PRESIDENCY UNIVERSITY

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PROGRAMME REGULATIONS & CURRICULUM

2024-28

PRESIDENCY SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

BACHELOR OF TECHNOLOGY (B.TECH.)
MECHANICAL ENGINEERING

PRESIDENCY UNIVERSITY

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi

PRESIDENCY SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

Program Regulations and Curriculum 2024-2028

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

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

(As amended up to the 24th Meeting of the Academic Council held on 3rd August 2024. This document supersedes all previous guidelines)

Regulations No.: PU/AC-24.10/MEC19/MEC/2024-28

Resolution No.10 of the 24th Meeting of the Academic Council held on 03rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 05th August, 2024.

AUGUST-2024

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 be a value-based, industry driven Mechanical Engineering Department committed to develop globally competent Mechanical Engineering professionals dedicated to transform the society.

1.6 Mission of Department of Mechanical Engineering

- Committed to inculcate application of Engineering knowledge, develop problem analysis and solving skills to be able to investigate complex engineering problems with modern tools.
- Create value-driven engineering professionals who are sensitive to societal concerns of environmental sustainability through ethical conduct.
- Develop excellent communication abilities with core skills of project management and team work.
- Imbibe passion for lifelong learning with individual growth path.
- Commitment towards excellence in Mechanical Engineering education through advancements in research and innovation.

- Design flexible course contents in disciplinary, interdisciplinary and research areas to enhance student's competitiveness.

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, 2025 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 2024-2028.
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 2024-2028 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 2024-2025.

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, 2024-2028;*

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 2024-2028 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 2024-2028 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 Programme 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 Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

8.1 Programme 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 entrepreneurship.

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, 2024-2028, 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) amples: 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 amples: 0-0-4; 1-0-4; 1-0-2; etc.)	Continuous Assessments	50%
	End Term Examination	50%
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	idelines 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 the 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 sub-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 (2024-2028) 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: B.Tech. (Mechanical Engineering) 2024-2028: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	Humanities and Social Sciences including Management Courses (HSMC)	09
2	Basic Science Courses (BSC)	17
3	Engineering Science Courses (ESC)	15
4	Professional Core Courses (PCC)	70
5	Professional Elective Courses (PEC)	24
6	Open Elective Courses (OEC)	9
7	Project Work (PRW)	16
8	Mandatory Courses (MAC)	0
	Total Credits	**160 (Minimum)**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 71% out of the total credits of 160 for B.Tech. (Mechanical Engineering) program of four years' duration.

The curriculum structure is designed as per the CBCS and incorporating OBE Principles. The students are provided with utmost flexibility in selection of the courses of their choice.

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

Minor Group	Minimum Credits from each minor group for various programs	
	MECHANICAL (MEC)	MECHATRONICS (MCM)
General	**15**	**9**
Additive Manufacturing	**9**	
Thermal and Fluids Engineering		
Manufacturing Technology Basket		

Mechanical Engineering Design		
Mechatronics Basket		**15**
Total credits to be earned in discipline elective basket	**24**	**24**

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 (not Semester Wise)
List of Courses Tabled – aligned to the Program Structure
(Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Course Basket, Type of Skills etc., as applicable).

Table 3.1: List of Humanities and Social Sciences including Management Courses (HSMC)						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	ENG1002	Technical English	1	0	2	2
2	PPS1001	Introduction to soft skills	0	0	2	1
3	ENG2001	Advanced English	1	0	2	2
4	PPS1012	Enhancing Personality through Soft skill	0	0	2	1
5	MGTxxxx	Management Course (Select any one course from Management Basket - I)	3	0	0	3
6	PPSXXXX	Introduction to Aptitude	2	0	0	0
		Total No. of Credits				**9**

Table 3.2: List of Basic Science Courses (BSC)						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	MAT1003	Applied Statistics	1	0	2	2
2	MAT1001	Calculus and Linear Algebra	3	0	2	4
3	PHY1001	Material Physics	2	0	2	3
4	CHE1017	Applied Chemistry	1	0	2	2
5	MAT2501	Integral Transforms and Partial Differential Equations	3	0	0	3
6	MAT2502	Numerical Methods and Complex Variables	3	0	0	3
					Total No. of Credits	**17**

Table 3.3: List of Engineering Science Courses (ESC)						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CIV1008	Basic Engineering Sciences	2	0	0	2
2	EEE1007	Basics of Electrical and Electronics Engineering	3	0	2	4
3	CSE1004	Problem solving using C	1	0	4	3
4	MEC1006	Engineering Graphics	2	0	0	2
5	CSE1006	Problem solving using Java	1	0	4	3
6	ECE2010	Innovative Projects using Arduino	-	-	-	1
Total No. of Credits						**15**

Table 3.4: List of Professional Core Courses (PCC)						
S. No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	MEC1004	Elements of Mechanical Engineering	1	0	2	2

2	MEC2514	Basic Thermodynamics	3	1	0	4
3	MEC2502	Fluid Mechanics and Machinery	3	1	0	4
4	MEC2022	Production Technology	4	0	0	4
5	MEC2023	Foundry Forging and Welding Lab	0	0	2	1
6	MEC2020	Material Science and Metallurgy	3	0	0	3
7	MEC2503	Fluid Mechanics and Machinery Lab	0	0	2	1
8	MEC2025	Metrology and Measurements Lab	0	0	2	1
9	MEC2021	Material Science and Material Testing Lab	0	0	2	1
10	MEC2024	Metrology and Measurements	3	0	0	3
11	MEC2504	Theory of Machines	3	1	0	4
12	MEC2505	Mechanics of Solids	4	0	0	4
13	MEC2515	Applied Thermodynamics	3	1	0	4
14	MEC2516	Heat and Mass Transfer	3	1	0	4
15	MEC2510	Heat and Mass Transfer Lab	0	0	2	1
16	MEC2507	Computer Aided Engineering Drawing	0	0	4	2
17	MEC2028	Machine Shop Practice Lab	0	0	2	1
18	MEC2508	Design of Machine Elements	3	1	0	4
19	MEC2026	Mechatronics	3	0	0	3
20	MEC2033	Production and Operations Management	3	0	0	3
21	MEC2031	Mechanisms, Machines and Design Lab	0	0	2	1
22	MEC2027	Mechatronics Lab	0	0	2	1
23	MEC2511	Computer Aided Machine Drawing	0	0	4	2
24	MEC2512	Finite Element Analysis	3	0	0	3
25	MEC2029	Hydraulics and Pneumatics	3	0	0	3
26	MEC2030	Automotive Engineering	3	0	0	3
27	MEC2032	Energy Conversion Engineering Lab	0	0	2	1
28	MEC2034	Finite Element Analysis Lab	0	0	4	2
					Total No. of Credits	**70**

Table 3.5 : List of course in Project Work basket (PRW)

S.No	Course Code	Course Name	L	T	P	C
1	MEC7100	Minor Project	-	-	-	4
2	MEC7000	Internship	-	-	-	2
3	MEC7300	Capstone Project	-	-	-	10
					Total No. of Credits	**16**

Table 3.6 : Mandatory Course (MAC)						
S. No.	Course Code	Course Name	L	T	P	C
1	CHE1018	Environmental Science	1	0	2	0
2	LAW1007	Indian Constitution and Professional Ethics for Engineers	1	0	0	0
					Total No. of Credits	0

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 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 4th and 5th Semesters or 6th and 7th 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 Elective Courses under various Specialisations / Stream Basket

Table 3.7 : Professional Electives Courses/Specialization Tracks – Minimum of 15 credits is to be earned by the student in a particular track and overall 24 credits.

Track 1 - Manufacturing

S.No	Course Code	Course Name	L	T	P	C
1	MEC3400	Computer Integrated Manufacturing	3	0	0	3
2	MEC3401	Smart Manufacturing	3	0	0	3
3	MEC3402	Nanotechnology	3	0	0	3
4	MEC3403	Flexible Manufacturing Systems	3	0	0	3
5	MEC3404	Product Design for Manufacturing and Assembly	3	0	0	3
6	MEC3405	Production Planning and Control	3	0	0	3
7	MEC3406	Additive Manufacturing and Its Applications	3	0	0	3
8	MEC3407	Micro and Nano Manufacturing	3	0	0	3
9	MEC3408	Statistics and Quality Control	3	0	0	3
10	MEC3409	Digital Manufacturing and IOT	3	0	0	3
11	MEC3410	Lean Manufacturing	3	0	0	3
12	MEC3440	Modern Manufacturing Processes	3	0	0	3

Track 2 – Mechatronics

S.No	Course Code	Course Name	L	T	P	C
1	MEC3411	Robotics	3	0	0	3
2	MEC3412	Control Engineering	3	0	0	3
3	MEC3413	Vehicle Health Monitoring, Maintenance and Safety	3	0	0	
4	MEC3414	Introduction to marine and Aerial Robotics	3	0	0	3
5	MEC3415	Autonomous Mobile Robots	3	0	0	3
6	MEC3416	Human Robot Interaction	3	0	0	3
7	MEC3417	Smart Mobility and Intelligent Vehicles	3	0	0	3
8	MEC3418	Manufacturing Control and Automation	3	0	0	3
9	MEC3419	Micro electro Mechanical systems	3	0	0	3
10	MEC3420	Introduction to Robotics and Automation	3	0	0	3

Track 3 – Thermal Engineering

S.No	Course Code	Course Name	L	T	P	C
1	MEC3421	Power Plant Engineering	3	0	0	3
2	MEC3422	Turbomachinery	3	0	0	3
3	MEC3423	Renewable Energy Systems	3	0	0	3
4	MEC3424	Advanced Heat Transfer	3	0	0	3
5	MEC3425	Compressible Fluid Flow	3	0	0	3
6	MEC3426	Refrigeration and Air Conditioning	3	0	0	3
7	MEC3427	Alternate Fuels	3	0	0	3
8	MEC3428	Computational Fluid Dynamics	3	0	0	3
9	MEC3429	Elements of Solar Energy Conversion	3	0	0	3
10	MEC3430	Product Design in RAC	3	0	0	3

Track 4 – Design

S.No	Course Code	Course Name	L	T	P	C
1	MEC3431	Mechanical Vibrations	3	0	0	3
2	MEC3432	Experimental Stress Analysis	3	0	0	3
3	MEC3433	Product Life Cycle Management	2	0	2	3
4	MEC3434	Theory of Elasticity	3	0	0	3
5	MEC3435	Theory of Plasticity	3	0	0	3
6	MEC3436	Tribology and Bearing Design	3	0	0	3
7	MEC3437	Fracture Mechanics	3	0	0	3
8	MEC3438	Mechanics of Composite Materials	3	0	0	3
9	MEC3439	Automotive Body Design	3	0	0	3

20. List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters.

Table 3.8 : Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 9

Sl. No.	Course Code	Course Name	L	T	P	C	Type of Skill/ Focus	Course Caters to	Prerequisites/ Corequisites	Antirequisites	Future Courses that need this as a Prerequisite
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	-	-	-	-
2	CIV1002	Environment Science and Disaster Management	3	0	0	3	FC	-	-	-	-
3	CIV2001	Sustainability Concepts in Engineering	3	0	0	3	S	-	-	-	-
4	CIV2002	Occupational Health and Safety	3	0	0	3	S	-	-	-	-
5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	-	-	-	-
6	CIV2004	Integrated Project Management	3	0	0	3	EN	-	-	-	-
7	CIV2005	Environmental Impact Assessment	3	0	0	3	EN	-	-	-	-
8	CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	-	-	-	-
9	CIV2044	Geospatial Applications for Engineers	2	0	2	3	EM	-	-	-	-
10	CIV2045	Environmental Meteorology	3	0	0	3	S	-	-	-	-
11	CIV3046	Project Problem Based Learning	3	0	0	3	S	-	-	-	-
12	CIV3059	Sustainability for Professional Practice	3	0	0	3	EN	-	-	-	-
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	Contemporary 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/EM	-	-	-	-
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 fundamentals	2	0	2	3	S/ 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 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 Basket											
1	ECE1003	Fundamentals of Electronics	3	0	0	3	F	-	-	-	-
2	ECE1004	Microprocessor based systems	3	0	0	3	F	-	-	-	-
3	ECE3089	Artificial Neural Networks	3	0	0	3	S	-	-	-	-
4	ECE3097	Smart Electronics in Agriculture	3	0	0	3	F/EM	-	-	-	-
5	ECE3098	Environment Monitoring Systems	3	0	0	3	F/EM	-	-	-	-
6	ECE3102	Consumer Electronics	3	0	0	3	F/EM	-	-	-	-

7	ECE3103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN	-	-	-	-
8	ECE3106	Introduction to Data Analytics	3	0	0	3	F/EM	-	-	-	-
9	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 Communication Skills for Engineers	1	0	0	1	-	-	-	-	-
DSA 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	KAN1001	Kali Kannada	1	0	0	1	S	-	-	-	-
2	KAN1003	Kannada Kaipidi	3	0	0	3	S	-	-	-	-
3	KAN2001	Thili Kannada	1	0	0	1	S	-	-	-	-
4	KAN2003	Pradharshana Kale	1	0	2	2	S	-	-	-	-
5	KAN2004	Sahithya Vimarshe	2	0	0	2	S	-	-	-	-
6	KAN2005	Anuvadha Kala Sahithya	3	0	0	3	S	-	-	-	-
7	KAN2006	Vichara Manthana	3	0	0	3	S	-	-	-	-
8	KAN2007	Katha Sahithya Sampada	3	0	0	3	S	-	-	-	-
9	KAN2008	Ranga Pradarshana Kala	3	0	0	3	S	-	-	-	-
Foreign Language Basket											
1	FRL1004	Introduction of French Language	2	0	0	2	S	S	-	-	-
2	FRL1005	Fundamentals of French	2	0	0	2	S	S	-	-	-
3	FRL1009	Mandarin Chinese for Beginners	3	0	0	3	S	S	-	-	-
Law Basket											
1	LAW1001	Introduction to Sociology	2	0	0	0	2	F	HP	-	-
2	LAW2001	Indian Heritage and Culture	2	0	0	0	2	F	HP/GS	-	-
3	LAW2002	Introdcution to Law of Succession	2	0	0	0	2	F	HP/GS	-	-
4	LAW2003	Introduction to Company Law	2	0	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 Ethics	2	0	0	2	F	HP/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	-	-	-	-
Mechanical Basket (not to be offered for Mechanical Department students)											
1	MEC3250	Engineering Drawing	1	0	4	3	S	-	-	-	-
2	MEC3251	Supply Chain Management	3	0	0	3	S/ EM/ EN	-	-	-	-
3	MEC3252	Six Sigma for Professionals	3	0	0	3	S/EM	-	-	MEC 2008	-
4	MEC3253	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
5	MEC3254	Safety Engineering	3	0	0	3	S/EM	ES	-	-	-
6	MEC3255	Additive Manufacturing	3	0	0	3	F/EM	-	-	-	-
7	MEC3256	Sustainable Technologies and Practices	3	0	0	3	S/EM	-	-	-	-
8	MEC3257	Industry 4.0	3	0	0	3	S/EM	-	-	-	-
Petroleum Basket											
1	PET1011	Energy Industry Dynamics	3	0	0	3	FC	ES	-	NIL	-
2	PET1012	Energy Sustainability Practices	3	0	0	3	FC	ES	-	NIL	-
Physics Basket											
1	PHY1003	Mechanics and Physics of Materials	3	0	0	3	FC / SD		-	-	-
2	PHY1004	Astronomy	3	0	0	3	FC		-	-	-
3	PHY1005	Game Physics	2	0	2	3	FC / SD		-	-	-
4	PHY1006	Statistical Mechanics	2	0	0	2	FC		-	-	-
5	PHY1007	Physics of Nanomaterials	3	0	0	3	FC		-	-	-
6	PHY1008	Adventures in nanoworld	2	0	0	2	FC		-	-	-
7	PHY2001	Medical Physics	2	0	0	2	FC	ES	-	-	-
8	PHY2002	Sensor Physics	1	0	2	2	FC / SD		-	-	-
9	PHY2003	Computational Physics	1	0	2	2	FC		-	-	-
10	PHY2004	Laser Physics	3	0	0	3	FC	ES	-	-	-
11	PHY2005	Science and Technology of Energy	3	0	0	3	FC	ES	-	-	-
12	PHY2009	Essentials of Physics	2	0	0	2	FC		-	-	-
Management Basket- I											
1	MGT2007	Digital Entrepreneurship	3	0	0	3	S/EM/EN	-	-	-	-
2	MGT2015	Engineering Economics	3	0	0	3	S	-	-	-	-
3	MGT2023	People Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Management Basket- II											
1	MGT1001	Introduction to Psychology	3	0	0	3	F	HP	-	-	-
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/EM/ 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/EM/EN	-	-	-	-
10	MGT2005	Economics and Cost Estimation	3	0	0	3	S/EM	-	-	-	-
11	MGT2006	Decision Making Under Uncertainty	3	0	0	3	S	-	-	-	-
12	MGT2008	Econometrics for Managers	3	0	0	3	S	-	-	-	-

13	MGT2009	Management Consulting	3	0	0	3	S/EM/EN	-	-	-	-
14	MGT2010	Managing People and Performance	3	0	0	3	S/EM/EN	HP/GS	-	-	-
15	MGT2011	Personal Finance	3	0	0	3	F	-	-	-	-
16	MGT2012	E Business for Management	3	0	0	3	S/EM	-	-	-	-
17	MGT2013	Project Management	3	0	0	3	EN / EM	GS/HP/ ES	-	-	-
18	MGT2014	Project Finance	3	0	0	3	EN / EM	HP	-	-	-
19	MGT2016	Business of Entertainment	3	0	0	3	EM/ EN	-	-	-	-
20	MGT2017	Principles of Management	3	0	0	3	S/EM/ EN	-	-	-	-
21	MGT2018	Professional and Business Ethics	3	0	0	3	S/EM/ EN	HP	-	-	-
22	MGT2019	Sales Techniques	3	0	0	3	S/EM/ EN	HP	-	-	-
23	MGT2020	Marketing for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
24	MGT2021	Finance for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
25	MGT2022	Customer Relationship 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 News Anchoring and News Management	0	0	2	1	EM	-	-	-	-

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-me04	Advanced Robotics	12 Weeks
2	noc25-me09	Basics of Mechanical Engineering - 2	12 Weeks
3	noc25-me15	Design of Mechanical Transmission Systems	12 Weeks
4	noc25-me19	Engine system and performance	12 Weeks
5	noc25-me27	Finite Element Modeling Of Welding Processes	12 Weeks

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

Sl. No.	Course ID	Course Name	Duration
1	noc25-me57	Nonlinear Vibration	12 Weeks
2	noc25-me64	Principles Of Industrial Engineering	12 Weeks
3	noc25-me67	Product Design and Manufacturing	12 Weeks
4	noc25-me70	Robotics: Basics and Selected Advanced Concepts	12 Weeks
5	noc25-me73	Strength Of Materials	12 Weeks

