret textual and visual materials using critical reading strategies to evaluate arguments, logic, and persuasion.
CO4. Produce persuasive and analytical essays using effective argumentation techniques and structured writing strategies.</td></tr>
<tr><td colspan="8">Course Content: Theory</td></tr>
<tr><td>Module 1</td><td>Foundations of Effective Communication</td><td>Case Studies/ Role play</td><td colspan="2">Cross-Cultural Competency</td><td colspan="3">4 Session</td></tr>
<tr><td colspan="8">Topics:
Fundamentals of Interpersonal Communication
Verbal, Non-verbal, and Paraverbal communication.
Cultural dimensions theory (Hofstede’s Cultural Dimensions).
Active Listening Techniques
Common Errors in Communication</td></tr>
<tr><td>Module 2</td><td>Mastering Speech Delivery</td><td>JAM</td><td colspan="2">Public Speaking Confidence</td><td colspan="3">4 Session</td></tr>
<tr><td colspan="8">Topics:
Introduction to Prompt Engineering
Speech Preparation and Organization
Techniques for Effective Impromptu Speaking
Practice Speech Delivery</td></tr>
<tr><td>Module 3</td><td>Critical Reading and Logical Analysis</td><td>Worksheet</td><td colspan="2">Critical Thinking and Analysis</td><td colspan="3">4 Session</td></tr>
<tr><td colspan="8">Topics:</td></tr>
</table>

• Critical Reading Strategies: Contextualizing, Figurative Language, Evaluating Logic of an Argument, Recognizing Emotional Manipulation, Analysing Visuals • Recognizing Logical Fallacies: Slippery Slope, False Dilemma, Post Hoc, Hasty Generalization, Ad Hominem, Straw Man, Bandwagon, No True Scotsman, Red Herring, Appeal to Authority, Sunk Cost, Appeal to ignorance				
Module 4	Writing Effective Arguments	Assignment	Clear and Coherent Writing	3 Session
Topics: • Understanding Critical Writing • Building Arguments (Pathos, Ethos, Logos) • Techniques for Persuasion				
Course Content: Practical Sessions				
Module 1	Foundations of Effective Communication			8 Session
1. Interpersonal Communication Charades with a Twist/Tone and Emotion Experiment/Mixed Messages Challenge/Role Reversal Conversations/Observation Exercise 2. Cross-cultural Communication Cultural Iceberg Analysis/Role-Play: Cross- Cultural Scenarios/Stereotypes vs Realities/Cross- /Cultural Negotiation Exercise/Cultural Sensitivity Case Studies 3. Active Listening Bingo TEDx/Story Building/Listening for Key Details/Interactive Podcast Listening/Fact or Opinion 4. Instagram/YouTube Vocabulary Activity				
Module 2	Mastering Speech Delivery			8 Session
5. Speech Writing 6. Impromptu Speech JAM /"Would You Rather" Explainer/Picture Prompt Speech/Reverse Speech Crafting				
Module 3	Critical Reading and Logical Analysis			8 Session
7. Critical Reading Strategies Critical Reading Worksheet/Identifying Bias in News Articles 8. Recognizing Logical Fallacies Debate Challenge with Fallacy Detection/ Fallacy Investigation with Podcasts or Social Media				
Module 4	Writing Effective Arguments			6 Session
9. Building Arguments Causes or Effects/Appeal Mash-Up/Debates on Controversial Topics 10. Persuasive Writing Creative Persuasive Writing/Opinion Writing				
Targeted Application & Tools that can be used: Quizziz, Chatgpt, Gemini, Youtube, Instagram, Quillbot, Grammarly, Padlet				

References

1. Adler, R. B., Rodman, G., & DuPré, A. (2019). *Understanding human communication (14th ed.)*. Oxford University Press.
2. Moore, B. N., & Parker, R. (2020). *Critical thinking* (13th ed.). McGraw-Hill Education.
3. DeVito, J. A. (2019). The interpersonal communication book (15th ed.). Pearson.
4. Ting-Toomey, S., & Dorjee, T. (2018). Intercultural competence: A model for teaching and assessing cross-cultural communication. *Journal of Intercultural Communication, 47*(2), 213–229. https://doi.org/10.1016/j.jicc.2018.03.004
5. https://www.ted.com/

Topics Relevant to "employability": Teamwork and Collaboration, Critical Thinking and Problem-Solving

Topics Relevant to "Human Values and Professional Ethics": Critical reasoning, Inclusivity and Fairness

Catalogue prepared by	**Dr. Tychicus David, Dr. Jayalakshmi E**
Recommended by the Board of Studies on	**January 2025**
Date of Approval by the Academic Council	