22. Recommended Semester Wise Course Structure

Semester 1 (Basic Engineering Science Cycle)										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1.	CHE1018	Environmental Science	1	0	2	0	3	MAC	-	-
2.	CIV1008	Basic Engineering Sciences	2	0	0	2	2	ESC	F/S	-
3.	EEE1007	Basics of Electrical and Electronics Engineering	3	0	2	4	5	ESC	F/S	-
4.	ENG1002	Technical English	1	0	2	2	3	HSMC	F/S	-
5.	LAW1007	Indian Constitution and Professional Ethics for Engineers	1	0	0	0	1	MAC	EM	ES
6.	PPS1001	Introduction to soft skills	0	0	2	1	2	HSMC	EM	HP
7.	MAT1003	Applied Statistics	1	0	2	2	3	BSC	SD	ES
8.	CSE1004	Problem solving using C	1	0	4	3	5	ESC	S/EM	-
		TOTAL	10	0	14	14	24	-	-	-

HSMC = Humanities and Social Sciences including Management Courses, BSC = Basic Science Courses, ESC = Engineering Science Courses, PCC = Professional Core Courses, PEC = Professional Elective Courses, OEC = Open Elective Courses,
PRW = Project Work, MAC = Mandatory Courses, MGTC = Management Course
FC = Foundation Course, SD = Skill Development, EM = Employability, EN = Entrepreneurship
GS = Gender Sensitization, ES = Environment and Sustainability, HP = Human Values and Professional Ethics

Semester 2 (Physics Cycle)										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1.	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	BSC	EM	-
2.	MEC1004	Elements of Mechanical Engineering	1	0	2	2	3	PCC	S/EM	-
3.	PHY1001	Material Physics	2	0	2	3	4	BSC	SD	-
4.	ENG2001	Advanced English	1	0	2	2	3	HSMC	SD	-
5.	PPS1012	Enhancing Personality through Soft skill	0	0	2	1	2	HSMC	-	-
6.	MEC1006	Engineering Graphics	2	0	0	2	2	ESC	SD	-
7.	CSE1006	Problem solving using Java	1	0	4	3	5	ESC	SD	ES
8.	ECE2010	Innovative Projects using Arduino	-	-	-	1	0	ESC	SD/EM	-
9.	CHE1017	Applied Chemistry	1	0	2	2	3	BSC	EM	-

		TOTAL	11	0	16	20	27			

Semester 3										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT2501	Integral Transforms and Partial Differential Equations	3	0	0	3	3	BSC	FC	-
2	MEC2514	Basic Thermodynamics	3	1	0	4	4	PCC	SD	-
3	MEC2502	Fluid Mechanics and Machinery	3	1	0	4	4	PCC	SD	-
4	MEC2022	Production Technology	4	0	0	4	4	PCC	SD	-
5	XXXXXX	Open Elective-I	3	0	0	3	3	OEC	EN	-
6	MEC2023	Foundry Forging and Welding Lab	0	0	2	1	2	PCC	SD	-
7	MEC2503	Fluid Mechanics and Machinery Lab	0	0	2	1	2	PCC	SD	-
8	MEC2025	Metrology and Measurements Lab	0	0	2	1	2	PCC	SD	-
9	MEC2024	Metrology and Measurements	3	0	0	3	3	PCC	SD	-
		TOTAL	19	2	6	24	27			

Semester 4										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT2502	Numerical Methods and Complex Variables	3	0	0	3	3	BSC	FC	-
2	MEC2504	Theory of Machines	3	1	0	4	4	PCC	SD	-
3	MEC2505	Mechanics of Solids	4	0	0	4	4	PCC	SD	-
4	MEC2515	Applied Thermodynamics	3	1	0	4	4	PCC	SD	-
5	MECXXXX	Professional Elective - I	3	0	0	3	3	PEC	EM	-
6	MEC2020	Material Science and Metallurgy	3	0	0	3	3	PCC	SD	-
7	MEC2021	Material Science and Material Testing Lab	0	0	2	1	2	PCC	SD	-
8	MEC2507	Computer Aided Engineering Drawing	0	0	4	2	4	PCC	SD	-
9	MEC2028	Machine Shop Practice Lab	0	0	2	1	2	PCC	SD	-
		TOTAL	19	2	8	25	29			

Semester 5										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MEC2508	Design of Machine Elements	3	1	0	4	4	PCC	SD	-
2	MEC2516	Heat and Mass Transfer	3	1	0	4	4	PCC	SD	-
3	MEC2026	Mechatronics	3	0	0	3	3	PCC	SD	-
4	MEC2027	Mechatronics Lab	0	0	2	1	2	PCC	SD	
5	MEC2031	Mechanisms, Machines and Design Lab	0	0	2	1	2	PCC	SD	-
6	MGTxxxx	Management Course (Select any one course from Management Basket - I)	3	0	0	3	3	HSMC		-
7	MEC2510	Heat and Mass Transfer Lab	0	0	2	1	2	PCC	SD	-
8	MEC2511	Computer Aided Machine Drawing	0	0	4	2	4	PCC	SD	-
9	MECXXXX	Professional Elective - II	3	0	0	3	3	PEC	EM	-
10	MEC7100	Minor Project	-	-	-	4	-	PRW	SD/EM/EN	-
		TOTAL	15	2	10	26	27	-	-	-

Semester 6										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MEC2512	Finite Element Analysis	3	0	0	3	3	PCC	SD	-
2	MEC2029	Hydraulics and Pneumatics	3	0	0	3	3	PCC	SD	-
3	MEC2030	Automotive Engineering	3	0	0	3	3	PCC	SD	-
4	MEC2033	Production and Operations Management	3	0	0	3	3	PCC	SD	-
5	MECXXXX	Professional Elective - III	3	0	0	3	3	PEC	EM	-
6	MECXXXX	Professional Elective - IV	3	0	0	3	3	PEC	EM	-
7	XXXXXXX	Open Elective - II	3	0	0	3	3	OEC	EN	-
8	MEC2032	Energy Conversion Engineering Lab	0	0	2	1	2	PCC	SD	-
9	MEC2034	Finite Element Analysis Lab	0	0	4	2	4	PCC	SD	-
10	PPSXXXX	Introduction to Aptitude	2	0	0	0	2	HSMC	SD	-
		TOTAL	23	0	6	24	29	-	-	-

Semester 7										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MECXXXX	Professional Elective - V	3	0	0	3	3	PEC	EM	-
2	MECXXXX	Professional Elective - VI	3	0	0	3	3	PEC	EM	-
3	MECXXXX	Professional Elective - VII	3	0	0	3	3	PEC	EM	-
4	MECXXXX	Professional Elective - VIII	3	0	0	3	3	PEC	EM	-
5	XXXXXXX	Open Elective -III	3	0	0	3	3	OEC	EN	
6	MEC7000	Internship	-	-	-	2	-	PRW	SD/EN/EM	-
		TOTAL	15	0	0	17	15	-	-	-

Semester 8										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MEC7300	Capstone Project	-	-	-	10	0	PRW	SD/EN/EM	-
		TOTAL				10	0	-	-	-

23. Course Catalogue

Course Catalogue of all Courses Listed including the Courses Offered by other School / Department and Discipline / Programme Electives – Course Code, Course Name, Prerequisite, Anti-requisite, Course Description, Course Outcome, Course Content (with Blooms Level, CO, No. of Contact Hours), Reference Resources.

Course Catalogues:

The Course Catalogues for the Courses offered by the department of Mechanical Engineering are shared below:

Course Catalogues:

<table>
<tr><td>Course Code:
CHE1018</td><td colspan="3">Course Title: Environmental Science
Type of Course: School Core- Theory and Lab</td><td>L-T-P-C</td><td>1-0-2-0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Course Description</td><td colspan="5">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="5">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="5">On successful completion of this course the students shall be able to:
1) Appreciate the historical context of human interactions with the environment and the need for eco-balance.
2) Describe basic knowledge about global climate change with particular reference to the Indian context.
3) Understand biodiversity and its conservation
4) Develop an understanding on types of pollution and ways to protect the environment
5) Learn about various strategies on Global environmental management systems</td></tr>
<tr><td>Course Content:</td><td colspan="5"></td></tr>
<tr><td>Module 1</td><td>Humans and the Environment</td><td>Assignment</td><td>Data Collection</td><td colspan="2">01 sessions</td></tr>
<tr><td colspan="6">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>Natural Resources and Sustainable Development</td><td>Assignment</td><td></td><td colspan="2">03 sessions</td></tr>
<tr><td colspan="6">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.
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.</td></tr>
</table>

Module 3	Environmental Issues: Local, Regional and Global	Case study		02 sessions

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 sessions

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 sessions

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 sessions

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	Environmental Management	Case study	Data analysis	02 sessions

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	Environmental Treaties and Legislation	Case study	Data analysis	01 sessions

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, 8th 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 9th BOS held on 10/07/23
Date of Approval by the Academic Council	21st Academic council dated: 6th September 2023

Course Code: CIV1008	**Course Title: Basic Engineering Sciences** **Type of Course: Theory Only**	**L-T P- C**	2	0	0	2
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This basic course on engineering science is designed to introduce students to the fields of civil, mechanical and petroleum engineering. Student will be exposed to various fields in civil engineering and different manufacturing techniques in addition to machinery for power production and consumption. Additionally, students will be getting an overview of various sectors of oil & gas industries. 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.					
Course Objective	The objective of the course is skill development of student by using Participative Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1] Recognize the significance of various disciplines in Civil Engineering 2] Discuss the recent evolutions in Civil Engineering 3] Explain various energies, energy generating machineries and energy consumption machineries 4] Describe the fundamental concept and terminology associated with the Petroleum Industry 5] Distinguish between conventional and modern manufacturing techniques.					
Course Content:						
Module 1	Introduction to various fields in Civil Engineering	Assignment	Case studies on different Civil Engineering Projects	6 Sessions		
Topics: Introduction to Civil Engineering: Definition, scope and branches of Civil Engineering, Role of Civil Engineer, Overview of Infrastructure.						
Module 2	Current Trends and Evolution in Civil Engineering	Assignment	icle Review	6 Sessions		
Topics: Mechanization in Construction, Application of Digital Technologies in Planning, Design, execution, monitoring and maintenance of Construction. Overview of Smart Cities.						
Module 3	Power Production and Consumption Machinery	Assignment & Quiz	Data Collection	6 Sessions		
Topics: Energy and its types, Engines and their applications, Pumps-Compressors and their applications.						
Module 4	Overview of Petroleum Engineering	Assignment & Quiz	Article Review	6 Sessions		
Overview of the Petroleum Industry, Importance of Petroleum Engineering, lifecycle of Petroleum products, Classifications of E&P activities: Key difference between Offshore and Onshore, Onshore facilities, offshore platforms, Digitization of petroleum engineering						
Module 5	Industry 4.0	Assignment & Quiz	Data Collection	6 Sessions		
Topics: Conventional manufacturing process: Metal forming, metal removal and metal joining process. Modern Manufacturing process: 3D Printing / Additive Manufacturing.						

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, onshore and offshore exploration and production activities

Project work/Assignment:

Assignment 1: Collect data and prepare report on various Mega Projects in Civil Engineering
Assignment 2: Review Articles on current evolutions in Civil Engineering.
Assignment 3: Collect data related to renewable energy generation (Wind, Solar)
Assignment 4: Prepare an energy consumption chart for a compressor or pumps.
Assignment 5: Prepare a report on role of 3D printing across various industries.
Assignment 6: Prepare an assignment on geopolitical influence on oil and gas industries.

Text Book:

T1. Elements of Civil and Mechanical Engineering, L.S. Jayagopal & R Rudramoorthy, Vikas Publishers

T2. Elements of Mechanical Engineering, by VK Manglik

T3. Fundamentals of Oil & Gas Industry for Beginners by Samir Dalvi, Notion Press; 1st edition

References

1. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and Publishers Pvt Ltd, Mumbai.
2. Nontechnical Guide to Petroleum Geology, Exploration, Drilling & Production by Norman J. Hyne, PennWell Books; 3rd Revised edition

Web-resources:

1. Basic Civil Engineering

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706932&site=ehost-live

2. Post-parametric Automation in Design and Construction

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live

3. Smart Cities : Introducing Digital Innovation to Cities

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live

4. 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

5. Mechanical Engineering
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_REDO_1705

6. Additive Manufacturing: Opportunities, Challenges, Implications
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live

7. Society of Petroleum Engineers (SPE)
https://www.spe.org/en/

8. PetroWiki: A comprehensive online resource created by the Society of Petroleum Engineers that provides information on various aspects of petroleum engineering.
https://petrowiki.spe.org/PetroWiki

9. Rigzone: A resource for news and information about the oil and gas industry, including job postings and industry trends.
https://www.rigzone.com/

Topics relevant to the development of SKILLS:

Engines-Turbines and their applications.
chanization in Construction.
itization in Petroleum Industries

Catalogue prepared by	Mr. Gopalakrishnan N/ Mr. Muralidhar/ Mr. Ajay H A/ Mr. Narendar Singh Tomar/Mr. Bhairab Jyoti Gogoi / Dr. Abhinav Kumar
Recommended by the Board of Studies on	18th BOS held on 05/07/2024
Date of Approval by the Academic Council	Academic Council Meeting No. 24, Dated 03/08/24

<table>
<tr><td>Course Code:
EEE1007</td><td colspan="3">Course Title: Basics of Electrical and Electronics Engineering.
Type of Course: Professional Core - Theory & Integrated Laboratory</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="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">This is a fundamental Course which is designed to know the use of basics of electrical and electronics engineering principles occurs in various fields of Engineering. The course emphasises on the characteristics and applications of electrical and electronic devices. The course also emphasizes on the working, analysis and design of electrical circuits using both active & passive components. Additionally, this course creates a foundation for the future courses such as Electrical machines, power system, power electronics Linear Integrated Circuits, Analog Communication and Digital Communication etc.
The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to visualize the real system performance, using both hardware and simulation tools.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain Skill Development through Experiential Learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
1. Apply basic laws of Electrical Engineering to compute voltage, currents and other parameters in the circuits.
2. Discuss the performance characteristics and applications of various electrical Machines.
3. Discuss various fundamental parameters appearing in the characteristics of semiconductor devices and their applications.
4. Summarize the operations of different biasing configurations of BJTs and amplifiers.
5. Demonstrate the working of electrical machines to observe performance characteristics
6. Demonstrate the working of electronic circuits to obtain the V-I Characteristics of various semiconductor devices.
7. Sketch the characteristics and waveforms relevant to standard electrical and electronic circuits</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td colspan="2">Introduction to Electrical Circuits</td><td colspan="2">Assignment/ Quiz</td><td colspan="2">merical solving Task</td><td colspan="2">13 Sessions</td></tr>
<tr><td colspan="9">DC Circuits: Concept of Circuit and Network, Types of elements, Network Reduction Techniques- Series and parallel connections of resistive networks, Star–to-Delta Transformations, Mesh Analysis, Nodal Analysis, Numerical examples.
AC Circuits: Fundamentals of single phase circuits - Series RL, RC and R-L-C Circuits, Concept of active power, reactive power and Power factor, Numerical examples.
Introduction to three phase system and relation between line and phase values in Star & Delta connection, Numerical examples.</td></tr>
<tr><td>Module 2</td><td colspan="2">Fundamentals of Electrical Machines</td><td colspan="2">Assignment/ Quiz</td><td colspan="2">merical solving Task</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="9">Electrical Machines: Single phase transformers: principle of operation and EMF equation, Numerical examples. DC Motor: principle of operation, Back EMF, torque equation, Numerical examples. AC Motor: Principle operation of Induction Motors and its Applications.</td></tr>
</table>

Special Machines: Introduction to special electrical machines and its applications.				
Module 3	Semiconductor and Diode applications	Assignment/ Quiz	mory Recall based Quizzes	10 Sessions
Mass Action Law, Charge densities in a semiconductor, Types of SC, Junction diodes -Ideal and practical behaviour, Modelling the Diode Forward Characteristic, and Diode applications like rectifiers, Clipping and clamping circuits. Zener diode, characteristics and its applications like voltage regulator.				
Module 4	Transistors and its Applications	Assignment/ Quiz	mory Recall-based Quizzes	10 Sessions
Transistor characteristics, Current components, BJT Configurations (CB, CC, CE configurations) and their current gains. Operating point, Biasing & stabilization techniques: Fixed Bias, Voltage divider bias and its stability factor and load line analysis. Single and multistage amplifier, Darlington pair. JFET (Construction, principal of Operation and Volt –Ampere characteristics). Pinch- off voltage, Comparison of BJT and FET. MOSFET (Construction, principal of Operation and symbol), MOSFET characteristics in Enhancement and Depletion modes.				
List of Laboratory Tasks: **Experiment No 1:** Verification of KVL and KCL for a given DC circuit. **Level 1:** Study and Verify KVL and KCL for the given electrical Circuit. **Level 2:** For the same circuit considered in level 1, perform the simulation using NI LabVIEW/Multisim/MATLAB. **Experiment No 2:** Analyse AC series circuits – RL, RC and RLC . **Level 1:** Conduct an experiment to perform and verify the impedance, current and power of Series RL and RC circuits **Level 2:** Conduct an experiment to perform and verify the impedance and current of RLC series circuits. **Experiment No 3:** Calculation of power and power factor of the given AC Circuit. **Level 1:** Conduct an experiment to measure the power and power factor for given resistive load. **Level 2:** Conduct an experiment to measure the power and power factor for given inductive load. **Experiment No 4:** Perform the experiments on given Transformer. **Level 1:** Verify the EMF equation of a transformer and compute the voltage transformation ratio. **Level 2:** Study the effect of load on the secondary side of the transformer and verify the EMF equation under load conditions. **Experiment No 5:** Load test on DC shunt motor **Level 1:** Conduct load test on DC shunt motor and find its efficiency at different loads **Level 2:** Conduct load test on DC shunt motor and plot the performance characteristics. **Experiment 6:** Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions. **Level 1:** Carry out an experiment to plot VI Characteristics and hence find the cut-in voltage on forward characteristics for the Silicon P-N Junction diode. **Level 2:** Carry out an experiment to plot VI Characteristics of Zener diode and hence find the zener voltage on reverse characteristics for the Silicon P-N Junction zener diode. **Experiment No. 7:** To observe the output waveform of half wave and full wave rectifier circuit and compute ripple factor and efficiency **Level 1:** Identify the components required for a rectifier circuit, rig up the circuit, and sketch the output waveforms without filter. **Level 2:** Rig up the rectifier circuit with RC filter, observe the output waveforms, determine the efficiency and ripple factor. **Experiment 8:** To construct clipping and clamping circuits for different reference voltages and to verify the responses. **Level 1:**Identify the components required for building a Clipper / Clamper circuit. Rig up the circuit according to the circuit diagram given and sketch the output waveform. **Level 2:** Given a sinusoidal input of 10 V p-p, implement a positive / negative clipper with output clipped at 2 V. **Experiment 9:** To calculate various parameters of emitter follower circuit using BJT				

Level 1: Identify the components required to implement an emitter follower circuit. Rig up the circuit and observe the variations in output waveform with respect to the variations in input waveform.
Level 2: Determine the values of Z_{in} input impedance and Z_{out} output impedance for Emitter Follower.
Experiment 10: To Implement RC Coupled amplifier using a BJT and sketch the frequency response.
Level 1: Identify the components required to implement an RC coupled amplifier circuit. Rig up the circuit and sketch the frequency response.
Level 2: From the frequency response curve determine the value of the mid band gain and the bandwidth.