<table>
<tr><td>Course Code: ENG1002</td><td colspan="2">Course Title:Technical English Type of Course:1] School Core2] Laboratory integrated</td><td>L-T-P-C</td><td>1-0-2-2</td></tr>
<tr><td>Version No.</td><td colspan="4">1.0 V. 3</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="4">Intermediate Level English</td></tr>
<tr><td>Course Anti-requisites</td><td colspan="4">NIL</td></tr>
<tr><td>Course Description</td><td colspan="4">Technical English course is designed to equip students with the language skills necessary for effective communication in technical and scientific contexts. The course focuses on the specialized vocabulary, writing styles, and communication techniques used in various technical fields, including engineering and information technology.</td></tr>
<tr><td>Course Objectives</td><td colspan="4">The objective of this course is to develop the learners' EMPLOYABILITY SKILLS by using
EXPERIENTIAL LEARNING and PARTICIPATIVE LEARNING TECHNIQUES.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of the course, the students shall be able to:
CO1. Develop proficiency in using technical vocabulary and terminology.
CO2. Apply language skills for better speaking skills in technical fields.
CO3. Write technical descriptions
CO4. Demonstrate writing skills in writing technical documents such as reports, manuals, and articles.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Fundamentals of Technical Communication</td><td>Worksheets & Quiz</td><td>Vocabulary building</td><td>9 Session</td></tr>
<tr><td colspan="5">• Introduction to Technical English
• Differences between Technical English and General English
• Technical Writing Basics
• Technical Vocabulary</td></tr>
<tr><td>Module 2</td><td>Technical Presentation</td><td>Presentations</td><td>Speaking Skills</td><td>12 Session</td></tr>
<tr><td colspan="5">Introduction
• Planning the Presentation
• Creating the Presentation
• Giving the Presentation</td></tr>
<tr><td>Module 3</td><td>Technical Description</td><td>Assignment</td><td>Group Presentation</td><td>12 Session</td></tr>
<tr><td colspan="5">• Product Description
• Process Description
• User Manuals</td></tr>
</table>

- Transcoding: Diagrams, charts and images

Module 4	Technical Writing	Assignment	Writing Skills	12 Session

Email Writing

Persuasive and Descriptive

Language Professional Email

Etiquette

Writing clear and concise technical

emails Communicating technical

information effectively **Technical**

Report Writing

Types of technical reports (Lab reports, research

reports, etc.) Components of technical reports

Writing an abstract and

executive summary

Structure and content

organization Transcoding:

diagrams, charts and images

List of Laboratory Tasks:

1. Module-1

Level 1: Worksheets
Level 2: Worksheets

2. Module 2

Level 1: Preparing Presentation
Level 2: Giving Presentation (Individual)

3. Module-3

Level 1: Product Description & User Manual
Level 2: Process Description
& Transcoding

4. Module 4

Level 1: mail writing
Level 2: Report Writing

Targeted Applications & Tools that can be used:

1. Flipgrid
2. Quizzes
3. Youtube Videos
4. Podcast

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

1. Bring out the essence of technical communication with reference to the conventions of technical communication, with examples
2. Prepare a technical presentation on the importance of Technical Communication and its relevance in a technical field, with real-life examples.

The following individual, as well as group Assignments, will be given to the students. 1. Presentation 2. Describing a product/process 3. Individual Reports	
Text Books 1. Kumar, Sanjay; Pushpalatha. *English Language and Communication Skills for Engineers.* Oxford University Press. 2018. 2. Brieger, Nick and Alison Paul. *Technical English Vocabulary and Grammar*. https://nmetau.edu.ua/file/technical_english_vocabulary_and_grammar.pdf	
Reference Book: 1. Chauhan, Gajendra Singh, and Kashmiramka, Smita, ***Technical Communication.*** Cengage Publication. 2018. 2. Sunder Jain. *Technical Report Writing*. Centrum Press, 2013. 3. John Bowden. "Writing a Report: How to Prepare, Write & Present Really Effective Reports?". 9th Edition 2011 Comfort, Jeremy et. al. 1984. *Business Reports in English*. Cambridge University Press. Sharma, R.C. and K. Mohan. 2011. Business Correspondence and Report Writing, Fourth Edition. Tata McGraw Hill.	
Topics Relevant to the Development of Employability Skills: **Speaking Skills, Writing Skills, Critical Thinking and Critical Analysis, and Group Communication.**	
Catalogue prepared by	**Dr. Vinodhini Chinnaswamy & Dr. T. Naresh Naidu**
Recommended by the Board of Studies on	**11th BoS on 05th July, 2024**
Date of Approval by the Academic Council	

Course Code: **PHY1002**	**Course Title: Optoelectronics and Device Physics** **Type of Course: 1] School Core & Laboratory integrated**	**L-T-P-C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to understand the fundamentals, working and applications of optoelectronic devices and to develop the basic abilities to appreciate the applications of advanced microscopy and quantum computers. The course develops the critical thinking, experimental and analytical skills. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to use the concepts for technological applications. The laboratory tasks aim to develop following skills: An attitude of enquiry, confidence and ability to tackle new problems, ability to interpret events and results, observe and measure physical phenomena, select suitable equipment, instrument and materials, locate faults in systems.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the concepts of semiconductors, magnetic materials and superconductors. CO2: Apply the concept of materials in the working of optoelectronic and magnetic devices. CO3: Discuss the quantum concepts used in advanced microscopy and quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields. CO5: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices. [Lab oriented].					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Optoelectronics and device physics "and attain **Skill Development** through **Experiential Learning** techniques					
Course Content:						

Module 1	Fundamentals of Materials.	Assignment	Plotting of magnetization (M) v/s Magnetic field (H) for diamagnetic, paramagnetic and ferromagnetic materials using excel/ origin software.	Session: 07