Targeted Application & Tools that can be used:

Targeted Applications: Application Area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: Multisim/ P Spice

Besides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis..

Project Work/ Assignment:

1. Article review: At the end, of course 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.

2. Presentation: There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

3. Case Study: - At the end of the course students will be given a 'real-world' application based circuits like Power Amplifier, Signal/Function Generator etc. as a case study. Students will be submitting a report which will include Circuit Diagrams, Design, Working Mechanism and Results etc. in appropriate format

Text Book(s):

1. Kothari D. P. & Nagrath I. J., "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education
2. 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.
3. A.P.Malvino, Electronic Principles,7thEdition, Tata McGraw Hill,2007
4. J. Millman, C. C. Halkias and C. D. Parikh, "Millman's Integrated Electronics", McGraw Hill Education, 2nd Edition.
5. Basics of Electrical & Electronics Laboratory Manual.

Reference Book (s):

1. John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
2. Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.
3. K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd
4. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.
5. A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition
6. A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition

Online Resources (e-books, notes, ppts, video lectures etc.):

1. https://presiuniv.knimbus.com/user#home
2. https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
3. Seminar Topic: https://nptel.ac.in/courses/108/105/108105153/ "Electrical Measurements"
4. Video lectures on "Electronic Devices" by Prof. Dr. A. N. Chandorkar, IIT Bombay http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html

5. Video lectures on "Analog Electronics" by Prof. S.C. Dutta Roy, IIT Delhi https://nptel.ac.in/courses/108/102/108102095/

6. Video lectures on "Diodes", by Prof. Chitralekha Mahanta, IIT Guwahati, https://nptel.ac.in/courses/117/103/117103063/

E-content:

1. "Introduction to Electrical Machines https://nptel.ac.in/courses/108/102/108102146/"
M. -Y. Kao, H. Kam and C. Hu, "Deep-Learning-Assisted Physics-Driven MOSFET Current Voltage Modeling," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 974-977, June 2022, doi: 10.1109/LED.2022.3168243
https://ieeexplore-ieee-org-resiuniv.knimbus.com/document/9758727
2. F. Bonet, O. Aviñó-Salvadó, M. Vellvehi, X. Jordà, P. Godignon and X. Perpiñà, "Carrier Concentration Analysis in 1.2 kV SiC Schottky Diodes Under Current Crowding," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 938-941, June 2022, doi: 10.1109/LED.2022.3171112. https://ieeexplore-ieeeorg-presiuniv.knimbus.com/document/9764749
3. M. Chanda, S. Jain, S. De and C. K. Sarkar, "Implementation of Subthreshold Adiabatic Logic for Ultralow-Power Application," in IEEE Transactions on Very Large Scale Integration (VLSI) Systems, vol. .23, no. 12, pp. 2782-2790, Dec. 2015.
https://ieeexplore.ieee.org/document/7018053
4. R. Raut and O. Ghasemi, "A power efficient wide band trans-impedance amplifier in submicron
CMOS integrated circuit technology," 2008 Joint 6th International IEEE Northeast Workshop on Circuits and Systems and TAISA Conference, 2008, pp. 113-116, doi: 0.1109/NEWCAS.2008.4606334. https://ieeexplore.ieee.org/document/4606334

Topics relevant to "SKILL DEVELOPMENT": Performing suitable experiments to compute the electric circuit parameters, performance operation of machines, and operation of semiconductor devices for **Skill Development** through **Experiential Learning techniques.** This is attained through assessment component mentioned in course plan.

Catalogue prepared by	Mr Sunil Kumar and Dr Ashutosh Anand
Recommended by the Board of Studies on	19th Bos held on 3rd July 2024
Date of Approval by the Academic Council	24th Academic Council Meeting held on 03/08/2024

<table>
<tr><td>Course Code:
ENG1002</td><td colspan="2">Course Title: Technical English
Type of Course:
1] School Core
2] 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:
1. develop proficiency in using technical vocabulary and terminology.
2. apply language skills for better speaking skills in technical fields.
3. write technical descriptions
4. 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 sessions</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 sessions</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 sessions</td></tr>
</table>

- Product Description
- Process Description
- User Manuals

- Transcoding: Diagrams, charts and images

Module 4	Technical Writing	Assignment	Writing Skills	12 sessions

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: Email 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.

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: **MAT1003**	**Course Title: Applied Statistics** **Type of Course:** School core- **Theory and Integrated course**		**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 1. Apply the techniques of descriptive statistics effectively 2. Interpret the ideas of probability and conditional probability 3. Demonstrate the knowledge of probability distributions 4. Compute statistical parameters, correlation and regression, probability and sampling distributions using R software.					
Module 1	Descriptive Statistics	Assignment	Coding needed	12sessions		
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		
Introduction 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	15 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	12 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

<table>
<tr><td>Course Code:
CSE1004</td><td colspan="4">Course Title: Problem Solving Using C
Type of Course: School Core Lab Integrated.</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="9">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="9">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="9">NIL</td></tr>
<tr><td>Course Description</td><td colspan="9">The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.</td></tr>
<tr><td>Course Object</td><td colspan="9">The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="9">On successful completion of this course the students shall be able to:
1. Write algorithms and to draw flow charts for solving problems
2. Demonstrateknowledgeanddevelopsimpleapplicationsin Cprogrammingconstructs
3. Develop and implement applications using arrays and strings
4. Decompose a problem into functions and develop modular reusable code
5. Solve applications in C using structures and Union
6. Design applications using Sequential and Random Access File Processing.</td></tr>
<tr><td>Course Content:</td><td colspan="9"></td></tr>
<tr><td>Module1</td><td colspan="3">Introduction to C Language</td><td>Quiz</td><td colspan="2">Problem Solving</td><td colspan="2">9 Sessions</td></tr>
<tr><td colspan="10">Topics: Introduction to Programming – Algorithms – Pseudo Code -Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.</td></tr>
<tr><td>Module2</td><td colspan="3">Introduction to Arrays and Strings</td><td>Quiz</td><td colspan="2">Problem Solving</td><td colspan="2">9 Sessions</td></tr>
<tr><td colspan="10">Topics: Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs –Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs– Matrix operations. Strings: Introduction– Declaring and Initializing String Variables–Reading Strings from Terminal–Writing String to Screen– String Handling Functions.</td></tr>
<tr><td>Module3</td><td colspan="3">Functions and Pointers</td><td>Quiz</td><td colspan="2">ProblemSolving</td><td colspan="2">9 Sessions</td></tr>
<tr><td colspan="10">Topics: Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion.
Pointers: Introduction – Declaring Pointer Variables–Initialization of Variables –Pointer Operators–Pointer Arithmetic–Arrays and Pointers–Parameter
Passing: Pass by Value, Pass by Reference.</td></tr>
<tr><td>Module4</td><td colspan="3">Structures and Union</td><td>Quiz</td><td colspan="2">Problem Solving</td><td colspan="2">9 Sessions</td></tr>
<tr><td colspan="10">Topics: Structures: Introduction–Defining a Structure–Declaring Structure Variable–Accessing Structure Members –Array of Structures –Arrays within Structures–Union: Introduction–Defining and Declaring Union–Difference Between Union and Structure.</td></tr>
<tr><td>Module5</td><td colspan="3">File handling</td><td>Case Study</td><td colspan="2">Problem Solving</td><td colspan="2">9 Sessions</td></tr>
<tr><td colspan="10">Topics: Files: Defining and Opening a File –Closing a File–Input/ Output Operation File – Random Access Files</td></tr>
</table>

List of Practical –Tasks Lab Sheet
1(Module I)
Programs using IO Statements, Conditional Statements and Looping Statements
Lab Sheet 2(Module II)
Programs using Arrays and Strings
LabSheet3(ModuleIII)
Programs using Functions and Pointers
Lab Sheet4(ModuleIV)
Programs using Structures and Unions
Lab Sheet5(ModuleV)
Programs using Files

Text Book(s):

1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.

Reference Book(s):

1. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
2. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015
4. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
5. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

Web Links and Video Lectures:

1. https://nptel.ac.in/courses/106/105/106105171/
2. https://archive.nptel.ac.in/courses/106/104/106104128/

Catalogue prepared by	**Dr S Hasan Hussain**
Recommended by the Board of Studies on	BOSNO :SOCSE 2nd BOSheldon10/07/23
Date of Approval by the Academic Council	AcademicCouncilMeetingNo21,Dated 06/09/2023

Course Code: **MAT1001**	**Course Title: Calculus and Linear Algebra** **Type of Course:** **1]School Core Lab Integrated**	**L-T-P-C**	**3**	**1**	**0**	**4**
Version No.	2.0					
Course Pre-requisites	Basic Concepts of Limits, Differentiation, Integration					
Anti-requisites	**NIL**					
Course Description	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.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "**CALCULUS AND LINEAR ALGEBRA" **and attain Skill Development through problem solving techniques**.					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Comprehend the knowledge of applications of matrix principles. 2) Understand the concept of partial derivatives and their applications. 3) Apply the principles of integral calculus to evaluate integrals. 4) Adopt the various analytical methods to solve differential equations.					
ourse Content:						
Module 1	Linear Algebra				16 sessions	
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. gineering Applications of Linear Algebra.						
Module 2	Partial Derivatives				14 sessions	
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.						
Module 3	Integral calculus				14 sessions	
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.

Beta and Gamma functions–inter-relation-evaluation of integrals using gamma and beta functions. Evaluate double & triple integrals.

Module 4	Differential Equations	Assignment		Programming	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	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:
MEC1004</td><td colspan="2">Course Title: Elements of Mechanical Engineering
Type of Course: Professional core Theory & Laboratory Integrated</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">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 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.</td></tr>
<tr><td>Course Objective</td><td colspan="7">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.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">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.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Thermal Engineering</td><td>Assignment</td><td colspan="3">Data Collection/any other such associated activity</td><td>4 Sessions</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>Module 2</td><td>Prime Movers</td><td>Assignment</td><td colspan="3">Data Collection/any other such associated activity</td><td>4 Sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction to different types of prime movers like IC engines (4-stroke) and Turbines (Water).</td></tr>
<tr><td>Module 3</td><td>Mechanical Power Transmission Drives</td><td>Assignment- Quiz</td><td colspan="3">Data Collection/any other such associated activity</td><td>4 Sessions</td></tr>
<tr><td colspan="8">Topics:
Classification of different power transmission systems.</td></tr>
<tr><td>Module 4</td><td>Manufacturing Processes</td><td>Assignment -Quiz</td><td colspan="3">Data Collection/any other such associated activity</td><td>3 Sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction to Manufacturing processes deals with machines tools, welding (arc)</td></tr>
</table>

List of Laboratory Tasks:	
Experiment N0 1: Making of TWO / THREE welding models using Arc Welding technique.	4 Sessions
Experiment No. 2: Making of TWO simple sheet metal models and joining using Soldering technique.	4 Sessions
Experiment No. 3: Making of TWO fitting models.	4 Sessions
Experiment No. 4: Plumbing, electrical wiring and other Life Skill techniques. Any TWO to be done. Targeted Application & Tools that can be used:	4 Sessions

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.

<table>
<tr><td>Course Code:
ENG2001</td><td colspan="3">Course tittle: Advanced English
Course Type: School Core</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="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">ENG1002 Technical English</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 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="8">On successful completion of the course the students shall be able to:
1. Recognize the elements of interpersonal and cross-cultural communication to address communication challenges effectively.
2. Demonstrate the ability to deliver structured and impromptu speeches using effective speaking techniques.
3. Interpret textual and visual materials using critical reading strategies to evaluate arguments, logic, and persuasion.
4. Produce persuasive and analytical essays using effective argumentation techniques and structured writing strategies.</td></tr>
<tr><td colspan="9">Course Content: Theory</td></tr>
<tr><td>Module 1</td><td colspan="2">Foundations of Effective Communication</td><td>Case Studies/ Role play</td><td colspan="2">Cross-Cultural Competency</td><td colspan="3">4 sessions</td></tr>
<tr><td colspan="9">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 colspan="2">Mastering Speech Delivery</td><td>JAM</td><td colspan="2">Public Speaking Confidence</td><td colspan="3">4 sessions</td></tr>
<tr><td colspan="9">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 colspan="2">Critical Reading and Logical Analysis</td><td>Worksheet</td><td colspan="2">Critical Thinking and Analysis</td><td colspan="3">4 sessions</td></tr>
<tr><td colspan="9">Topics:
• 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</td></tr>
<tr><td>Module 4</td><td colspan="2">Writing Effective Arguments</td><td>Assignment</td><td colspan="2">Clear and Coherent Writing</td><td colspan="3">3 sessions</td></tr>
</table>

Topics**:**

- Understanding Critical Writing
- Building Arguments (Pathos, Ethos, Logos)
- Techniques for Persuasion

Course Content: Practical Sessions

Module 1	**Foundations of Effective Communication**	8 sessions

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 sessions

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 sessions

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 sessions

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	**8th January 2025**
Date of Approval by the Academic Council	

Course Code: **MEC1006**	**Course Title: Engineering Graphics** **Type of Course:** **1] Professional Core Course** **2] Theory**	**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 sessions : 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 sessions : 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 sessions : 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 sessions : 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.			

Course Code: MEC2020	**Course Title: Material Science and Metallurgy** **Type of Course: Professional core & Theory only**	**L-T-P-C**	3-0-0-3
Version No.	1		
Course Pre-requisites	NIL		
Anti-requisites	NIL		
Course Description	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.		
Course Out Comes	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.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Material Science and Metallurgy**" and attain **SKILL DEVELOPMENT** through Participative learning techniques.		
Course Content:			

Module 1	Introduction to crystal structures and diffusion:	12 Sessions
Topics: Fundamental concepts, atomic structure, atomic bonding, crystal structure, defects and diffusion [Remember Level]		
Module 2	Phase diagram:	10 Sessions
Topics: Solidification, Phase Equilibria, Phase transformation, Iron carbon system, Numericals [Understanding Level]		
Module 3	Heat treatment:	10 sessions
Topics: TTT diagram, CC curve, Microstructures developed, Different Heat Treatment processes. [Understanding Level]		
Module 4	Engineering materials	13 Sessions
Topics: Properties and applications of alloy steels, tool steels, cast iron, copper and Al base alloy, Ni base alloys, Composites, ceramics, Polymers. [Remember Level]		
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).	
Text Book **T1:** G.E. Dieter, "Mechanical Metallurgy", G. E. Dieter. Mechanical Metallurgy, Mc Graw Hill Book Co., New York 1986. **T2:** **"**Metallography and Materials Testing Lab Manual", Presidency University	
References **R1:** W. D. Callister, "Material Science and Engineering: An Introduction", Wiley. **R2:** 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 **Participative learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Vivek Kumar Pandey, Assistant Professor
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: **CSE1006**	**Course Title:** Problem Solving using JAVA **Type of Course: Professional Core and Integrated**	**L-T- P- C**	1	0	4	3
Version No.	2.0					
Course Pre-requisites	CSE1004 – Problem Solving Using C					
Anti-requisites	Nil					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA 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 basic programming concepts. [Understand] **CO2:** Apply the concept of classes, objects and methods to solve problems. [Application] **CO3:** Apply the concept of arrays and strings. [Appy] **CO4:** Implement inheritance and polymorphism building secure applications. [Apply] **CO5:** Apply the concepts of interface and error handling mechanism. [Apply]					
Course Content:						
Module 1	Basic Concepts of Programming and Java	Assignment	Problem Solving	15 Sessions (L3 + P12)		
Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.						
Module 2	Classes, objects, methods and Constructors	Assignment	Problem Solving	17 Sessions (L3 + P14)		
Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.						
Module 3	Arrays, String and String buffer	Assignment	Problem Solving	13 Sessions (L3 + P10)		
Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.						
Module 4	Inheritance and Polymorphism	Assignment	Problem Solving	17 Sessions (L3 + P14)		
Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.						
Module 5	Input & Output Operation in Java	Assignment	Problem Solving	13 Sessions (L3 + P10)		

Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.
P1: Programming Exercises on Basic Concepts. LEVEL 1: Discuss about datatypes and variables. LEVEL 2: Demonstrate a simple java program P2: Programming Exercises on Basic Concepts. LEVEL 1: Discuss about datatypes and variables. LEVEL 2: Demonstrate a simple java program P3: Programming Exercises on operators, expressions based on a given scenario. LEVEL 1: Explain operators, expressions. LEVEL 2: Demonstrate operators P4: Programming Exercises Command Line Arguments based on a given scenario. LEVEL 1: Explain command line arguments LEVEL 2: Demonstrate command line arguments P5: Programming Exercises on basic Input/ Output functions and Control Statements: Branching LEVEL 1: Explain Input/ Output functions LEVEL 2:Demonstrate Control Statements: Branching P6: Programming Exercises on Control Statements: Looping LEVEL 1: Explain variour loops. LEVEL 2:Demonstrate Control Statements: Looping P7: Programming Exercises on Creating Objects, classes on a given scenario. LEVEL 1: Illustrate class, object and methods. LEVEL 2: Execute java program using class and objects P8: Programming Exercises on Adding methods and Constructors to the class based on a given scenario. LEVEL 1: Illustrate methods and constructors LEVEL 2: Execute java program using methods and constructors P9: Programming Exercises on methods based on a given scenario. LEVEL 1: Illustrate method overloading LEVEL 2: Apply method overloading for the given scenario. P10: Programming Exercises on methods based on a given scenario. LEVEL 1: Illustrate constructors overloading LEVEL 2: Apply constructor overloading for the given scenario P11: Programming Exercises on methods for static members bassed on a given scenario. LEVEL 1: Benefits of usage static members LEVEL 2: Usage of Static Members for the given scenario P12: Programming Exercises on static methods based on a given scenario. LEVEL 1: Benefits of usage static methods LEVEL 2: Usage of Static Methods for the given scenario. P13: Programming Exercises on nested Classes based on a given scenario. LEVEL 1: Benefits of usage nested classes LEVEL 2: Apply the concept of usage of nested classes for the given scenario P14: Programming Exercises on Arrays and its built-in functions based on a given scenario. LEVEL 1: Illustrate one dimensional arrays and its functions. LEVEL 2: Demonstrate programs with single-dimensional arrays and operations. P15: Programming Exercises on Arrays and its built-in functions based on a given scenario. LEVEL 1: Illustrate multi dimensional arrays and its functions. LEVEL 2: Demonstrate programs with multi-dimensional arrays and operations. P16: Programming Exercises on String Class and its built-in functions based on a given scenario. LEVEL 1: Explain about String class and String methods. LEVEL 2: Execute simple java applications for String and StringBuffer operations P17: Programming Exercises on String Buffer Class and its built-in functions based on a given scenario. LEVEL 1: Explain about StringBuffer class and String methods. LEVEL 2: Execute simple java applications for String and StringBuffer operations

P18: Programming Exercises on String Builders and its built-in functions based on a given scenario.
LEVEL 1: Explain about String Builders.
LEVEL 2: Execute java applications for String Builders
P19: Programming Exercises on single, multi level Inheritance and super keyword based on given scenario.
LEVEL 1: Explain single and multi level inheritance.
LEVEL 2: Demonstrate simple applications for the different types of inheritance
P20: Programming Exercises hierarchical Inheritance and super keyword based on given scenario.
LEVEL 1: Explain hierarchical inheritance.
LEVEL 2: Demonstrate simple applications for hierarchical inheritance
P21: Programming Exercises on Overriding.
LEVEL 1: Differentiate method overloading and method overriding.
LEVEL 2: Demonstrate simple program with dynamic method dispatch.
P22: Programming Exercises on Final based on given scenario.
LEVEL 1: Implement programs using concept of final.
LEVEL 2: Use final keyword for the given problem
P23: Programming Exercises on Abstract keyword based on given scenario.
LEVEL 1: Implement programs using concept of Abstract.
LEVEL 2: Use abstract keyword for the given problem
P24: Programming Exercises on Interface based on a given scenario.
LEVEL 1: Differentiate abstract class about interface
LEVEL 2: Implement interfaces in the given problem
P25: Programming Exercises on Exception Handling based on a given scenario.
LEVEL 1: Explain exception handling
LEVEL 2: Solve the given problem using exception handling mechanism.
P26: Programming Exercises on Character Stream Classes based on a given scenario.
LEVEL 1: Explain Character Stream Classes
LEVEL 2: Solve the given problem using Character Stream Class.
P27: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P28: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P29: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P30: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.