Topics: Concept of energy bands, charge carriers, carrier concentration, concept of Fermi level, Hall effect, Superconductors: Josephson effect.				
Module 2	Advanced Devices and applications	Assignment	Data collection on efficiency of solar cells.	No. of Sessions : 8
Topics: p-n junctions, Zener diode, transistor characteristics, Optoelectronic devices:, Solar cells, I-V characteristics, and LEDs				
Module 3	Quantum concepts and Applications	Term paper	Seminar on quantum computers.	No. of Sessions : 8
Topics: Planck's quantum theory, applications of Quantum theory: de-Broglie hypothesis, matter waves, properties. de-Broglie wavelength associated with an electron. Heisenberg's uncertainty principle				
Module 4	Lasers and Optical fibers	Term paper	Case study on medical applications of Lasers.	No. of Sessions :07
Topics: Interactions of radiations with matter, Characteristics of laser, conditions and requisites of laser, Modern day applications of laser: LIDAR, LASIK, Cutting, Welding and Drilling. Principle of optical fibers, Numerical aperture and acceptance angle (Qualitative), Attenuation, Applications: Point to point communication with block diagram, application of optical fibers in endoscopy.				
List of Laboratory Tasks: Experiment No. 1: Experimental errors and uncertainty using excel Level 1: Calculation of accuracy and precision of a given data Level 2: propagation of errors in addition, subtraction, multiplication and division. Experiment N0 2: To determine the wavelength of semiconductor diode Laser and to estimate the particle size of lycopodium powder using diffraction. Level 1: Determination of Wavelength of Laser Level 2: Finding the particle size of lycopodium powder. Experiment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier. Level 1: To determine the proportionality of Hall Voltage and magnetic flux density Level 2: To determine the polarity of Charge carrier. Experiment No. 4: To study the I-V characteristics of a given zener diode in forward and reverse bias conditions. Level 1: To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage. Level 2: To study I –V characteristics of the given Zener diode in forward bias and to determine knee voltage and forward resistance.				

Experiment No. 5: To study input and output characteristics of a given Transistor.

Level 1: To determine the input resistance of a given transistor.

Level 2: To determine current transfer characteristics and transistor parameters of a given transistor.

Experiment No. 6: Determination of Fermi energy and Fermi temperature of a given metal and bimetallic wire.

Level 1: Determination of Fermi energy and Fermi temperature of given metal wire.

Level 2: Determination of Fermi energy and Fermi temperature of given bimetallic wire.

Experiment No. 7: To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance and To measure the photo-current as a function of the irradiance at constant voltage.

Level 1 To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance.

Level 2: To measure the photo-current as a function of the irradiance at constant voltage.

Experiment No. 8: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance.

Level 1: To study the I-V characteristics

Level 2: I-R characteristics of a solar cell as a function of the irradiance.

Experiment No. 9: Calculate the numerical aperture and study the losses that occur in optical fiber cable. .

Level 1: Calculate the numerical aperture.

Level 2: study the losses that occur in optical fiber cable.

Experiment No. 10: To determine the magnetic susceptibility of a given diamagnetic and paramagnetic substances using Quincke's method.

Level 1: To determine the magnetic susceptibility of a given diamagnetic substance.

Level 2: To determine the magnetic susceptibility of a given paramagnetic substance.

Experiment No. 11: To study the hysteresis loop of an iron core and to find its coercivity and retentivity. To show the effect of varying voltage and frequency on hysteresis loop.

Level 1: To study the hysteresis loop of an iron core and to find its coercivity and retentivity. .

Level 2: To show the effect of varying voltage and frequency on hysteresis loop.

Experiment No. 12: Determining the wavelength of the electrons for different accelerator voltages by applying the Bragg condition and Confirming the de Broglie equation for the wavelength.

Level 1: Determining the wavelength of the electrons for different accelerator voltages by applying the Bragg condition.

Level 2: Confirming the de Broglie equation for the wavelength.

Experiment No. 13: To measure the transition temperature and resistivity of a high temperature superconductor.

Level 1: To measure the transition temperature.

Level 2: To determine the resistivity of a high temperature superconductor.

Experiment No. 14: Plotting I-V characteristics in forward and reverse bias for LEDs

and Determination of knee voltage.

Level 1: Plotting I-V characteristics in forward and reverse bias for LEDs

Level 2: Determination of knee voltage.

Experiment No. 15: Determination of Stefan's constant and verification of Stefan-Boltzmann Law.

Level 1: Determination of Stefan's constant

Level 2: Verification of Stefan-Boltzmann Law.

Targeted Application & Tools that can be used:

1. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM.
2. Origin, excel and Mat lab soft wares for programming and data analysis.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

1. Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons.
2. Write a report on importance of quantum entanglement in supercomputers.

Text Book

1. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2018.

References:

1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002.
2. Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011.
3. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017.
4. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012
5. Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019

E-Resourses:

1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live
2. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live
3. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live
4. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live
5. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live

Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers.

for Skill Development through Participative Learning Techniques. This is attained through the

Assignment/ Presentation as mentioned in the assessment component in course handout.	
Catalogue prepared by	Dr. Anindita, Dr. Sivasankar Reddy, Dr. Naveen C S, Dr. Mohan kumar Naidu, Dr. Deepthi P R, Dr. Mahaboob Pasha, Dr. Ranjeth Kumar Reddy, Dr. Pradeep Bhaskar, Dr. G. Srinivas Reddy, Dr. Saurav Kumar Kajli, Dr. Charan Prasanth
Recommended by the Board of Studies on	12th BOS conducted on 11th January 2025
Date of Approval by the Academic Council	

Course Code: CSE1002	Course Title: Innovative Project-Arduino Using Embedded C	L- T-P- C	0	0	0	1
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	In this course the students will learn fundamental concepts of 'C' and Embedded C, problem solving using C in a systematic way to read and write the C code and to implement them on Arduino prototype board. The course will also demonstrate how to assemble various sensory devices and program them using Arduino platform as a basis. Students will have the opportunity of gaining real-world experience in handling IoT devices involving hardware and software combinations. The course also offers in-depth knowledge of designing, developing, coding and implementing Arduino projects.					
Course Objective	The objective of the course is **Employability Skills** of student by using **PARTICIPATIVE LEARNING** techniques.					
Course Outcomes	**On successful completion of the course the students shall be able to** CO1. Write a program using Arduino programming language using Embedded 'C'. CO2. Explain the main features of the Arduino prototype board CO3. Demonstrate the hardware interfacing of the peripherals to Arduino system. CO4. Demonstrate the functioning of live projects carried out using Arduino system.					
Course Content:						

Module 1: Basics of C, Branching and looping: Structure of C programs,Variables, Keywords, Datatypes, declaration and Initialization, **Decision Making and Branching:** if, if-else, else-if ladder, switch statement **Decision making and looping**: for, while, and do-while statements

(9 Sessions) [Blooms level selected: Understand Level]

Module 2: Arrays, functions, strings: Arrays: Introduction, one dimensional array, two dimensional array, Functions: User defined functions, Categories, searching and sorting, Strings: Introduction, string handling functions.

(8 Sessions) [Blooms level selected: Understand Level]

Module 3: Structures and Pointers: Structure definition ,syntax and application of structures, definition of pointers ,syntax, pass –by-reference.

(5 Sessions) [Blooms level selected: Apply Level]

Module 4: Introduction to Arduino and Sensory Devices:

Introduction to Arduino, Pin configuration, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, i/o Functions, Arduino IDE, Various Cloud Platforms Arduino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor , Connecting Switches and actuators , sensor interface with Arduino.

Introduction to 3D Printer: 3D Printer technology and its working Principles, Applications. Introduction to online Simulators: Working with Tinkercad Simulator

(8 Sessions) Application Level) [Blooms level selected: Apply Level]

Topics: Types of Arduino boards, sensors, 3D Printer

Targeted Application & Tools that can be used:

Application Area:

Home Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning. These are just a few examples of the many application areas where Arduino and sensors can be applied. The flexibility and affordability of Arduino, combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.

Professionally Used Software: students can use open SOURCE Softwares Arduino IDE and Tincker CAD

Project work/Assignment:

1. Projects: At the end of the course students will be completing the project work on solving many real time issues.

2. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .

3. Presentation: There will be a presentation from interdisciplinary students group, where the students will be given a project on they have to demonstrate the working and discuss the applications for the same

Textbook(s):

E Balagurusamy "Programming in ANSI C" , Mc Graw Hill Publications,7th Edition

Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition

Reference Book(s)

1. Neerparaj Rai "Arduino Projects for Engineers" BPB publishers,first edition, 2016.

2. Ryan Turner "Arduino Programming " Nelly B.L. International Consulting Ltd. first edition,2019.

1) https://www.tutorialspoint.com/arduino/index.html.
2) https://create.arduino.cc/projecthub/projects/tags/sensor.
3) https://3dprinting.com/what-is-3d-printing.

Online Resources (e-books, notes, ppts, video lectures etc.): 1. Arduino trending Projects < https://www. https://projecthub.arduino.cc/> 2. Introduction to Arduino < https://onlinecourses.swayam2.ac.in/aic20_sp04/preview> 3. Case studies on Wearable technology< https://www.hticiitm.org/wearables> **E-content:** 1. Cattle Health Monitoring System Using Arduino and IOT (April 2021| IJIRT | Volume 7 Issue 11 | ISSN: 2349-6002) 2. M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh" IOT BASED SMART SECURITY SYSTEM USING ARDUINO" 2021 JETIR August 2021, Volume 8, Issue 8. 3. R. Maheswar, P. Jayarajan, S. Vimalraj, G. Sivagnanam, V. Sivasankaran and I. S. Amiri, "Energy Efficient Real Time Environmental Monitoring System Using Buffer Management Protocol," 2018, pp. 1-5, doi: 10.1109/ICCCNT.2018.8494144. **https://ieeexplore.ieee.org/document/8494144**. 4. Yaser S Shaheen,Hussam., " Arduino Mega Based Smart Traffic Control System ," December 2021 Asian Journal of Advanced Research and Reports 15(12): 43-52, 2021(15(12): 43-52, 2021):15(12): 43-52, 2021.
Topics relevant to development of "SKILL": System design for achieving Sustainable Development Goals.