Targeted Application & Tools that can be used : JDK /eclipse IDE/ net Beans IDE.

Text Book

T1 Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 11th Edition,2019.

References

R1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

R3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf

E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)

Web **resources**
ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q
ps://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to development of "Skill Development":

1. Static Polymorphism
2. Method overloading, constructors
3. constructor overloading
4. this keyword
5. static keyword and Inner classes
6. Inheritance and Polymorphism.

for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: ECE2010	**Course Title: Innovative Projects using Arduino**	**L- T-P- C**	0	0	0	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 Arduino microcontrollers and their application in various real time projects involving sensors. Throughout the course, students will learn the fundamentals of Arduino programming and gain hands-on experience with a wide range of sensors. Students will explore how to connect and interface sensors with Arduino boards, read sensor data, and use it to control various output devices This course is suitable for beginners who are interested in exploring the world of electronics and developing practical applications using Arduino and sensors.					
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** 1. Explain the main features of the Arduino prototype board 2. Demonstrate the hardware interfacing of the peripherals to Arduino system. 3. Understand the types of sensors and its functions 4. Demonstrate the functioning of live projects carried out using Arduino system**.**					
Course Content:						

Module 1	Basic concepts of Arduino	Hands-on	Interfacing Task and Analysis	4 Sessions
Topics: Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API's , Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, Arduino i/o Functions, Arduino Communications, Arduino IDE, Various Cloud Platforms.				
Module 2	Sensory Devices	Hands-on	Interfacing Task and Analysis	4 Sessions
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.				
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):

Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition

References

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.

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	BOS NO: 17Th BoS meeting held on 5th July 2023

of Studies on	
Date of Approval by the Academic Council	Academic Council Meeting No. 21 dated on _____

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: 6) Identify the suitable polymers to replace the conventional materials 7) Summarize the importance of various electrochemical sources in energy systems 8) Describe the knowledge of electrochemistry principles for protection of different metals from corrosion. 9) Explain the fundamental principles in water treatment					
Course Content:						
Module 1	Polymers	Case study	Data Collection and analysis	4 sessions		
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 sessions		
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 sessions		
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 sessions		

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=ECATALOGUE_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 Quantifying 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	7th BoS on 25 July 2022
Date of Approval by the Academic Council	18th BOS meeting held on 3rd August 2022

<table>
<tr><td>Course Code:
MEC2021</td><td>Course Title: Material Science and Material Testing Lab
Type of Course: Professional core & Laboratory only</td><td>L-T-P-C</td><td>0-0-2-1</td></tr>
<tr><td>Version No.</td><td colspan="3">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="3">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="3">NIL</td></tr>
<tr><td>Course Description</td><td colspan="3">Materials and Metallurgy 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 Out Comes</td><td colspan="3">On successful completion of the course the students shall be able to:
CO 1: Describe the crystal structure, crystal imperfections and diffusion process in solids
CO 2: Explain phase diagrams and various heat treatment processes.
CO 3: Classify various engineering materials and their applications.
CO 4: Conduct Hardness, tensile, shear and compression tests of metallic specimens.
CO 5: Identify the defects inside the body by using Non-Destructive testing methods.</td></tr>
<tr><td>Course Objective</td><td colspan="3">The objective of the course is to familiarize the learners with the concepts of "Materials and Material Testing Lab" and attain SKILL DEVELOPMENT through Experiential learning techniques.</td></tr>
<tr><td>Course Content:</td><td colspan="3"><table>
<tr><td>Experiment no</td><td>Experiment Name</td></tr>
<tr><td>1</td><td>Study of Hardness of a given specimen using Rockwell Hardness Testing machine.</td></tr>
<tr><td>2</td><td>Study of Hardness of a given specimen using Brinnel Hardness Testing machine</td></tr>
<tr><td>3</td><td>Study of Hardness of a given specimen using Vickers Hardness Testing machine</td></tr>
<tr><td>4</td><td>Izod and Charpy tests on Mild steel, Copper and Brass Specimen</td></tr>
<tr><td>5</td><td>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 & composite</td></tr>
<tr><td>6</td><td>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</td></tr>
<tr><td>7</td><td>Tensile test on metallic (Mild steel) specimens using a Universal testing machine</td></tr>
<tr><td>8</td><td>Compression test on metallic (Mild steel) specimens using a Universal testing machine</td></tr>
</table></td></tr>
</table>

	9	Shear test on metallic (Mild steel) specimens using a Universal testing machine
	10	Bending test on metallic (Mild steel) specimens using a Universal testing machine
	11	Torsion test on metallic (Mild steel) specimens using a Torsion testing machine
	12	Fatigue Test on metallic (Mild steel) specimens using a fatigue testing machine.

Targeted Application & Tools that can be used: 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

T1: "Materials and Metallurgy lab manual" Presidency University.

References

R1: W. D. Callister, "Material Science and Engineering: An Introduction", Wiley.

(iii) Web-Resources:

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=ELSEVIER1_20983

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.

Catalogue prepared by	Dr. Vivek Kumar Pandey
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: MAT2501	**Course Title: Integral Transforms and Partial Differential Equations** **Type of Course:1] School Core**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	Calculus and Differential Equations					
Anti-requisites	**NIL**					
Course Description	This course aims to introduce various transform techniques such as Laplace transform, Fourier transform and Z-transform in addition to expressing functions in terms of Fourier series. The course covers applications of Laplace transform to LCR circuits and solutions of different equations using Z-transform. The course also deals with the analytical methods for solving partial differential equations and the classical applications of partial differential equations.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Transform Techniques, Partial Differential Equations"** and attain **Skill Development through Problem Solving Techniques**.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. CO1 - Express functions in terms of uniformly convergent Fourier series. 2. CO2 - Apply Laplace transform technique to solve differential equations. 3. CO3 - Employ Z-transform techniques to solve difference equations. 4. CO4 - Solve a variety of partial differential equations analytically.					
Course Content:						
Module 1	**Laplace Transforms**		**12 Sessions**			
Definition and Laplace transform of elementary functions. Properties of Laplace transform, and Laplace transform of periodic function, unit-step function and Impulse function – related problems. Inverse Laplace transform of standard functions - problems, initial and final value theorem. Convolution theorem, solution of linear and simultaneous differential equations and LCR Circuit.						
Module 2	**Fourier Series**	**Assignment**	**8 Sessions**			
Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.						
Module 3	**Fourier Transforms and Z - Transforms**		**13 Sessions**			
Fourier Transforms: Definitions, infinite Fourier transforms, Fourier sine and cosine transforms, inverse Fourier transforms, Problems. **Difference equations and Z-transforms:** Z-transforms – Basic definitions, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Difference equations – Basic definitions, Application of Z-transforms to solve difference equations.						
Module 4	**Partial Differential Equations**	**Assignment**	**12 Sessions**			
Formation of PDE, Solution of non-homogeneous PDE by direct integration, Solution of homogeneous PDE involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear PDE. of the type P p + Q q = R. Applications of PDE: Derivation of one-dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two-dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions (Boundary value problems).						
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 to equip them with the necessary numerical approaches and basic statistical tools to tackle engineering and real-life problems.						
Assignment:						

3. Newton-Raphson Methods, Gauss-Seidel Method, LU Decomposition, Trapezoidal Rule, Simpson's rule, Runge-Kutta 4th Order.

Text Book

1. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
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

E-resources/ Web links:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_140238
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_233298
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_204892
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_246791
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_223548
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_134719
7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_32614
8. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
9. 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 differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

Catalogue prepared by	**Dr. Husna**
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: **MEC2514**	**Course Title: Basic Thermodynamics** **Type of Course: 1] Professional Core Course 2] Theory**	**L-T-P-C**	**3**	**1**	**0**	**4**
Version No.	1.0					
Course Pre-requisites	[1] MEC1004: Elements of Mechanical Engineering & Lab [2] MAT1001: Calculus and Linear Algebra					
Anti-requisites	**NIL**					
Course Description	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.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Basic Thermodynamics**" and attain **SKILL DEVELOPMENT** through Problem solving methodologies.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1] Summarize the basic concepts of thermodynamics. 2] Compute the properties of pure substance with the help of steam tables. 3] Apply the first & second laws of thermodynamics to control mass and steady flow control volume system. 4] Predict feasibility of thermodynamic process and availability of maximum work.					
Course Content:						
Module 1	Introduction to Thermodynamics	Case Study	Data Analysis	12 S + 5 T		
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.						
Module 2	Application of First Law	Assignment	Data Collection and Analysis	10S + 5 T		
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						
Module 3	Second Law of thermodynamics and entropy:	Assignment	Data Analysis through Programming	12 S + 5 T		
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				
Module 4	Properties of Pure Substances	Assignment	Simulation & Data Analysis	11 S + 5 T
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				
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: T1. Yunus A Cengel, Michael A, Boles, "Thermodynamics", McGraw Hill Education (India) Pvt Ltd.,5th edition, 2017				
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				
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.				
Catalogue prepared by	Dr.Udaya Ravi M			
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx			
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx			

Course Code: **MEC2502**	**Course Title: Fluid Mechanics and Machinery** **Type of Course:** **1] Professional Core Course**	**L-T-P-C**	**3**	**1**	**0**	**4**
Version No.	1					
Course Pre-requisites	[1] MEC1004 Elements of Mechanical Engineering, [2] MAT1001 Calculus and Linear Algebra					
Anti-requisites	NIL					
Course Description	This Course is designed to present the fundamental laws relating to the static and dynamic behaviour 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.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Fluid Mechanics and Machinery**" and attain **SKILL DEVELOPMENT** through **Problem solving Methodologies.**					
Course Outcomes	CO1 Summarize the basic properties of fluids. CO2 Employ the concept of hydrostatics to various pressure measuring devices. CO3 Apply equations of motion to different types of fluid flows. CO4 Apply the principle of energy conservation to flow measuring devices. CO5 Interpret various energy losses for fluid flow through pipes.					
Course Content:						
Module 1	Introduction to Fluid Mechanics	Assignment	Data collection		8S + 2T sessions	
Topics: Introduction to fluids and fluid mechanics, Concepts of velocity, acceleration, momentum, density, specific gravity, specific volume, viscosity, capillarity, surface tension, bulk modulus, compressibility.						
Module 2	Fluid Statics	Assignment	Mathematical		9S+ 2T sessions	
Topics: Pascal Law and application, Hydrostatic Law and its application, Types of pressures, Conservation of momentum, Pressure Measuring devices – Manometers, Pressure acting on a inclined surface, Buoyancy, Archimedes Principle, Stability conditions for floating bodies**.**						
Module 3	Fluid Kinematics	Assignment	Mathematical		10 S + 5T sessions	
Topics: Definition of fluid kinematics, Velocity, acceleration, change in momentum, law of conservation of mass, types of flows, concept of turbulence, Reynolds number and its importance, Continuity equation (1D & 3D), Hagen Poiseulle's equation, Velocity potential function and stream function and its significance in relevance to rotational and ir-rotational flows.						

Module 4	Fluid Dynamics	Assignment	Mathematical	12S + 4T sessions
Introduction to Fluid dynamics, Conservation of energy, Energy balance equation (Bernoulli's Equation), Flow measuring devices, Boundary Layer theory and basic definitions, Compressible fluid flows**.**				
Module 5	Flow through pipes	Assignment	Mathematical	6 S + 2T sessions
Topics: Concept of friction, Losses during fluid flow- Major and Minor, Pumps and Compressors.				

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.

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 **Problem solving Methodologies**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Prashanth S P
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: MEC2022	**Course Title: Production Technology** **Type of Course: Program Core & Theory Only**	**L-T-P-C**	**4**	**0**	**0**	**4**
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course helps students to develop the understanding of various manufacturing process like casting, welding, metal forming and sheet metal work. To comprehend the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, milling, Drilling, shaping and allied machines, Grinding and allied machines and to understand the behavior of tool under different environment .					
Course Objective	The objective of the course is **skill development** of student by using **Participative 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: Describe the nomenclature of cutting tools and tool life. CO5: Discuss different machining operations using diverse machine tools					
Course Content:						
Module 1	Casting process	Case Study	Compare and analyze the microstructure obtained in different casting process .	12 sessions		
opics: 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.						
Module 2	joining process	Assignment	Learning different welding process	12 sessions		
Topics: 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 3	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 4	Introduction to tools	Assignment	Cutting tool nomenclature & Tool wear	10 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 4	Introduction to Machine Tools	Assignment	Machine tools Operations	14 sessions
Lathe: Centre lathe, constructional features, specification, operations – taper turning methods. Milling Machine-Construction, types, operations, Gear generation method, construction of gear milling, hobbing Drilling Machine-constructional features, specification, operations, Shaper and planner Machine-Construction, operations. Grinding-Surface grinding, centreless grinding and internal grinding.				

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.

Machine tools are used in manufacturing industries to convert raw materials into finished products

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Case study: Compare and analyze the microstructure (grain size) obtained in different casting process.

Assignment: Simulate the open die forging process using Deform software.

Assignment: Programming to calculate machining time on various machine tool in Python.

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:

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.

Web-Resources:

W1: https://nptel.ac.in/courses/112104304

W2: Japanese Production technique, Roy L. Nersesian 2002 https://presiuniv.knimbus.com/user#/searchresult?searchId=metal%20forming&_t=1654838829754

W3**:** Implementation of sustainable manufacturing practices in Indian manufacturing companies, Sumit Gupta, G.S. Dangayach,A.K. Singh,M.L. Meena and P.N. Rao 2018 https://presiuniv.knimbus.com/user#/searchresult?searchId=Rao,%20P.N&_t=1654840680158

Topics relevant to "SKILL DEVELOPMENT": Casting, Forging and different welding techniques for **SKILL DEVELOPMENT** through **Particpative learning Techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Aravinda T Asst. Professor, Dept. of Mechanical Engineering, Presidency University**.**
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: **MEC2023**	**Course Title: Foundry Forging & Welding Lab** **Type of Course: Professional Core/ Laboratory only**	**L-T-P-C**	0	0	2	1
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course helps the students to experience the practical concepts in preparation of green sand moulds using single and multi-patterns, tests for analyzing the properties of green sand such as moisture content, clay content and permeability. It also includes manual forging operations involving preparation of square bar from cylindrical bar and bolt preparation. The students will have hands on experience of different welding operations which include arc welding, gas welding, the TIG and MIG welding processes.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Foundry Forging & Welding Lab**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.					
Course Out Comes	After successful completion of the course the students shall be able to: 1. Prepare green sand molds using different patterns and produce casting. 2. Analyze different properties required in mold sand and core sand. 3. Demonstrate different forging operations 4. Demonstrate different welding operations					
Course Content	**Total Sessions-30** **Exp. 01:** Brief introduction to laboratory and its equipment's, devices, tools and safety instructions.-2 Sessions **Exp. 02:** Sand Mold preparation using single piece pattern-2 Sessions **Exp. 03:** Sand Mold preparation using multi-piece pattern. 2 Sessions **Exp.04:** Sand mold Preparation Without using a pattern **-**2 Sessions **Exp. 05:** Shear strength test, Compression test **-**2 Sessions **Exp. 06:** Tensile Test & Transverse test of core sand **-**2 Sessions **Exp.07:** Sieve Analysis on sample sand-2 Sessions **Expt.08:** Permeability Test **-**2 Sessions **Exp.09:** Forging Operation-1- 3 Sessions **Exp. 10:** Forging Operation-2 -3 Sessions **Exp. 11:** Welding Operation 1: Gas Welding, Spot Welding- 2 Sessions **Exp. 12**: Welding operation 2: Tig Welding, Mig Welding- 2 Sessions					
Targeted Application & Tools that can be used: Foundary Forging & Lab						
Text Book T1: P N Rao, "*Manufacturing Technology* – Vol. 1", McGraw Hill Education.						
References [1] Nagendra Parashar B.S., Mittal R.K., "Elements of Manufacturing Processes", PHI publications. [2] Kalpakjian and Steven Schmid," Manufacturing Engineering and Technology", Prentice Hall. **Web Resources:** https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueid=INTECH_1_2609						
Topics relevant to "SKILL DEVELOPMENT": Casting, Forging and different welding techniques for **SKILL DEVELOPMENT** through **Experiential 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	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