Catalogue prepared by	Dr. Divya Rani/Dr Ashutosh Anand
Recommended by the Board of Studies on	BOS NO:
Date of Approval by the Academic Council	Academic Council Meeting

Course Code: **ECE2011**	**Course Title: Innovative Projects using Raspberry Pi**	**L-T-P- C**	-	-	-	1
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course is designed to provide an in-depth understanding of Raspberry-pi Single Board Computers and their application in various real time projects involving sensors. Throughout the course, students will learn Raspberry-pi programming and gain hands-on experience with a wide range of sensors. Students will explore how to connect and interface sensors with Raspberry-pi, read sensor data, and use it to control various output devices This course is suitable for advance learners who are interested in exploring the world of electronics and developing practical applications using Raspberry-pi and sensors.					
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies by using sensors and their interfacing to solve real-time problems **.**					
Course Outcomes	**On successful completion of the course the students shall be able to** CO1. Understand the concept of micro python CO2. Explain the main features of the Raspberry-pi prototype board CO3. Analyse the hardware interfacing of the peripherals to a Single board computer system. CO4. Demonstrate the functioning of live projects carried out using Raspberry-pi system					
Course Content:						

Module 1	**Introduction to Micro python**	Hands-on	Interfacing Task and Analysis	4 Sessions
Topics: Introduction to MicroPython, Comparison with other programming languages, Setting up the MicroPython development environment, Basics of MicroPython syntax and structure.				
Module 2	**Working with Raspberry-pi**	Hands-on	Interfacing Task and Analysis	4 Sessions
Introduction to raspberry pi boards, pin-diagram, different types of raspberry pi boards and its application, LED and switch control. Mastering Modules, Setup Raspberry - PuTTY SSH,VNC Viewer to interface with more complicated sensors and actuators. Various Libraries and its functions.				
Topics: Micro Python, types of Raspberry-pi boards, sensors, 3D Printer				
Targeted Application & Tools that can be used: **Application Area:** Home Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation,				

Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning. These are just a few examples of the many application areas where Arduino and sensors can be applied. The flexibility and affordability of Arduino, combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.

Professionally Used Software: students can use open SOURCE Softwares Thonny Python, Python IDLE etc.

Project work/Assignment:

1. Projects: At the end of the course students will be completing the project work on solving many real time problems.
2. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .

3. Presentation: There will be a presentation from interdisciplinary students group, where the students will be given a project on they have to demonstrate the working and discuss the applications for the same

Textbook(s):
Monk Simon "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions", Publisher(s): O'Reilly Media, Inc. ISBN: 9781098130923 fourth Edition.

References
Reference Book(s)
1. Charles Bell Micro Python for the Internet of Things: A Beginner's Guide to Programming with Python on Microcontrollers" by" Edition 1, 2017, ISBN 978-1-4842-3123-4
2. Stewart Watkiss "Learn Electronics with Raspberry Pi " Apress Berkeley, CA . second edition,2020. ISBN978-1-4842-6348-8

Online Resources (e-books, notes, ppts, video lectures etc.):
1. Raspberry-pi Projects < https://magpi.raspberrypi.com/articles/category/tutorials/>
2. Introduction to internet of things< https://nptel.ac.in/courses/106105166>
3. Case studies on Wearable technology< https://www.hticiitm.org/wearables>

E-content:
1. Basil, Eliza Sawant, S.D. "IoT based traffic light control system using Raspberry Pi " DOI 10.1109/ICECDS.2017.8389604

2. Supriya S, 2Dr. Aravinda " Green leaf disease detection and identification using Raspberry Pi https://www.irjet.net/archives/V9/i8/IRJET-V9I847.

3. Dr. E.N. Ganesh., "Health Monitoring System using Raspberry Pi and IOT

Topics relevant to development of "SKILL": System design for achieving Sustainable Development Goals.

Catalogue prepared by	Dr. Divya Rani /Dr Ashutosh Anand
Recommended by the Board of Studies on	BOS NO: 17Th BoS meeting held on 5th July 2023
Date of Approval by the Academic Council	Academic Council Meeting No. 21 dated on ______________

<table>
<tr><td>Course Code:
PPS 1002</td><td colspan="2">Course Title: Soft skills for Engineers

Type of Course: Practical Only Course</td><td>L-T-P-C</td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">Students are expected to understand Basic English.
Students should have desire and enthusiasm to involve, participate and learn.</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course is designed to develop effective communication skills and boost confidence levels. The activity-based modules cover the art of Questioning, how to ask questions, goal setting with emphasis on time and stress management, creating the first impression and introducing one self and finally culminating with the etiquettes of email writing. The pedagogy used will be group discussions, flipped classrooms, continuous feedback, role-play and mentoring.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Soft Skills for Engineers” and attain Skill Development through Experiential Learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7">On successful completion of this course the students shall be able to:

CO1 Employ effective communication skills
CO2 Practice questioning techniques for better decision making
CO3 Differentiate individual strengths and weaknesses for self-awareness and stress management
CO4 Recognise the need to set SMART GOALS</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Art of Questioning</td><td colspan="3">Role plays</td><td colspan="3">4 Session</td></tr>
<tr><td colspan="8">Topics: Note Taking, Framing Open-ended and Close-ended questions, Funnel technique, Probing questions, Leading questions, Rhetorical questions, 5W1H Technique Vocab Building Every Class</td></tr>
<tr><td colspan="8">Dedicate 5-10minutes towards vocabulary building in every session</td></tr>
<tr><td>Module 2</td><td>Goal Setting & Time Management</td><td colspan="3">Journal + Outbound training</td><td colspan="3">8 Session</td></tr>
<tr><td colspan="8">Goal Setting (SMART Goals), Time Management Matrix, Steps to managing time through outbound group activity, Making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity</td></tr>
<tr><td>Module 3</td><td>Self-introduction and Creating an Impression</td><td colspan="3">Grooming checks + Evaluation</td><td colspan="3">8 Session</td></tr>
<tr><td colspan="8">Topics: Body Language, Grooming guidelines for boys/girls, Common mistakes in Grooming at workplace and social gathering, Etiquettes at work place & social gathering, SWOT – Self-awareness analysis, Self-introduction template, evaluation of self-introduction in class</td></tr>
<tr><td>Module 4</td><td>E-mail Etiquette</td><td colspan="3">Industry expert / Trainer</td><td colspan="3">4 Session</td></tr>
<tr><td colspan="8">Topics: Dos and Don’ts of professional email etiquette, practice writing emails (activity)</td></tr>
<tr><td>REVISION</td><td>Recap & Summary</td><td colspan="3"></td><td colspan="3">2 Session</td></tr>
<tr><td colspan="8">Revision of all the modules, overall feedback from the students with regards to the syllabus.</td></tr>
<tr><td colspan="8">Targeted Application & Tools that can be used: LMS</td></tr>
</table>

Topics relevant to development of "SKILL": Art of Questioning, Goal Setting & Time Management, Self-introduction and Creating an Impression, E-mail Etiquette for Skill Development through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	L&D Department Faculty members
Recommended by the Board of Studies on	BOS NO 3 Dated 10 Feb 23
Date of Approval by the Academic Council	20 ACM dated 15 Feb 23

<table>
<tr><td>Course Code:
PPS 2002</td><td>Course Title: Being Corporate Ready
Type of Course: Practical</td><td>L-T- P- C</td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">Students are expected to understand Basic English.
Students should have desire and enthusiasm to involve, participate and learn.</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The course is designed to enable engineering students to enhance their confidence level through effective communication, presentation and group discussion skills. The modules are planned for the students who are preparing to enter the corporate world by helping them in understanding etiquette and trends in the same. The methods used will be research, group discussion, and interview skills.</td></tr>
<tr><td>Course Out Comes</td><td colspan="6">On successful completion of this course the students shall be able to:
CO 1 Demonstrate effective presentation skills
CO2 Express thoughts/opinions in an acceptable manner in group discussions
CO 3 Develop active listening skills
CO4 Demonstrate interpersonal skills
CO 5 Recognize the fundamental nuances of Corporate Etiquette</td></tr>
<tr><td>Course Content</td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td colspan="4">Presentation skills</td><td colspan="2">16 Session</td></tr>
<tr><td colspan="7">Topics:
Presentation Skills, Opening-Body-Closing, Audibility, speech clarity, fluency, voice modulation, Non-verbal communication and body language.
Activity: Individual presentations</td></tr>
<tr><td>Module 2</td><td colspan="4">Group Discussion</td><td colspan="2">08 Session</td></tr>
<tr><td colspan="7">Topics:
Group Discussion techniques, Mind Mapping, DEF, GOD, Action Plans for GD
Activity: Group Discussions</td></tr>
<tr><td>Module 3</td><td colspan="4">Corporate Etiquettes</td><td colspan="2">02 Session</td></tr>
<tr><td colspan="7">Topics:
Do’s and Don’ts in an office meeting, types of handshake, use of business card, understanding dress codes, accessorizing professionally, telephone etiquettes, interacting with colleagues</td></tr>
<tr><td>Module 4</td><td colspan="4">Activity-based Learning</td><td colspan="2">02 Session</td></tr>
<tr><td colspan="7">Topics:
Fun activities followed by debriefing</td></tr>
<tr><td colspan="7">Targeted Application & Tools that can be used:
LMS
YouTube Links: https://youtu.be/z__jxoczNWc
TED Talks: https://youtu.be/xkq8dr_5ofs</td></tr>
<tr><td colspan="7">Project work/Assignment: Mention the Type of Project /Assignment proposed for this course</td></tr>
<tr><td colspan="7">Individual presentations
LMS MCQ</td></tr>
<tr><td colspan="7">References</td></tr>
</table>