<table>
<tr><td>Course Code:
MEC2503</td><td>Course Title: Fluid Mechanics and Machinery Lab
Type of Course: Professional core & Laboratory only</td><td>L-T-P-C</td><td>0-0-2-1</td></tr>
<tr><td>Version No.</td><td colspan="3">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="3">[1] MEC 1004 Elements of Mechanical Engineering, [2] MAT 1001 Calculus and Linear Algebra</td></tr>
<tr><td>Anti-requisites</td><td colspan="3">NIL</td></tr>
<tr><td>Course Description</td><td colspan="3">This is an introductory course where the flow behavior, fluid forces and analysis tools are introduced. The goals of the experiments include determination of forces generated when fluid flow takes place over a solid object, applications of the control volume approach, demonstration of the momentum and energy equations and engineering correlations. Intricate flow phenomena such as separations and transition to turbulence are demonstrated. Experimental setups such as flow through a tube, flow over a flat plate, wind tunnel and smoke tunnel are made available to the students. The lab experiments utilize U-tube manometer, stop watch and data acquisition.</td></tr>
<tr><td>Course Out Comes</td><td colspan="3">On successful completion of the course the students shall be able to:
CO1: Analyze the pipe flow and flow measurements in various channels.
CO2: Explain the procedure of performance analysis of turbines and pumps in various operating conditions
CO3: Describe the basics quantities of fluid flow phenomena
CO4: Find the head losses in various fluid machineries</td></tr>
<tr><td>Course Objective</td><td colspan="3">The objective of the course is to familiarize the learners with the concepts of "Fluid Mechanics and Machineries" and attain SKILL DEVELOPMENT through Experiential learning techniques.</td></tr>
<tr><td>Course Content:</td><td colspan="3"><table>
<tr><th>Session No.</th><th>Name of the Experiment</th></tr>
<tr><td>01</td><td>Verify the Bernoulli's Theorem and plot a graph of total energy vs. distance.</td></tr>
<tr><td>02</td><td>Study the transition zone using Reynold's Number.</td></tr>
<tr><td>03</td><td>Determine Coefficient of Discharge C_d</td></tr>
<tr><td>04</td><td>Determine coefficient of discharge C_d</td></tr>
<tr><td>05</td><td>To study and determine the fluid forces acting on the different types of vanes</td></tr>
<tr><td>06</td><td>Determine coefficient of Discharge C_d and Coefficient of Velocity C_v</td></tr>
</table></td></tr>
</table>

	07	Determine the friction factor for pipes
	08	Determine head loss and loss coefficient for pipe fitting
	09	Determine coefficient of discharge C_d
	10	Study of rotameter
	11	Study of centrifugal pump
	12	Study of axial flow fan
	13	Study of Kaplan turbine
	14	Study of Pelton wheel turbine
	15	Study of francis turbine
	16	Study of wind tunnel

Targeted Application & Tools that can be used: Orifice Meter, Venturi Meter, Turbines and other flow measurement machines

Text Book

T1: "Fluid Mechanics and Machinery Laboratory Manural" Presidency University.

T2: P. N Modi and S. M. Seth, "Hydraulics and Fluid Mechanics, "Rajsons Publications Pvt. Limited.

References

R1 White, Frank M., "Fluid Mechanics" McGraw Hill Education (India).

R2 Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, John W. Mitchell, "Fluid Mechanics: SI Version" Wiley India.

R3 Fluid Mechanics and Hydraulic Machines by RK Banzal, Laxmi Publications Pvt Ltd.

(iii) Web-Resources:

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

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 **experimental Learning techniques**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Prashanth S P
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: MEC2024	**Course Title: Metrology and Measurements** **Type of Course: Professional Core**		**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	MAT1001					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Metrology And Measurement**" and attain **SKILL DEVELOPMENT** through Participative learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Explain the purpose, parameters, and error sources in measurement systems, including accuracy, precision, and regression analysis. 2. Apply calibration principles, measurement techniques, and comparator-based systems for linear and angular measurements. 3. Analyze and design limits, fits, tolerances, and apply geometric dimensioning and tolerancing (GD&T) for manufacturing applications. 4. Utilize mechanical and surface metrology tools for assessing dimensional and surface characteristics of components. 5. Evaluate thermal and flow parameters using advanced measurement systems and transducers.					
Course Content:						
Module 1	Measurement Purpose and Parameters	Assignment	Data Collection	8 sessions		
Topics: Parameters: Geometry (straightness, flatness, roundness), displacement, force, speed, torque, flow, pressure, temperature, acceleration. Definitions: Accuracy, precision, range, resolution, uncertainty, and error sources. Regression analysis: Applications in measurement and data evaluation.						
Module 2	Measurement Principles	Case Study	Lab based activity	8 sessions		
Topics: Structure and examples of measurement systems.Calibration principles: Importance and techniques.Linear measurements: Vernier calipers, micrometers, and slip gauges. Angular measurements: Sine bar, bevel protractor, and taper gauges.Comparators: Mechanical, electrical (LVDT), and pneumatic comparators.						
Module 3	Limits, Fits, Tolerances, and GD&T	Case Study	CMM study in lab	10 sessions		
Topics: Definitions: Tolerance zones, grades, and geometric tolerances.Hole and shaft systems: IT grades and applications in assembly.Taylor's principle of gauging and gauge design. Geometric dimensioning and tolerancing (GD&T): Symbols, datums, and tolerances.						

Case studies: GD&T in industrial applications				
Module 4	Mechanical and Surface Metrology	Assignment	Awareness of different software for surface texture.	10 sessions
Topics: Dimensional metrology: Form tester, CMM, and 3D scanning tools.Surface metrology: Surface roughness parameters and their significance.Tools for surface measurement: Stylus system, optical microscopes, and laser scanning.Process metrology: Tool wear, work piece quality, and process monitoring				
Module 5	Thermal and Flow Measurements	Assignment	Lab based activity.	09 sessions
Topics: Thermal measurement: Devices for measuring temperature, thermal conductivity, and diffusivity.Examples: Thermocouples, RTDs, thermistors, pyrometers. Flow measurement: Obstruction methods, magnetic flow meters, and ultrasonic flow meters.Transducers: Types (strain gauges, displacement transducers), working principles, and industrial applications.Digital data acquisition: Interfacing transducers with electronic control systems.				
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.				
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.				
References 1] "Metrology and Measurements Lab Manual", Presidency University. 2) Frank R Spellman, " The handbook of Meterology",				
Topics relevant to "SKILL DEVELOPMENT": Screw Thread Measurement, Bevel Protractor for **SKILL DEVELOPMENT** through **Participative learning techniques** . This is attained through the assessment component mentioned in the course handout				
Catalogue prepared by	Dr. Sandeep G M			
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx			
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx			

Course Code: MEC2025	**Course Title: Metrology and Measurements Lab** **Type of Course: Professional Core/ Laboratory only**	**L-T-P-C**	**0**	**0**	**2**	**1**
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 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 to the theory and methods for conducting experimental work in the laboratory and calibration of various instruments.					
Course Objective	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.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Demonstrate basic knowledge of measurement systems and their components. 2. Operate various instruments for measuring mechanical and electrical parameters accurately. 3. Integrate measurement systems for process monitoring and control. 4. Design and apply limits, fits, and tolerances for practical applications.					
Course Content:						

List of Experiments:Total sessions-30
Dimensional Metrology
1. Calibration of Vernier calipers and micrometers for dimensional accuracy.
2. Measurement of angles using sine bar, sine center, and bevel protractor.
3. Verification of dimensions and tolerances using slip gauges and gauge blocks.Form Metrology
4. Measurement of gear tooth profiles using gear tooth Vernier and micrometer.
5. Measurement of screw thread parameters using floating carriage micrometer. Surface Metrology
6. Surface finish measurement using a surface profiler or optical microscope.
7. Use of autocollimators for angular measurement and alignment.Mechanical Measurements
8. Calibration and testing of strain gauges for stress and strain measurements.
9. Calibration of linear variable differential transformers (LVDT) for displacement measurement.Data Acquisition and Advanced Metrology
10. Coordinate measuring machine (CMM) for dimensional analysis and 3D scanning.
11. Calibration of pressure transducers and thermocouples.
12. Study and implementation of digital data acquisition systems: interfacing transducers with control and measurement systems.

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.
Applications: Quality assurance, process control, aerospace, automotive, and industrial metrology.

Tools and Software: CMM & MCOSMOS.	
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.	
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",	
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 plan	
Catalogue prepared by	Dr. Sandeep G M
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: MAT2502	**Course Title: Numerical Methods and Complex Variables** **Type of Course:1] School Core**	**L-T- P- C**	**3**	**0**	**0**	**3**
Version No.	2.0					
Course Pre-requisites	Calculus & Differential Equations					
Anti-requisites	NIL					
Course Description	Numerical methods contain solutions of system of linear equations, roots of non-linear equations, interpolation, numerical differentiation and integration. It plays an important role in solving various engineering sciences problems. Complex Variable is functions involving complex numbers as variables, exploring concepts like limits, continuity, differentiation, integration, and series within the complex plane, with a focus on key topics like Cauchy-Riemann equations, complex exponentials, contour integration, residues, and applications to solving real-world problems in physics and engineering.					
Course Objective	Numerical methods is to provide approximate, yet accurate solutions to complex mathematical problems that are often difficult or impossible to solve analytically, by using computational techniques to generate solutions through iterative processes, especially when dealing with real-world scenarios involving large datasets or intricate equations. Complex variable is to study the techniques of complex variables and functions together with their derivatives, Contour integration and transformations. To study complex power series, classification of singularities, calculus of residues and its applications in the evaluation of integrals, and other concepts and properties.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1 - Demonstrate the applications of numerical methods to find the roots of polynomial equations and eigen values of real symmetric matrices. CO2 - Interpret the fitted parameters and apply curve fitting techniques to real-world data analysis problems. CO3 - Apply various numerical methods for solving linear Ordinary & Partial differential equations arising in engineering field. CO4 - Apply the Cauchy-Riemann equations to identify analytic functions.					
Course Content:						
Module 1	**Solution of Linear Systems of Equation**					***(10 Classes)***
Solution of algebraic and transcendental equations: Various types of errors - Bisection method, Regula-Falsi method, Newton-Raphson method, Graffe's method - Bairstow's method - Newton's method for solving f(x,y) = 0 and g(x,y) = 0, secant method, Fixed point iteration method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method, Iterative methods of Gauss Jacobi and Gauss Seidel, Sufficient conditions for convergence - LU decomposition method, Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.						
Module 2	**Interpolation and Curve Fitting**	**Assignment**				***(10 Classes)***
Newton's forward and backward interpolation, Divided difference method, Lagrange's method. Method of least squares to fit equations of the form $y = ax + b$, $y = ax^2 + bx + c$, $y = ae^{bx}$, $y = ab^x$ and $y = ax^b$.						
Module 3	**Numerical Differentiation and Integration**					***(10 Classes)***
Numerical differentiation, Numerical integration: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Gaussian quadrature rule. Solution of ordinary differential equations: Taylor series method, modified Euler's method, Runge-Kutta method for 4th order. Euler's method - Taylor's method - Runge-Kutta method of fourth order - Numerical solution of Laplace equation - One-dimensional heat flow equation and wave equation by finite difference methods.						
Module 4	**Complex Variables**	**Assignment**				***(15 Classes)***
Introduction, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic						

conjugate; Conformal mappings.
Complex Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Targeted Application & Tools that can be used:
Numerical methods are widely applied in various fields like engineering, physics, finance, and biology, primarily used to solve complex problems where analytical solutions are difficult or impossible to find, allowing for the approximation of solutions through computational algorithms.
Complex variable methods are applied to elliptical problems in fluid mechanics, and linear elasticity. The techniques presented for solving parabolic problems are the Laplace transform and separation of variables, illustrated for problems of heat flow and soil mechanics.

Assignment:

1. Calculate its absolute and relative errors for different input values using a numerical method like the Taylor series approximation.
2. Given sin 45° = 0.7071, sin 50° = 0.7660, sin 55° = 0.8192, sin 60° = 0.8660 find sin 57° $and\ sin$ 52° using an appropriate interpolation formula.
3. Find the equation of the polynomial which passes through the points (4,-43), (7, 83), (9, 327), (12, 1053) using Newton's divided difference interpolation formula.

Text Book

1. Brown & Churchill, Complex Variables and Applications, McGraw Hill Higher Education; 9th edition.
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition.
2. 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.
3. Carlos A. Berenstein & Roger Gay, Complex Variables - An Introduction, Springer-Verlag New York Inc.

E-resources/ Web links:

10. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_166145
11. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_141727
12. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_135224
13. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_246791
14. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_190270
15. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
16. 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 differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

Catalogue prepared by	**Dr. Chandni Kumar & Dr. Heena Firdose**
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: **MEC2504**	**Course Title: Theory of Machines** **Type of Course:** **1] Professional Core Course** **2] Theory**	**L- T-P- C**	**3**	**1**	**0**	**4**
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 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, and 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, balancing, gyroscope and governors.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Theory of Machines**" and attain **SKILL DEVELOPMENT** through Problem solving methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: 1)To help students comprehend the basic ideas of mechanism 2) To help students comprehend how cams, gears, and flywheels work. 3) To impart understanding of mechanism design and the dynamic loads that affect the mechanism. 4) Construct the velocity and acceleration profile of kinematic analysis on planar mechanisms 5)To give an insight on the concepts of balancing, vibration and speed governing devices					
Course Content:						
Module 1	Introduction to Mechanisms and kinematics	Assignment	Programming Task, Data Analysis task		09 sessions+03T	
Topics:Introduction, mechanisms and machines, terminology, planar mechanism - Kinematic diagram and inversion, Mobility, Coincident joints, Grubbler and Grashoff's law, Four bar, single and double slider mechanisms and their inversions.						
Module 2	Velocity and Accelerations in Mechanisms	Quiz	Analytical thinking		09 sessions+3T	

Velocity and acceleration in planar mechanisms - Relative velocity method, Coriolis component of acceleration, Kennedy's Theorem, Instantaneous Centre method.				
Module 3	Kinematic analysis of Cams and Gears	Assignment	Data Collection and Analysis	09 sessions+05T
Topics: .Cams: Types of cams – Types of followers – Definitions – Motions of the followers – Layout of cam profiles. Gear: terminology, fundamental of gearing, involute profile, interference and undercutting, minimum number of teeth, contact ratio - Gear trains: simple, compound and epicyclic problems				
Module 4	Synthesis of planar mechanism and Dynamic Force Analysis	Assignment	Data Collection and Analysis	09 sessions+05T
Topics:Two position and Three position synthesis of planar mechanism - Graphical and analytical methods - Freudenstein equation. Introduction-D' Alembert's principle-static and inertial force analysis of reciprocating engine Equivalent dynamic system. Turning moment diagram-four stroke engine-multicylinder engine-design of flywheel of IC engine-design of flywheel rim- design of flywheel of punching press.				
Module 5	Balancing and Vibration and Governors and Gyroscope	Assignment	Data Collection and Analysis	09 sessions+03T
Static and Dynamic Balancing of Rotating Masses, Balancing of Reciprocating Masses. Introduction to vibration - Terminologies - Single degree of freedom- damped and undamped-free and forced vibration – Vibration isolation and Transmissibility. Transverse vibrations of shafts – Whirling of shaft -Torsional vibration of single rotor and two rotors' systems.				

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	Dr Yuvaraja Naik
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: **MEC2505**	**Course Title: Mechanics of Solids** **Type of Course:** **1] Professional Core Course** **2] Theory**	**L- T-P- C**	4	0	0	4
Version No.	1.0					
Course Pre-requisites	MAT1001 Calculus and Linear Algebra					
Anti-requisites	**NIL**					
Course Description	This course is well designed to provide a fundamental understanding of the behavior of materials under different loading conditions, both static and dynamic. These materials are part of engineering structures and machines. It focuses on developing the skills to model and analyse 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.					
Course Objective	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.					
Course Outcomes	CO1 Compute the Normal and temperature Stress and Strain in Mechanical components. CO2 Estimate Principal stresses and strains and draw Mohr's circle. CO3 Resolve the Shearing and Bending forces and draw their diagrams. CO4 Obtain the Bending and Shearing Stresses and draw their diagrams. CO5 Illustrate twisting moment and Torsion in shafts CO6 Evaluate Hoop stress in thin and thick cylinders CO7 Predict deflection in beams by different techniques..					
Course Content:						
Module 1	Simple Stresses and Strains	Assignment	Data collection	13 sessions		
Topics: Brief Introduction, Stress and strain graphs and concepts, elastic constants, axial loads, statically indeterminate axially loaded members, thermal stress and strain. Numerical						
Module 2	Compound Stress and Strains Shear Force and Bending Moment diagrams	Assignment	Mathematical	13 sessions		
Topics: Stress at a point on different planes in 2-D, transformation of stresses, principal and maximum shear stresses, Mohr's Circle. Numerical. Shear Force and Bending moment diagrams for cantilever, simply supported and overhanging beams with all types of loads. Numerical on SFD & BMD.						
Module 3	Bending and Shear Stresses	Assignment	Mathematical	10 sessions		
Bending stresses in beams. Bending equation. Numerical. Shear stress distribution in beams. Numerical.						
Module 4	Torsion and Thin & Thick Cylinders	Assignment	Mathematical	12 sessions		
Topics: Torsion, angle of twist, Torsion Equation. Numerical. Introduction to thick and thin cylinders. Hoop stress and tangential stress. Numerical.						
Module 5	Deflection of Beams	Assignment	Mathematical	12 sessions		

Topics: Introduction to deflection of Beams and method of Integration, Macaulay's method and Moment area methods for solution.
Targeted Application & Tools that can be used: Application Area is Geophysical phenomenon, Aerospace, Aerodynamics, Microfluidics, Pipe network, Turbo-machinery. Industries using above applications and tools – Siemens, Quest Global, TATA, Simulent consulting, Triveni Engineering, GE etc
TEXTBOOKS: 1. E. P. Popov, "Engineering Mechanics of Solids", Prentice Hall, 2. S Ramamrutham, R Narayanan, "Strength of Materials 16/e", Dhanpath Rai Publishing Co Pvt Ltd., **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 plan.