1. Crucial Conversations: Tools for Talking When Stakes are High by Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler, McGraw-Hill Contemporary(2001) 2. How to Win Friends and Influence People, Dale Carnegie, Gallery Books (first published 1936) 3. Just Listen: Discover the Secret to Getting Through to Absolutely Anyone by Mark Goulston M.D. AMACOM; Reprint edition (March 4, 2015) 4. Power Questions: Build Relationships, Win New Business, and Influence Others by Andrew Sobel and Jerold 5. http://www.forbes.com/sites/lisaquast/2014/04/07/office-etiquette-tips-to-overcome-bad-manners-at-work/ 6. https://www.wordstream.com/blog/ws/2014/11/19/how-to-improve-presentation-skills 7. https://www.cbs.de/en/blog/15-effective-presentation-tips-to-improve-presentation-skills/	
Catalogue prepared by	Ms. Nirmal Kaur, Mr. Debamalya Bhattacharjee, Mr. Sangram Priyadarsan
Recommended by the Board of Studies on	Mention the BOS Number and the Date of BOS
Date of Approval by the Academic Council	Mention the Academic Council Meeting No. & the date of the meeting:

Course Code: PPS4005	**Course Title: Aptitude For Employability Type of Course: Practical Only**			**L-T-P- C**	0	0	2	1
Version No.	1.0							
Course Pre-requisites	Students should have the basic concepts of Quantitative aptitude, Verbal ability along with its applications in real life problems.							
Anti-requisites	Nil							
Course Description	This course is designed to enable the students to enhance their skills in quantitative aptitude and verbal ability skills.							
Course Objective	The objective of the course is to familiarize the learners with concepts in Quantitative Aptitude and Verbal ability through problem solving techniques suitable for their career development.							
Course Outcomes	On successful completion of the course the students shall be able to: CO1] **Recall** all the basic mathematical concepts CO2] **Identify** the principle concept needed in a question CO3] **Solve** the quantitative and logical ability questions with the appropriate concept.							
Course Content:								
Module 1	Quantitative Ability	Lab-10hrs		Platform Assessment-10hrs				20 Session
Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss, Time Speed and Distance, Simple Interest and Compound Interest, Probability, Permutation and Combination.								
Module 2	Verbal Ability	Lab-5hrs		Platform Assessment-5hrs				**10** Session
Topics: - Parts of Speech, Subject Verb Agreement, Spotting Error, Cloze Test, Verbal Analogies, Reading Comprehension, Idioms & Phrases, Para Jumbles								
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS								
Evaluation **Continuous Evaluation** • Topic wise evaluation								
Text Book 1. Fast track objective by Rajesh Verma 2. R S Aggarwal 3. S.P Bakshi								

References 1. www.indiabix.com 2. www.testbook.com 3. www.youtube.com/c/TheAptitudeGuy/videos	
Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Faculty of L&D
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

<table>
<tr><td>Course Code:
PPS3018</td><td colspan="2">Course Title: Preparedness for Interview
Type of Course: Practical Only Course</td><td>L- T- P- C</td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">Students are expected to understand Basic English.

Students should have desire and enthusiasm to involve, participate and learn.</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course is designed to enable students to understand soft skills concepts to be corporate ready. The modules are set to improve self-confidence, communicate effectively and Prepare for the Interview to assist in employability. It helps the students to get a glimpse of the acceptable corporate readiness and equip them with the fundamental necessities of being able to confidently deal with the highly competitive corporate environment and helps in crafting different types of resumes. The pedagogy used will be group discussions, flipped classrooms, continuous feedback, role-play and mentoring.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of "Preparing for Interview" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7">On successful completion of this course the students shall be able to:

CO1: Develop professional Resumes

CO2: Illustrate Resumes effectively

CO3: Apply skills and knowledge learnt for active and effective Group Discussions and Interview</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Resume Building</td><td colspan="2">Classroom activity</td><td colspan="2"></td><td colspan="2">10 Session</td></tr>
<tr><td colspan="8">Topics: Resume structure, use of templates, Do's and Don'ts, ATS methods, Cover Letter and Video Resume
Activity: Real world scenarios</td></tr>
<tr><td>Module 2</td><td>Group Discussion</td><td colspan="2">Mock G D</td><td colspan="2"></td><td colspan="2">9 Session</td></tr>
<tr><td colspan="8">Topics: -Group discussion as a placement process, GD techniques like Keyword. SPELT & POV of affected parties. Do & Don't of GD, Case-lets and topics for GD, practice session and evaluation
Activity:- Real world scenarios</td></tr>
</table>

Module 3	Personal Interview	Grooming checks + Evaluation + Mock Interview+ Role Play		9 Session
Topics: Placement process, Different interview rounds, HR interviews, Interview questions and desired answers, Different types of interviews, Do’s and Don'ts. **Activity: -** Role Play & Real-world scenario				
Module 4	Recap/Revision /Feedback Session	Practice sessions		2 Session
Targeted Application & Tools that can be used: 1. TED Talks 2. You Tube Links 3. Role Play activities				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Continuous Individual Assessment				
The Topics related to Skill Development: Art Of Presentation and Group Discussion for **Skill Development** through **Participative Learning** Tech- niques. This is attained through assessment Component mentioned in course handout.				
Catalogue prepared by	**Faculty of L&D**			
Recommended by the Board of Studies on	**BOS held on**			
Date of Approval by the Academic Council	**Academic Council Meeting held on**			

<table>
<tr><td>Course Code:
CIV1008</td><td colspan="2">Course Title: Basic Engineering Sciences
Type of Course: School Core Theory Only</td><td>L-T-P- C</td><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This basic course on engineering science is designed to introduce students to the fields of civil and mechanical engineering. Student will be exposed to various fields in civil engineering and different manufacturing techniques in addition to machinery for power production and consumption. This course acquaints students to basics of Industry 4.0 and Construction 4.0. The course aims to enable students to appreciate the multidisciplinary nature of engineering design and operations in the current era with mechanization and digitization transforming every aspect of engineering.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of Basic Engineering Sciences and attain <u>Skill Development</u> through <u>Participative Learning techniques</u></td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On successful completion of this course the students shall be able to:
CO1] Recognize the significance of various disciplines in Civil Engineering
CO2] Discuss the recent evolutions in Civil Engineering
CO3] Explain various energies, energy generating machineries and energy consumption machineries
CO4] Distinguish between conventional and modern manufacturing techniques.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Introduction to various fields in Civil Engineering</td><td colspan="2">Assignment</td><td colspan="2">Case studies on different Civil Engineering Projects</td><td colspan="2">6 Sessions</td></tr>
<tr><td colspan="8">Topics: Introduction to Civil Engineering: Definition, scope and branches of Civil Engineering, Role of Civil Engineer, Overview of Infrastructure.</td></tr>
<tr><td>Module 2</td><td>Current Trends and Evolution in Civil Engineering</td><td colspan="2">Assignment</td><td colspan="2">Article Review</td><td colspan="2">6 Sessions</td></tr>
<tr><td colspan="8">Topics: Mechanization in Construction, Application of Digital Technologies in Planning, Design, execution, monitoring and maintenance of Construction. Overview of Smart Cities.</td></tr>
<tr><td>Module 3</td><td>Power Production and Consumption Machinery</td><td colspan="2">Assignment & Quiz</td><td colspan="2">Data Collection</td><td colspan="2">6 Sessions</td></tr>
<tr><td colspan="8">Topics: Energy and its types, Engines and their applications, Pumps-Compressors and their applications.</td></tr>
<tr><td>Module 4</td><td>Industry 4.0</td><td colspan="2">Assignment & Quiz</td><td colspan="2">Data Collection</td><td colspan="2">6 Sessions</td></tr>
<tr><td colspan="8">Topics: Conventional manufacturing process: Metal forming, metal removal and metal joining process.
Modern Manufacturing process: 3D Printing / Additive Manufacturing.</td></tr>
<tr><td colspan="8">Targeted Application & Tools that can be used:
Application Areas include design and implementation of Smart City projects, Infrastructure maintenance, Power production, IC engines, Electric vehicles.</td></tr>
<tr><td colspan="8">Text Book:
T1. Elements of Civil and Mechanical Engineering, L.S. Jayagopal & R Rudramoorthy, Vikas Publishers</td></tr>
</table>

T2. Elements of Mechanical Engineering, by VK Manglik
References 1. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and Publishers Pvt Ltd, Mumbai. **Web-resources:** 2. Basic Civil Engineering https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706932&site=ehost-live 3. Post-parametric Automation in Design and Construction https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live 4. Smart Cities : Introducing Digital Innovation to Cities https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live 5. Innovation Energy: Trends and Perspectives or Challenges of Energy Innovation https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2323766&site=ehost-live 6. Mechanical Engineering https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_REDO_1705 7. Additive Manufacturing: Opportunities, Challenges, Implications https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live
Topics relevant to "SKILL DEVELOPMENT": Engines-Turbines and their applications, Mechanization in Construction for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Mr. Gopalakrishnan N/ Mr. Muralidhar/ Mr. Ajay H A/ Mr. Narendar Singh Tomar
Recommended by the Board of Studies on	14th BOS held on 30/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/22

NTCC Course Catalogs: -

Course Code: **PIP2001**	**Course Title:** **Capstone Project** **Type of Course:** **NTCC**	**L- T-P- C**	-	-	-	4
Version No.	**2.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work or Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain **Employability Skills** through **Experiential Learning** techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1. Identify the engineering problems related to local, regional, national or global needs. CO2. Apply appropriate techniques or modern tools for solving the intended problem. CO3. Design the experiments as per the standards and specifications. CO4. Interpret the events and results for meaningful conclusions. CO5. Appraise project findings and communicate effectively through scholarly publications.					
Catalogue prepared by	Dr Joshi Manohar V					
Recommended by the Board of Studies on	BoS No: 17th, held on 25/07/23					
Date of Approval by the Academic Council	21st Academic Council Meeting					

Course Code: **PIP4005**	**Course Title:** **Internship** **Type of Course:** **NTCC**	**L- T-P- C**	-	-	-	5
Version No.	**2.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work or Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain **Employability Skills** through **Experiential Learning** techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1. Identify the engineering problems related to local, regional, national or global needs. CO2. Apply appropriate techniques or modern tools for solving the intended problem. CO3. Design the experiments as per the standards and specifications. CO4. Interpret the events and results for meaningful conclusions. CO5. Appraise project findings and communicate effectively through scholarly publications.					
Catalogue prepared by	Dr Joshi Manohar V					
Recommended by the Board of Studies on	BoS No: 17th, held on 25/07/23					
Date of Approval by the Academic Council	21st Academic Council Meeting					