Catalogue prepared by	Dr. Udaya Ravi M
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: **MEC2515**	**Course Title: Applied Thermodynamics** **Type of Course:** **1] Professional Core Course 2] Theory**		**L- T-P- C**	**3**	**1**	**0**	**4**
Version No.	2.0						
Course Pre-requisites	MEC3226: Basic Thermodynamics						
Anti-requisites	NIL						
Course Description	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.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Applied Thermodynamics**" and attain **SKILL DEVELOPMENT** through Problem solving methodologies.						
Course Outcomes	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.						
Course Content:							
Module 1	Reciprocating Internal Combustion Engine	Assign ment	Data Collection/any other such associated activity	15 sessions			
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.							
Module 2	Gas turbine and Jet propulsion	Assign ment	Data Collection/any other such associated activity	15 Sessions			
Topics: Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency.							
Module 3	Vapour Power Cycles	Assign ment-Quiz	Data Collection/any other such associated activity	15 Sessions			
Topics:							

<table>
<tr><td colspan="5">Carnot cycle, Rankine cycle, reheat cycle, regenerative cycle, steam cycles for nuclear power plant, back-pressure and extraction turbines and cogeneration.</td></tr>
<tr><td>Module 4</td><td>Refrigeration Cycle</td><td>Assign ment - Quiz</td><td>Data Collection/any other such associated activity</td><td>15 Sessions</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td colspan="5">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</td></tr>
<tr><td colspan="5">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:
3. Michael J. Moran and Howard N. Shapiro, “Fundamentals of Engineering Thermodynamics”, 8th Edition, John Wiley & Sons, 2014.
4. P.K. Nag, “Engineering Thermodynamics” 5th Edition, McGraw-Hill Education, 2013.
5. 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”: 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 plan.</td></tr>
<tr><td colspan="2">Catalogue prepared by</td><td colspan="3">Mr. Narender Singh</td></tr>
<tr><td colspan="2">Recommended by the Board of Studies on</td><td colspan="3">BOS NO: 15th BOS held on 29/7/2022</td></tr>
<tr><td colspan="2">Date of Approval by the Academic Council</td><td colspan="3">Academic Council Meeting No. 18, Dated 03/08/2022.</td></tr>
</table>

Course Code: MEC2516	**Course Title: Heat and Mass Transfer** **Type of Course: Program core & Theory only**	**L-T-P-C**	3-1-0-4
Version No.	1.0		
Course Pre-requisites	MEC3226, MEC4003		
Anti-requisites	NIL		
Course Description	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. The Course also involves Radiative heat transfer, Emissivity, Stefan Boltzmann constant, solar radiation and radiation properties of an environment, heat transfer between black surfaces, shape factor formula for open ends of cylinders and effective emissivity of finned surface, condensation and boiling, principles of mass transfer.		
Course Out Comes	On successful completion of the course the students shall be able to: CO1. Apply the concept of steady state conduction heat transfer in solids. CO2. Employ the methods of lumped heat capacity to solve unsteady-state conduction problems. 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 Objective	The objective of the course is to familiarize the learners with the concepts of "**Heat and Mass Transfer**" and attain SKILL DEVELOPMENT through Problem solving Methodologies.		
Course Content:			

Module 1 Conduction 15 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 –problems. [Apply level]

Module 2 Transient Conduction 8 sessions

Topics: Unsteady state conduction in one dimension – significance of Biots and Fourier's number – classification and identification of the given transient case – lumped heat capacity system –problems.

[Apply level]

Module 3 Convection 15 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 flow – heat transfer coefficients – empirical correlations. Natural convection – heat transfer from vertical plate– empirical relation in free convection. [Apply level]

Module 4 **Radiation** 15 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. [Apply level]

Module 5 **Heat exchangers** 8 Sessions

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. Problems. [Apply level]

Targeted Application & Tools that can be used: Conductions Heat Transfer, convection heat transfer, radiation heat transfer, heat exchangers.

Text Book

T1: J P Holman, Souvik Bhattacharyya, "Heat Transfer" McGraw Hill Education (India) Pvt Ltd.

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

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.

(iii) Web-Resources:

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

Topics relevant to "SKILL DEVELOPMENT": Determination of conductions Heat Transfer, convection heat transfer, radiation heat transfer, efficiency of heat exchangers through Problem solving Methodologies.. This is attained through assessment component mentioned in course plan.

Catalogue prepared by	Mr.Basavaraj Devakki
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

<table>
<tr><td>Course Code: MEC2510</td><td>Course Title: Heat and Mass Transfer Lab
Type of Course: Professional core & Laboratory only</td><td>L-T-P-C</td><td>0-0-2-1</td></tr>
<tr><td>Version No.</td><td colspan="3">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="3">MEC3226, MEC4003</td></tr>
<tr><td>Anti-requisites</td><td colspan="3">NIL</td></tr>
<tr><td>Course Description</td><td colspan="3">The Course aims at learning the practical concepts in different modes of heat transfer like, conduction, convection and radiation. It also includes experiments on heat exchangers, condensation, boiling and mass transfer.</td></tr>
<tr><td>Course Out Comes</td><td colspan="3">On successful completion of the course the students shall be able to:
CO.1 Calculate the thermal conductivity of substance.
CO.2 Employ the methods of lumped heat capacity to calculate the heat transfer coefficient.
CO.3 Calculate the heat transfer coefficient in forced and natural convection.
CO.4 Compute the heat transfer by radiation mode between 2 surfaces.
CO.5 Calculate the rate of heat transfer taking place in parallel and counter flow heat exchangers.</td></tr>
<tr><td>Course Objective</td><td colspan="3">The objective of the course is to familiarize the learners with the concepts of "Heat and Mass Transfer Lab" and attain SKILL DEVELOPMENT through Experiential learning techniques.</td></tr>
<tr><td>Course Content:</td><td colspan="3"><table>
<tr><th>Experiment no</th><th>Experiment Name</th></tr>
<tr><td>1</td><td>To calculate the thermal conductivity of metal rod and to plot temperature distribution along the length of rod</td></tr>
<tr><td>2</td><td>To calculate the thermal conductivity of insulating powder</td></tr>
<tr><td>3</td><td>To study heat transfer through insulating medium.</td></tr>
<tr><td>4</td><td>To study the heat transfer through conduction in composite wall</td></tr>
<tr><td>5</td><td>To study the unsteady state heat transfer by the lumped capacitance.</td></tr>
<tr><td>6</td><td>To study heat transfer in forced convection.</td></tr>
<tr><td>7</td><td>To study the heat transfer in natural convection.</td></tr>
<tr><td>8</td><td>To study the heat transfer in a pin fin apparatus by forced convection</td></tr>
</table></td></tr>
</table>

	9	To calculate value of Stefan Boltzmann's constant of hemisphere temperature on it.
	10	To calculate the emissivity of test plate.
	11	To study the heat transfer phenomena in parallel flow heat exchanger
	12	To study the heat transfer phenomena in counter flow heat exchanger

Targeted Application & Tools that can be used: Conductions Heat Transfer, convection heat transfer, radiation heat transfer, heat exchangers.

Text Book

T1: "Heat and mass transfer lab manual" Presidency University.

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

References

R1: "Heat and mass transfer", by J P Holman.

(iii) Web-Resources:

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

Topics relevant to "SKILL DEVELOPMENT": Determination of conductions Heat Transfer, convection heat transfer, radiation heat transfer, efficiency of heat exchangers through **Experiential Learning techniques**. This is attained through assessment component mentioned in course plan.

Catalogue prepared by	Basavaraj Devakki
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: MEC2507	**Course Title: Computer Aided Engineering Drawing** **Type of Course: Professional Core/ Laboratory only**	**L-T-P-C**	**0**	**0**	**4**	**2**
Version No.	1.0					
Course Pre-requisites	MEC1006					
Anti-requisites	**NIL**					
Course Description	This course introduces the role of computers in engineering design, focusing on computer-aided design (CAD) and solid modeling techniques. Through hands-on experience with CAD software, students will learn to create 3D models, prepare technical drawings, and use data exchange standards for design applications.					
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	Upon completion of this course, students will be able to: 1. Explain the role of computers in design processes and CAD standards for data exchange. 2. Create solid models and assemblies using industry-standard CAD software. 3. Interpret boundary and constructive solid geometry (CSG) models and apply them to technical drawings.					
Course Content:	Module 1: Introduction to CAD and Standards Role of computers in design, analysis, and manufacturing processes. Overview of popular CAD software and input/output devices. Exchange standards: IGES, DXF, STEP, STL, and their applications in CAD.-10 sessions Module 2: Solid Modeling Techniques Solid modeling techniques: Sweep (linear and curved) and Boolean operations. Representation of solid models: Boundary and Constructive Solid Geometry (CSG). Practical exercises: Creating and modifying solid models using CAD software.10 sessions Module 3: Assemblies and Visualization Creating assemblies from individual parts in CAD software. Generating sectional, exploded, and detailed views for technical documentation. Interpreting complex assembly drawings and visualizations.10 sessions					
Targeted Application & Tools that can be used: **Applications:** Design engineers, CAD specialists, manufacturing engineers. Tools: Industry-standard CAD software such as SolidWorks, CATIA, or Autodesk Inventor.						
Text Book • Ibrahim Zeid, Mastering CAD CAM, Tata McGraw Hill Publishing Co., 2007. • C. McMohan and J. Browne, CAD/CAM Principles, Pearson Education, 2nd Edition, 1999. • Michael E. Mortenson, Geometric Modeling, Tata McGraw Hill, 2013. • W. M. Neumann and R.F. Sproul, Principles of Computer Graphics, McGraw Hill, 1989. • D. Hearn and M.P. Baker, Computer Graphics, Prentice Hall Inc., 1992.						

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	Dr. Sandeep G M
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: **MEC2028**	**Course Title: Machine Shop Practice Lab** **Type of Course:** **1] Professional Core** **2] Laboratory only**	**L-T-P-C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	MEC3204					
Anti-requisites	**NIL**					
Course Description	The course is designed with an objective of giving an overview of basic manufacturing processes like machining process for converting raw material to finished products. It is a practical oriented course detailing about Machine tools such as lathe, milling machine, shaping machine, Surface grinding, Slotting machine, drilling machines and CNC Machine with allied operations. The course also provides hands on approach on different machining operations such as thread cutting, Taper turning, Knurling, Internal threading, Gear generation, key way generation, surface finishing, Drilling operations and also to give an exposure to CNC programming.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Machine Shop Practice Lab**" and attain **SKILL DEVELOPMENT** through Experiential learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Understand working of Lathe, Shaper, Drilling and Milling 2] Select the fixture, cutting tools and machine tools according to drawing. 3] Produce physical models by using different Machine tools. 4] Learn and implement safety work practice and work environment. 5] Understand programming on CNC lathe and Milling machine.					
Course Content:	1]Turning operation on a given mild steel workpiece on a lathe machine 2] Facing and chamfering operation on a given mild steel workpiece on a lathe machine 3] Step turning and grooving operation on a given mild steel workpiece on a lathe machine 4] Taper turning operation on a given mild steel workpiece on a lathe machine 5] Drilling and boring operation on a given mild steel workpiece on a lathe machine 6] Knurling and thread cutting operation on a given mild steel workpiece on a lathe machine 7] Key way milling operation on a given mild steel workpiece on a universal milling machine 8] End milling operation on a given mild steel workpiece by using vertical milling machine 9] Gear Cutting operation on a given aluminium blank by using Horizontal milling machine 10] Drilling, Counter sinking and tapping operation by using drilling machine 11] V groove cutting on a given mild steel workpiece by using shaper machine 12] Key way slotting on a given mild steel workpiece using Milling machine. 13] Basic CNC programming demonstration. 14] Basic Grinding Operation demonstration.					
Targeted Application & Tools that can be used: **Preparing physical models by using different machine tools in the manufacturing sector.**						
Text Book						

1. P N Rao, "Manufacturing Technology – Vol. 2", McGraw Hill Education. 2. A Text Book of Engineering Metrology: R.K. Jain, Khanna Publishers.
References 1. P N Rao, "Manufacturing Technology – Vol 1", McGraw Hill Education. 2. Nagendra Parashar B.S, Mittal R.K., "Elements of Manufacturing Processes", PHI publications. Web Resources: https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433
Topics relevant to "SKILL DEVELOPMENT": Lathe machine, Shaper Machine operations for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through the assessment component mentioned in the course plan.

Catalogue prepared by	Dr.Aravinda T Asst. Professor, Dept. of Mechanical Engg.
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

<table>
<tr><td>Course Code: MEC2508</td><td colspan="2">Course Title: Design of Machine Elements
Type of Course: Professional Core & Theory only</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="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">MEC3209 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 Course is designed with an objective of giving an overview of designing appropriate machine transmission components and their applications.

This course offers a comprehensive understanding of the design principles of various machine elements. It integrates theoretical foundations and practical approaches to design components such as gears, springs, shafts, fasteners, brakes, and power screws. The course emphasizes creative problem-solving, safety considerations, fatigue life, and manufacturability while equipping learners with essential skills for contemporary engineering applications.</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" 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:
1. Analyse machine elements subjected to static and fatigue loads using appropriate failure theories.
2. Design transmission systems, such as, belts & chains, for efficient power transfer.
3. Design and analyse springs, fasteners, welded and bolted joints for various engineering applications.
4. Analyse and design shafts and bearings for strength, rigidity, and durability.
5. Design transmission systems, such as, gears, for optimal performance and reliability.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td colspan="2">Introduction to Machine Design</td><td>Assignment</td><td colspan="2">Programming Task</td><td colspan="2">10 sessions</td></tr>
<tr><td colspan="8">Topics:
Anatomy of machines: Functional dissection of mechanical systems such as motorcycles, washing machines, etc.
Design considerations: Limits, fits, tolerances, and standardization.
Material selection: Properties and suitability for machine elements.
Friction, lubrication, and wear considerations.
Static failure theories: Normal stress, shear stress, distortion energy theory, von Mises stress.
Factor of safety: Selection and application.
Stress concentration factors and their effects.
Fatigue failure: Mean and alternating stresses, S-N curves, endurance strength.
Failure criteria: Goodman, Gerber, and Soderberg lines.
Practical problems on static and fatigue loading.</td></tr>
<tr><td>Module 2</td><td colspan="2">Design of Belt and Chain Drives</td><td>Case Study</td><td colspan="2">Simulation and data analysis task</td><td colspan="2">12 sessions</td></tr>
<tr><td colspan="8">Topics:
Types of belts and chains: Flat belts, V-belts, timing belts, and roller chains.
Power transmission principles and efficiency analysis.</td></tr>
</table>

Selection criteria for belts and chains based on load and speed requirements.
Design considerations: Tension analysis, initial tension, and creep.
Comparative analysis of belt and chain drives.
Applications and case studies.

Module 3	Design of Springs, Fasteners, and Joints	Assignment	Simulation/Data Analysis	12 sessions

Topics:
Types of springs: Helical, compression, tension, torsional, and leaf springs.
Stresses and deflections in springs under static and fatigue loads.
Threaded fasteners: Bolted joint analysis, preloaded bolts, and thread design.
Riveted joints: Types and stress analysis.
Welded joints: Strength evaluation and design.
Practical design problems and case studies.

Module 4	Design of Shafts and Bearings	Assignment	Modelling	12 sessions

Topics:
Shafts: Design for strength and rigidity, solid and hollow shafts, combined bending, torsion, and axial loading.
Bearings: Types of bearings (sliding and rolling contact), bearing life estimation, and material selection.
Design considerations for keys and couplings: Stress analysis and application.
Case studies in shaft and bearing design.

Module 5	Design of Gears	Assignment	Simulation/Data Analysis	14 sessions

Topics:
Gears: Spur, helical, bevel, and worm gears – definitions, geometry, and material selection.
Stress analysis: Lewis equation, dynamic and wear loads.
Applications of gear in mechanical design.

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 & ANSYS for design, simulation, and analysis.

Project work/Assignment:

Project Assignment: Carry out a directional stress analysis on different stress concentration geometry.
Assignment: 1] Design and analyse a flat plate and a shaft under specified loads using hand calculations, 3D modelling software, and ANSYS for structural analysis; submit a detailed report with visualizations and results.
Assignment 2] Design a knuckle joint to sustain a load based on a unique student ID-derived formula. Compute dimensions using permissible stresses for tension, compression, and shear as determined by the given equations. Perform a detailed stress analysis and validate the design.

Textbooks:
V.B. Bhandari, Design of Machine elements, Tata Mc Graw Hill, 3rd Edition, 2010.
Joseph E. Shigley, Mechanical Engineering Design, McGraw Hill, 6th Edition, 2003.

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. Juvinal, R.C and Kurt M.Marshek, Machine component design, John Wiley, 2012.
4. Design Data Handbook – K. Lingaiah, 2012.
5. 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": Designing the components such as gears, springs, shafts, fasteners, brakes, and power screws through Problem solving Methodologies.. This is attained through assessment component mentioned in course plan.	
Catalogue prepared by	Dr. Sandeep G M
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: MEC2026	**Course Title: Mechatronics** **Type of Course: Program core & 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 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.		
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamentals of mechatronic system and its applications. 2] Identify the types of sensors, transducers and signal conditioning processes used in automated machines. 3] Recognize sequencing schedule for a specific process using various actuating systems. 4] Describe logic gates and working of controllers.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Mechatronics** " and attain **SKILL DEVELOPMENT** through Participative learning techniques.		
Course Content:			

Module 1	Introduction to Mechatronics	10 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.		
Module 2	Sensors Transducers and Signal Conditioning	15 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	10 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	10 Sessions
Topics: Digital Electronics, Microprocessors, and Controllers: Programmable logic controllers - Basic structure, programming and ladder diagram.		

Targeted Application & Tools that can be used: Digital Electronics, Microprocessors, and Controllers	
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/	
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 **Participative Learning techniques**. This is attained through assessment component mentioned in course handout	
Catalogue prepared by	Basavaraj Devakki
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: **MEC2033**	**Course Title: Production and Operations Management** **Type of Course: Professional Core& 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 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.					
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies					
Course Outcomes	On successful completion of this course the students shall be able to: 1) Recognize the importance of production management in industry. 2) Describe Facility location problems and aggregate planning. 3) Solve problems in sequencing and Scheduling in production environment. 4) Summarize the various modern production management tools.					
Course Content:						
Module 1	Introduction to Production Management	Assignment	Data Collection and Analysis	10 sessions		
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.						
Module 2	Production Planning and Control	Case Study	Simulation and data analysis task	10 sessions		
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.						
Module 3	Sequencing and Scheduling	Assignment	Data Collection and Analysis	12 sessions		
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						
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.						
Module 4	Modern Production Management Tools	Case Study	Data collection and Programming	13 sessions		

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.

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, Ultra Tech),

Professionally Used Software: DYNAMIC 3i Production Planning, IQMS, Fishbowl

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.

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

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

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.

Course Code: **MEC2031**	**Course Title: Mechanisms, Machines and Design Lab** **Type of Course: 1] Professional Core Course 2] Laboratory 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: 1. To practically relate to concepts discussed in Design of Machine Elements, Mechanical Vibrations & Dynamics of Machines courses. 2. To identify forces and moments in mechanical system components and identify vibrations in machine elements and design appropriate damping methods. 3. To understand the working Principles of machine elements such as Governors, Gyroscopes and measure strain in various machine elements using strain gauges. 4. Perform the journal bearing experiments and record the observation.					
Course Content						

Syllabus: Total Sessions-30

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

5. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Proell / watt Governor (Only one or more).
6. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
7. Determination of stresses in Curved beam using strain gauge.
8. Determination of Pressure distribution in Journal bearing.
9. 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 29/7/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/2022.

Course Code: MEC2027	**Course Title: Mechatronics Lab** **Type of Course: Professional core & Laboratory only**	**L-T-P-C**	**0-0-2-1**
Version No.	1.0		
Course Pre-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course involves the 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 Out Comes	On successful completion of the course the students shall be able to: CO1. To Practically use the hydraulic and pneumatic circuits for given application. CO2. To identify the correct sequencing of pneumatic circuits and simulate in AUTOSIM-200 software. CO3. To understand the working principles of electric motors.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Mechatronics Lab**" and attain SKILL DEVELOPMENT through Experiential learning techniques.		
Course Content:	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.	
Text Book **T1:** "Mechatronics lab manual" Presidency University.	
References 1. W. Bolton," Mechatronics ", Pearson Publication	
Topics relevant to "SKILL DEVELOPMENT": Operation of single and double acting cylinder through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Basavaraj Devakki
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: MEC2511	**Course Title: Computer Aided Machine Drawing** **Type of Course: Professional Core/ Laboratory only**	**L-T-P-C**	0	0	4	2
Version No.	2.0					
Course Pre-requisites	MEC1006					
Anti-requisites	NIL					
Course Description	This course covers key concepts and practical skills in computer-aided machine drawing, focusing on sheet metal design, mold design, technical drawing, and proficiency in advanced design techniques. It begins with an introduction to sheet metal design and progresses to advanced methods for creating complex parts and assemblies. The mold design section includes both basic and advanced topics, such as core/cavity design and material flow analysis. The technical drawing module emphasizes 2D drafting, detailing, and advanced techniques like exploded views. The course also includes rigorous practice sessions to enhance students' expertise in computer-aided drafting and design for real-world applications in machine drawing.					
Course Out Comes	1. Develop detailed machine components using computer-aided design tools, ensuring accuracy and adherence to engineering standards. 2. Apply principles of sheet metal design to create machine parts with accurate flat patterns and ensure manufacturability. 3. Design mold components with a focus on assembly integration and performance optimization for machine applications. 4. Prepare precise 2D machine drawings with advanced annotations, bill of materials (BOM), and exploded views for effective communication of design intent.					
Course Content:	Here's the syllabus with module topics: Module 01: Sheet Metal Design and Analysis-8 Sessions • Introduction to sheet metal design and manufacturing techniques. • Material properties and flat pattern creation. • Advanced methods for designing and assembling sheet metal parts. Module 02: Mold Design Fundamentals-8 Sessions • Basic concepts of mold design: core, cavity, and parting lines. • Types of molds and their applications. • Advanced techniques for designing mold components and optimizing performance. Module 03: Technical Drawing Tools and Techniques-8 Sessions • Fundamentals of 2D drawing creation, views, and detailing. • Annotation tools for dimensions, tolerances, and notes. • Advanced techniques for exploded views and BOM preparation. Module 04: Design and Assembly of Machine Components-8 Sessions					

	• Design and assembly of a chuck. • Design and assembly of a gearbox. • Design and assembly of a shaft-bearing system.
Targeted Application & Tools that can be used: Design engineer, draftsmen and Solid works	
Text Book 1. N.D. Bhatt, Machine Drawing, Charotar Book Stall, Anand, 1996 2. GodFrey C. Onwubolu, Introduction to SolidWorks A Comprehensive Guide with Applications in 3D Printing, CRC Press, 2022 3. K.L.Narayana, Production drawing, New Age International Pvt. Ltd. New Delhi, 2003.	
References 1. S Trayambak Murthy, "Text book of Computer Aided Machine Drawing", CBS 2. K.R.Gopalakrishna, Machine Drawing, Subhas Stores, Bangalore, 2002	
Topics relevant to "SKILL DEVELOPMENT": Course uses Solid works software to design sheet metal model design concepts, machine components, mould design, technical drawing for **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Sandeep G M
Recommended by the Board of Studies on	BOS No: 20th BOS held on 19/12/2024
Date of Approval by the Academic Council	

Course Code: **MEC2512**	**Course Title: Finite Element Analysis** **Type of Course:** **1] Professional Core Course**		**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	MAT1001, MAT2501					
Anti-requisites	**NIL**					
Course Description	The course is designed with the objective of giving an overview of the basics of finite element modelling 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 isoperimetric 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 **participative** 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.					
Course Content:						
Module 1	Introduction to Finite Element Method	Case Study	Mathematical			13 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	Mathematical			12 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.						

Module 3	Analysis of Beams	Case Study	Mathematical	10 sessions
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.				
Module 4	Analysis of Trusses	Case Study	Mathematical	10 sessions
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				

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.
5. 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 **Participative learning techniques**. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Prashanth S P
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: MEC2029	**Course Title: Hydraulics and Pneumatics** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**L-T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	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.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of "**Hydraulics and Pneumatics**" and attain **Skill Development** through Problem solving methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamentals of Hydraulic Power Pumps, Actuators and Motors. 2] Explain control components in Hydraulic Systems. 3] Solve the numerical problems related to hydraulic efficiency of motors. 4] Describe the fundamentals of pneumatic system, Actuators, Valves, Pneumatic circuits and logic circuits.					
Course Content:						
Module 1	Introduction to Hydraulic System	Assignment	Data collection		10 sessions	
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.						
Module 2	Energy transfer in hydraulic actuators and motors	Case study	Identify various valves considering a hydraulic system.		12 sessions	
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						
Module 3	Introduction to Pneumatic	Assignment	Data Collection		12 sessions	

	System and its control			
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 **SKILLS DEVELOPMENT** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course plan.				
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: **MEC2030**	**Course Title: Automotive Engineering** **Type of Course:** **1] Professional Core Course 2] Theory**		**L-T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Fundamentals of Automobile Engineering**" and attain **SKILL DEVELOPMENT** through Participative learning Techniques.					
Course Description	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.					
Course Outcomes	Student will be able to 1) Identify the different parts of an automobile and it's working 2) Understand the working of transmission and braking systems 3) Comprehend the working of steering and suspension systems					
Course Content:	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.					
Module 1	ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS	Assignment	SI and CI engines	08 Sessions		
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.						
Module 2	Transmission System	Case Study	Suspension system	08 Sessions		
Transmission system: Definition and layout of Transmission System**, r**equirements of transmission system**, t**ypes of transmission system**,** units of transmission system, clutch and its types, gear box, propeller shaft, universal joints, axles and differentials, types of drives.						
Module 3	Cooling, and Lubrication System	Assignment	Systems of lubrication	10 Sessions		
Topics						

Cooling system: Definition and objective**, t**ypes 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.

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 "SKILLS DEVELOPMENT": Ignition System, Braking System of Automobiles for developing **SKILLS DEVELOPMENT** through **Problem-Solving methodologies**. This is attained through the assessment component mentioned in the course plan.

Catalogue prepared by	Mr. Prashanth S P
Recommended by the	15th BoS held on 22/07/2022

Board of Studies on	
Date of Approval by the Academic Council	18th Meeting of the Academic Council held on 03rd August, 2022

<table>
<tr><td>Course Code:
MEC2032</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">MEC3226, 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="12">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>
<tr><td>8</td><td colspan="6">Performance test on 4-Stroke 4 Cylinder Diesel Engine for Morse Test.</td></tr>
<tr><td>9</td><td colspan="6">Variable compression ratio for diesel engine with constant speed</td></tr>
<tr><td>10</td><td colspan="6">Performance test on 4-Stroke 4 Cylinder Petrol Engine for Morse Test</td></tr>
</table>

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	

<table>
<tr><td>Course Code:
MEC2034</td><td>Course Title: Finite Element Analysis Lab
Type of Course: Professional core and Laboratory only</td><td>L-T-P-C</td><td>0-0-4-2</td></tr>
<tr><td>Version No.</td><td colspan="3">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="3">MAT1001, MAT2501</td></tr>
<tr><td>Anti-requisites</td><td colspan="3">Nil</td></tr>
<tr><td>Course Description</td><td colspan="3">This lab course introduces students to the practical application of Finite Element Analysis techniques using industry-standard software tools. The primary focus is on building and analyzing models to solve real-world engineering problems in structural mechanics, heat transfer, and vibrations. Students will gain hands-on experience in creating geometries, applying boundary conditions, meshing, and interpreting results to make data-driven design decisions.</td></tr>
<tr><td>Course Out Comes</td><td colspan="3">On successful completion of the course the students shall be able to:
CO1: Develop a strong foundation in the principles and methodologies of Finite Element Analysis
CO2: Gain proficiency in using industry-standard FEA software for creating models, applying loads, and running simulations for structural, thermal, and vibrational analyses.
CO3: Enhance the ability to interpret simulation results, validate them against theoretical or experimental data, and apply these insights to optimize designs.
CO4: Apply FEA techniques to solve real-world engineering challenges, fostering critical thinking and effective decision-making in design and analysis processes.</td></tr>
<tr><td>Course Objective</td><td colspan="3">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.</td></tr>
<tr><td>Course Content:</td><td colspan="3"><table>
<tr><th>Session No.</th><th>Name of the Experiment</th></tr>
<tr><td>01</td><td>Introduction to FEA and Software Interface</td></tr>
<tr><td>02</td><td>Geometry Creation and Assigning Material Properties</td></tr>
<tr><td>03</td><td>Meshing Fundamentals: Element Types and Quality Analysis</td></tr>
<tr><td>04</td><td>Static Structural Analysis: Beam and Truss Structures</td></tr>
<tr><td>05</td><td>Thermal Analysis: Steady-State Heat Conduction</td></tr>
</table></td></tr>
</table>

	06	Transient Thermal Analysis: Heat Transfer Over Time
	07	Modal Analysis: Determining Natural Frequencies
	08	Harmonic Analysis: Vibrational Response of a Structure
	09	Nonlinear Analysis: Plastic Deformation of a Component
	10	Contact Analysis: Bolted Joint Simulation
	11	Fatigue Analysis: Life Estimation of a Structural Member
	12	Optimization Techniques: Weight Reduction in a Design
	13	Case Study: Multi-Physics Analysis (Thermal-Structural)
	14	Final Project: Real-World Problem Solving and Report Writing

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.

5. Web Resources: https://presiuniv.linways.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 plan.	
Catalogue prepared by	Dr. Prashanth S P
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

Course Code: **MEC 3068**	**Course Title: Production and Operations Management** **Type of Course: Professional Core& 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 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.					
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies					
Course Outcomes	On successful completion of this course the students shall be able to: 1) Recognize the importance of production management in industry. 2) Describe Facility location problems and aggregate planning. 3) Solve problems in sequencing and Scheduling in production environment. 4) Summarize the various modern production management tools.					
Course Content:						
Module 1	Introduction to Production Management	Assignment	Data Collection and Analysis	10 sessions		
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.						
Module 2	Production Planning and Control	Case Study	Simulation and data analysis task	10 sessions		
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.						
Module 3	Sequencing and Scheduling	Assignment	Data Collection and Analysis	12 sessions		

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

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.

Module 4	Modern Production Management Tools	Case Study	Data collection and Programming	13 sessions

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.

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, Ultra Tech),
Professionally Used Software: DYNAMIC 3i Production Planning, IQMS, Fishbowl

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.

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

References

3. Chary, S. N. Production and operations management. McGraw Hill Education, 2017.

4. 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

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.

Discipline Elective Courses:

Course Code: **MEC3400**	**Course Title: Computer Integrated Manufacturing** **Type of Course:** **1] Professional Elective Course** **2] 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 computer assisted modern manufacturing technologies. The course includes 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.					
Course Objective	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.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1] Describe various types of automation and production concept 2] Distinguish various automated flow line and Assembly line. 3] Outline Flexible manufacture system and group technology. 4] Apply CNC Part Programming and inspection principles. 5] Explain the Computer aided process planning and concurrent engineering					
Course Content:						
Module 1	Introduction and Scope of CIM in Industry	Assignment	Automation	08 sessions		
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.						
Module 2	NC/ CNC Machine Tools	Assignment & Case study	Machine tools	09 sessions		
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, Induction Tachometers, Counting devices. Constructional Features of CNC Machines						
Module 3	Constructional Features of CNC Machines	Seminar	CNC system	10 sessions		
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						
Module 4	Adaptive Control	Assignment	Application of Adaptive Control System	12 sessions		

Topics: Machining systems. Adaptive control optimization system, adaptive control constraint system, applications to machining processes, Benefits of Adaptive control 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	Dr. 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	Academic Council Meeting No. 24, dated 03/08/2024

<table>
<tr><td>Course Code:
MEC3401</td><td colspan="4">Course Title: Smart Manufacturing
Type of Course:
1] Professional Elective Course
2] 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="9">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="9">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="9">NIL</td></tr>
<tr><td>Course Description</td><td colspan="9">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.</td></tr>
<tr><td>Course Objective</td><td colspan="9">The objective of the course is to familiarize the learners with the concepts of "Smart Manufacturing" and attain EMPLOYABILITY SKILL through Participative learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="9">On successful completion of this course the students shall be able to:
1] Explain the different areas of Industrial Internet
2] Outline the designing industrial internet systems
3] Explain the security of the Industrial Internet
4] Outline the active part of industry 4.0
5] Explain the economic aspects and applications of day to day life smart factories</td></tr>
<tr><td>Course Content:</td><td colspan="9"></td></tr>
<tr><td>Module 1</td><td colspan="2">Introduction to the Industrial Internet</td><td>Assignment</td><td colspan="2">A report on use of IoT in common applications</td><td colspan="4">10 sessions</td></tr>
<tr><td colspan="10">Topics:
The Internet of Things: An overview; Horizontal and vertical aspects of the Internet of Things, What Is the Industrial Internet?, Innovation and the IoT, Intelligent Devices, Introduction to Industry 4.0 , Industry 4.0 Reference assembly line, lean Manufacturing</td></tr>
<tr><td>Module 2</td><td colspan="2">Designing Industrial Internet Systems</td><td>Case Study</td><td colspan="2">On IIoT</td><td colspan="4">08 sessions</td></tr>
<tr><td colspan="10">Topics:
The Concept of the IIoT, Modern Communication Protocols, Wireless Communication Technologies, Building Blocks of Industry 4.0, AI&ML</td></tr>
<tr><td>Module 3</td><td colspan="2">Securing the Industrial Internet</td><td>Case Study</td><td colspan="2">Report on system Security</td><td colspan="4">08 sessions</td></tr>
<tr><td colspan="10">Topics:</td></tr>
</table>

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: **MEC3402**	**Course Title:** **Nanotechnology** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**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 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.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of "**Nanotechnology**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Recognize the basic properties of Nano materials. 2. Distinguish between various Nano material perspectives applicable to Nano technology. 3. Summarize the effect of Nano fluids on the boiling heat transfer. 4. Identify the processing techniques involved in investigation of Nano technology.					
Course Content:						
Module 1	Nanotechnology and over view	Term paper	Data Collection/any other such associated activity	04 sessions		
Topics: Introduction to Nanoscience & Nanotechnology. History of Nano materials, Natural & Man-made nanomaterials. Benefits of nanotechnology. Applications – latest trends						
Module 2	Structure & Synthesis of Nanomaterials	Term paper	Data Collection/any other such associated activity	14 sessions		
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						
Module 3	Investigation techniques	Term paper	Data Collection/any other such associated activity	10 sessions		
Topics: Scanning probe microscopes, Electron microscopes – SEM, TEM, Optical microscopes, x ray photoelectron spectroscopy, Energy dispersive spectroscopy.						
Module 4	Properties of Nanomaterials	Assignment	Data Collection/any other such associated activity	10 sessions		

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 1. Charles P. Poole Jr, Frank J. Owens, "*Introduction to Nanotechnology",* Wiley and Sons. 2. Bharat Bhushan, "*Handbook of Nanotechnology",* Spinger. 3. 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:** W1.https://nptel.ac.in/courses/112/106/112106065/ W2:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NIFTEM_CUSTOM_2123 "**Nano Applications,** Materials Engineering, Engineering and Technology, Science Direct," W3: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			

Course Code: **MEC3403**	**Course Title: Flexible Manufacturing Systems** **Type of Course:** **1]Professional Elective Course** **2] Theory**		**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:** [1] Understand the function of NC, CNC and DNC machines [2] Analyze the Quantitative aspects of FMS. [3] Explain the Machine cell design and part families. [4] Outline the various production control issues and tool management. [5] Analyze the economic aspects and justification of FMS.					
Course Content:						
Module 1	Introduction to manufacturing systems, Part programming	Assignment	Programming simple machined components	12 Session		
Topics: 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. Review of NC, CNC, DNC, Adaptive control and robotics in manufacturing. Advantages, disadvantages and applications. Part Programming: Manual and APT part programming for simple objects						
Module 2	Introduction to FMS, Group Technology and Cellular manufacturing	Assignment	Solving numerical to form ideal cells	10 sessions		

Topics:
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	Assignment	Justification of using FMS in manufacturing systems	10 sessions

Introduction to material handling, principles of material handling, different material handling equipment such as industrial truck, 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

Module 4	Tooling and system planning in FMS	Case study	Control of cutting tools and its practices in Machine Shop Lab	07 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

Module 5	Planning and implementation of FMS	Assignment	Behavioral issues in implementing FMS	06 sessions

Planning, integration, system configuration, FMS layout and implementation.
Organizational and behavioral issues in the implementation of FMS, economic justification of FMS
Toyota production systems, Lean manufacturing and Kanban system.
Introduction to simulation of FMS and data base design for FMS.

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/

Weblinks: 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	Mr. Prashanth S P
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

<table>
<tr><td>Course Code:
MEC3404</td><td colspan="3">Course Title: Product Design for Manufacturing and Assembly
Type of Course:
1] Professional Elective Course
2] Theory</td><td>L-T-P-C</td><td>3-0-0-3</td></tr>
<tr><td>Version No.</td><td colspan="5">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Course Description</td><td colspan="5">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="5">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="5">On successful completion of this course the students shall be able to:
[1] Understand constraints of manufacturing processes that limit design possibilities with respect to cycle time, material handling, and other factory costs.
[2]Apply casting considerations in machining
[3]Apply principles of DFA to make efficient patterns and moulds
[4]Select proper materials and manufacturing processes Die casting</td></tr>
<tr><td>Course Content:</td><td colspan="5"></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="6">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>10 sessions</td></tr>
<tr><td colspan="6">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>12 sessions</td></tr>
<tr><td colspan="6">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>
</table>

Topics:
Die casting alloys, cycle, machines, dies, finishing, Assembly techniques, Design principles, Powder metallurgy processing, stages, compaction characteristics, Tooling, Sintering, Design 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 Academic Council Meeting dated 03/08/2024

Course Code: **MEC3405**	**Course Title**: **Production Planning and Control** **Type of Course**: **1] Professional Elective Course 2] Theory**		**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	07 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 Planning	Assignment	Data analysis	08 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	Presentation	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	Presentation	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 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: 3/8/22

Course Code: **MEC3406**	**Course Title:** **Additive manufacturing & Its Applications** **Type of Course:** **Professional 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

Course Code: **MEC3407**	**Course Title: Micro and Nano Manufacturing** **Type of Course:** **1] Professional Elective Course** **2] Theory**		**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 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**.**					
Course Objectives	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.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Get an awareness of different techniques used in micro and nano manufacturing. 2. Understand micro and nanofabrication techniques and other processing routes in micro and nano manufacturing. 3. Discuss about different techniques used in micro joining and the metrology tools in micro and nano manufacturing					
Course Content:						
Module 1	Overview of Micro and Nano Manufacturing	Assignment	Applications of Micro and Nano machining	10 sessions		
Topics: Introduction to Precision engineering, mIcro 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	07 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	08 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	08 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	08 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.			

<table>
<tr><td>Course Code:
MEC3408</td><td colspan="4">Course Title: Statistics and Quality Control
Type of Course:
1] Professional Elective Course
2] 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="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">Industrial Engineering Techniques</td></tr>
<tr><td>Course Description</td><td colspan="8">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.</td></tr>
<tr><td>Course Objective</td><td colspan="8">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.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
1. Explains the basic concept of Quality, Quality tools
2. Analyze process capability and operating characteristic curves
3. Construct control charts and evaluate revised control limits
4. Describe Six sigma methodology to improve quality</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td colspan="2">Quality – An overview</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td colspan="3">6 sessions</td></tr>
<tr><td colspan="9">Topics:
Introduction and definition of quality, quality control, Cost of quality, 7 basic Quality control tools.</td></tr>
<tr><td>Module 2</td><td colspan="2">Data collection and measurement analysis.</td><td>Case Study</td><td colspan="2">data analysis task</td><td colspan="3">15 sessions</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td>Module 3</td><td colspan="2">Control Charts</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td colspan="3">14 sessions</td></tr>
<tr><td colspan="9">Topics:</td></tr>
</table>

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: MEC3409	**Course Title: Digital Manufacturing and IOT** **Type of Course:** **1] Professional Elective Course**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course explores the integration of advanced manufacturing processes with the Internet of Things (IoT) to revolutionize production systems. Students will learn how digital technologies, such as automation, additive manufacturing, and cloud computing, are applied in modern manufacturing environments to enhance efficiency, flexibility, and product quality. The course emphasizes the role of IoT in enabling smart factories, real-time monitoring, predictive maintenance, and data-driven decision-making.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Digital Manufacturing and IOT**" 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 principles of digital manufacturing and IoT. CO2: Design and implement IoT-enabled manufacturing systems. CO3: Analyze real-time data to optimize production processes. CO4**:** Explore emerging trends and challenges in Industry 4.0.					
Course Content:						
Module 1	Introduction to Digital Manufacturing and IoT	Case Study	Descriptive	13 sessions		
Topics: Overview of Digital Manufacturing and IoT, Evolution from Industry 3.0 to Industry 4.0, Key Enabling Technologies (IoT, AI, Robotics, Cloud Computing), Fundamentals of IoT Architecture and Communication Protocols, Smart Factories: Concepts and Applications, Role of Sensors and Actuators in IoT Systems, Case Study: Digital Transformation in Manufacturing.						
Module 2	IoT-Enabled Manufacturing Systems	Case Study	Descriptive	12 sessions		
Topics: IoT Device Integration in Manufacturing Processes, Real-Time Data Acquisition and Processing, Edge Computing vs. Cloud Computing in IoT Applications, Data Analytics and Visualization Tools for IoT, Predictive Maintenance and Condition Monitoring Using IoT, Cyber-Physical Systems and their Role in Manufacturing, Digital Twins: Concepts, Creation, and Applications, Hands-On: Setting Up a Basic IoT System.						
Module 3	Advanced Digital Manufacturing Technologies	Case Study	Descriptive	10 sessions		
Topics: Additive Manufacturing (3D Printing) and IoT Integration, Automation and Robotics in Smart Factories, Autonomous Systems and Collaborative Robots (Cobots), Artificial Intelligence in						

Manufacturing Decision-Making, Augmented Reality (AR) and Virtual Reality (VR) in Production, Blockchain for Secure Manufacturing Supply Chains, Case Study: Advanced Digital Manufacturing Systems.				
Module 4	Challenges, Future Trends, and Industry Applications	Case Study	Descriptive	10 sessions
Topics: Security and Privacy Concerns in IoT Systems, Standards and Regulations in Digital Manufacturing, Sustainability and Green Manufacturing through IoT, Emerging Trends: 5G, AIoT, and Quantum Computing, Smart Logistics and Supply Chain Management with IoT, Industry Applications: Automotive, Aerospace, Healthcare, and Electronics, Project Presentation: Proposing a Smart Manufacturing Solution, Course Summary and Future Opportunities in Digital Manufacturing.				
Targeted Application & Tools that can be used: **Application** • Smart factories • Predictive maintenance • Construction and housing • Machine Design and Analysis **Tools** • MATLAB • Python • CAD/CAM Software				
Text Book's **1. "Internet of Things: A Hands-On Approach" (1st Edition)** by Arshdeep Bahga, Vijay Madisetti, Publisher: VPT.Finite Element Analysis Theory and Application with Ansys by Saeed Moaveni, 4th Edition, Pearson Publications 2015. **2. "Digital Manufacturing: The Revolution in Manufacturing" (1st Edition)** by Thomas L. Tuttle, Publisher: CRC Press.Modelling and Simulation Lab manual – Presidency University, Bangalore.				
References **1. "Industrial Internet of Things: Cybermanufacturing Systems" (1st Edition)** by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, Publisher: Springer. **2. "Smart Manufacturing: The Lean and IoT Revolution" (1st Edition)** by Tony L. K. Wang, Publisher: Wiley.				
Topics relevant to EMPLOYABILITY SKILL : Digital Manufacturing and IoT – The integration of IoT and cyber-physical systems, with applications in industrial settings, covering IoT protocols, security, and real-time data analysis E**MPLOYABILITY SKILL** through **Participative learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Prashanth S P			
Recommended by the Board of Studies on	20th BOS Meeting held on 19th Dec 2024			
Date of Approval by the Academic Council				

Course Code: **MEC3410**	**Course Title: Lean Manufacturing** **Type of Course:** **1] Professional Elective Course**		**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course introduces the principles and practices of **Lean Manufacturing**, focusing on continuous improvement, waste reduction, and efficient production techniques. Students will learn how to implement Lean tools and strategies to optimize production processes, increase product quality, and reduce costs. The course covers key concepts such as value stream mapping, Kaizen, 5S, Kanban, and Six Sigma, which are essential for creating a culture of operational excellence in modern manufacturing environments. Through practical case studies and hands-on activities, students will understand how to apply Lean principles to achieve higher productivity and competitiveness.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Lean Manufacturing** " 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 key principles and philosophy of Lean Manufacturing. **CO2:** Learn to identify and eliminate waste in production processes. **CO3:** Implement Lean tools such as Kaizen, 5S, and Value Stream Mapping. **CO4:** Develop skills to drive continuous improvement in manufacturing systems.					
Course Content:						
Module 1	Introduction to Lean Manufacturing	Case Study	Descriptive	13 sessions		
Topics: Overview of Lean Manufacturing and its Principles, History and Evolution of Lean Manufacturing, The Concept of Waste in Manufacturing (Muda), Core Principles: Value, Flow, Pull, and Perfection, Understanding Value Stream in Lean Context, Benefits and Challenges of Lean Manufacturing, Case Study: Lean Transformation in Industry						
Module 2	Identifying and Reducing Waste	Case Study	Descriptive	12 sessions		
Topics: Types of Waste (Muda) in Manufacturing, Identifying Non-Value-Added Activities, Waste Elimination through Just-in-Time (JIT), Overview of the Kaizen Philosophy and Practices, Using Kaizen Events for Waste Reduction, Value Stream Mapping (VSM) Introduction, Creating a Value Stream Map (Current State), Analyzing and Improving a Value Stream Map (Future State).						
Module 3	Lean Tools and Techniques	Case Study	Descriptive	10 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	Implementing Lean Manufacturing and Measuring Success	Case Study	Descriptive	10 sessions
Topics: Steps for Lean Implementation in an Organization, Overcoming Resistance to Change in Lean Adoption, Role of Leadership in Lean Manufacturing, Employee Engagement and Involvement in Lean Practices, Key Performance Indicators (KPIs) for Lean Success, Sustaining Lean Improvements: The Role of Continuous Improvement, Lean and Six Sigma: Integration for Enhanced Efficiency, Measuring and Reviewing Lean Success: Case Studies and Metrics.				
Targeted Application & Tools that can be used: **Application** • Manufacturing Process Optimization • Just-in-Time (JIT) Production • Quality Control and Continuous Improvement • Supply chain optimization **Tools** • 5W • Kaizen • Kanban				
Text Book's 1. "The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer" (2nd Edition) by Jeffrey K. Liker, Publisher: McGraw-Hill. 2. "Lean Thinking: Banish Waste and Create Wealth in Your Corporation" (1st Edition) by James P. Womack, Daniel T. Jones, Publisher: Free Press.				
References 1. "Lean Production for Competitive Advantage: A Comprehensive Guide to Lean Methodologies and Management Practices" (1st Edition) by John W. Davis, Publisher: McGraw-Hill. 2. "The Lean Six Sigma Pocket Toolbook: A Quick Reference Guide to 100 Tools for Improving Quality and Speed" (1st Edition) by Michael L. George, David Rowlands, Mark Price, John Maxey, Publisher: McGraw-Hill.				
Topics relevant to EMPLOYABILITY SKILL : Lean manufacturing – Enhancing supply chain performance by improving communication and collaboration, reducing lead times, and optimizing inventory using Lean techniques like **Kanban** and **Standardized Work**. **EMPLOYABILITY SKILL** through **Participative learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Prashanth S P			
Recommended by the Board of Studies on	20th BOS Meeting held on 19th Dec 2024			
Date of Approval by the Academic Council				

Course Code: **MEC3440**	**Course Title: Modern Manufacturing Processes** **Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	2					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	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.					
Course Outcomes	**On successful completion of this course the students shall be able to:** (1) Distinguish the various methods of manufacturing processes. (2) Discuss the principles, processes and applications of Advanced Machining & Casting Processes (3) Discuss the principles, processes and applications of Advanced Welding & Metal Forming Processes (4) Apply the various Lean Techniques & utilization of various technology that can be applied to industries for improving organizational performance					
Course Content:						
Module 1	Introduction to Manufacturing	Assignment	10 Sessions			
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.						
Module 2	Advanced Machining & Casting Processes	Case Study	15 Sessions			
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	Assignment	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	Assignment	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: • Creating smart factories where manufacturing technologies are upgraded and transformed by cyber-physical systems (CPSs), the Internet of Things (IoT), and cloud computing • 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 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: MEC3411	**Course Title: Robotics Type of Course: 1]Professional Elective Course 2] Theory**	**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: 1. Apply the concepts of inverse manipulator kinematics to a robot. 2. Apply the concepts of kinetics and kinematics to a robot. 3. Choose a suitable trajectory generation scheme for robot tasks. 4. 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	12 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: **MEC3412**	**Course Title: Control Engineering** **Type of Course:** **1] Professional Elective** **2] Theory**		**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:** 1. Identify the type of control system, controllers, various test signals, compensators, stability, concepts, analogous systems and frequency response terminologies, 2. Develop mathematical models of mechanical, electrical, electro-mechanical and hydraulic control systems in order to obtain system response for given input test signals, 3. Obtain the transfer functions by applying block diagrams reduction techniques and signal flow graphs for different applications of control system. 4. 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	7 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 Diagrams and Signal Flow Graphs	Assignment	Simulation task	8 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: MEC3413	**Course Title: Vehicle Health Monitoring, Maintenance and Safety** **Type of Course: 1] Professional Elective Course** **2] Theory**		**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 in-depth understanding of **Vehicle Health Monitoring**, **Maintenance**, and **Safety**. It covers modern diagnostic tools, sensor technologies, and data analytics to monitor vehicle health in real-time, focusing on predictive and preventive maintenance techniques to optimize performance and reduce breakdowns. Students will learn how to implement effective maintenance strategies, adhere to industry safety standards, and understand the integration of advanced technologies like IoT and AI for better diagnostics and safety.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Vehicle Health Monitoring**, **Maintenance**, and **Safety**" 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 principles and importance of vehicle health monitoring and how it contributes to vehicle performance and longevity. CO2: Comprehend the role of diagnostic tools and sensors in detecting and analyzing vehicle issues. CO3: Recognize the key safety standards and regulations applicable to vehicles, ensuring compliance with industry norms. CO4: Comply with safety regulations and standards, ensuring vehicles meet industry safety requirements and best practices.					
Course Content:						
Module 1	Introduction to Vehicle Health Monitoring and Maintenance	Case Study	Descriptive	13 sessions		
Topics: Overview of vehicle health monitoring systems, principles of predictive maintenance, types of vehicle sensors and diagnostic tools, introduction to vehicle data analytics, understanding vehicle diagnostics (OBD-II, CAN Bus), and case study on vehicle failure prevention.						
Module 2	Maintenance Strategies and Best Practices	Case Study	Descriptive	12 sessions		
Topics: Preventive, predictive, and corrective maintenance strategies, maintenance scheduling, spare parts management, cost optimization, analyzing vehicle wear and tear, and						

<table>
<tr><td colspan="5">documentation/reporting practices.</td></tr>
<tr><td>Module 3</td><td>Vehicle Safety Systems and Standards</td><td>Case Study</td><td>Descriptive</td><td>10 sessions</td></tr>
<tr><td colspan="5">Topics:
Vehicle safety technologies, safety regulations (FMVSS, ISO, SAE), role of sensors in safety (ADAS, collision avoidance), tire and brake system monitoring, emergency response systems, and safety management practices.</td></tr>
<tr><td>Module 4</td><td>Advanced Diagnostics and Real-Time Monitoring</td><td>Case Study</td><td>Descriptive</td><td>10 sessions</td></tr>
<tr><td colspan="5">Topics:
Diagnostic tools for modern vehicles, real-time monitoring technologies, IoT and AI in vehicle maintenance, machine learning for predictive analytics, remote diagnostics, fleet management optimization, and case studies on monitoring systems.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Application
• Predictive Maintenance
• Fleet Management
• Improved Safety
• Reduced Downtime
Tools
• On-Board Diagnostics (OBD-II)
• CAN Bus System
• Telematics Systems
• Advanced Driver Assistance Systems (ADAS)</td></tr>
<tr><td colspan="5">Text Book’s
1."The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer" (2nd Edition) by Jeffrey K. Liker.
2."Lean Thinking: Banish Waste and Create Wealth in Your Corporation" (1st Edition) by James P. Womack and Daniel T. Jones.</td></tr>
<tr><td colspan="5">References
1."Automotive Diagnostics and Maintenance" (1st Edition) by Tracy Martin.
2. "Vehicle Safety and Maintenance Systems" (1st Edition) by Robert Bosch</td></tr>
<tr><td colspan="5">Topics relevant to “EMPLOYABILITY SKILL”: Vehicle Health Monitoring, Maintenance, and Safety – Implement effective maintenance strategies, adhere to industry safety standards, and understand the integration of advanced technologies like IoT and AI for better diagnostics and safety. EMPLOYABILITY SKILL through Participative learning techniques. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td colspan="2">Catalogue prepared by</td><td colspan="3">Dr. Prashanth S P</td></tr>
<tr><td colspan="2">Recommended by the Board of Studies on</td><td colspan="3">20th BOS Meeting held on 19th Dec 2024</td></tr>
<tr><td colspan="2">Date of Approval by the Academic Council</td><td colspan="3"></td></tr>
</table>

Course Code: **MEC3414**	**Course Title: Introduction to marine and Aerial Robotics** **Type of Course:** **1] Professional Elective Course** **2] Theory**		**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course provides an introduction to the fundamental principles, technologies, and applications of marine and aerial robotics. Students will explore the design, control, and operation of autonomous systems, including underwater vehicles (ROVs/AUVs) and drones (UAVs). The course covers topics such as robot kinematics, dynamics, sensor integration, control systems, and navigation strategies in complex environments. Emphasis is placed on the unique challenges associated with operating in water and air, such as buoyancy, drag, turbulence, and communication constraints.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Marine and Aerial Robotics**" and attain **EMPLOYABILITY SKILL** through **Participative** learning techniques.					
Course Outcomes	CO1 Understand the fundamental principles of marine and aerial robotic systems. CO2 Design and implement control strategies for robotic platforms in water and air. CO3 Analyse and solve challenges related to sensing, navigation, and communication in dynamic environments. CO4 Develop and evaluate solutions for applications in exploration, data collection, and autonomous operations.					
Course Content:						
Module 1	Fundamentals of Marine and Aerial Robotics	Assignment	Data collection	12 sessions		
Topics: Fundamentals of marine and aerial robotics, Overview of their applications, history, and current trends, key components of robotic systems, including sensors, actuators, controllers, and power systems, followed by the principles of buoyancy and hydrodynamics for underwater robotics and the basics of aerodynamics and flight mechanics for aerial systems.						
Module 2	Sensors, Actuators, and Control Systems	Assignment	Mathematical	12 sessions		
Topics: Overview of sensors for robotics, sensor calibration and data acquisition, actuators for marine and aerial systems, introduction to control systems, feedback and PID control, control						

strategies for marine robots, control strategies for aerial robots, and hands-on lab for building a simple control system.				
Module 3	Navigation and Autonomy	Assignment	Mathematical	12 sessions
Topics: Localization and mapping basics, navigation in GPS-denied environments, environmental mapping with sensors, path planning algorithms, swarm robotics, machine learning in robotics, communication between robotic systems, and hands-on lab for programming autonomous navigation.				
Module 4	Applications and Future Trends	Assignment	Mathematical	09 sessions
Real-world applications of marine robotics, real-world applications of aerial robotics, ethical and environmental considerations, emerging technologies in robotics, course project demonstrations, and wrap-up with future learning opportunities.				
Targeted Application & Tools that can be used: Marine and aerial robotics are utilized in applications such as underwater exploration, environmental monitoring, search and rescue operations, and precision agriculture. Tools like Gazebo and V-REP are employed for simulation and modeling, while ROS and Arduino facilitate control and programming.				
Textbook T1.A First Course in Aerial Robots and Drones Author: Yasmina Bestaoui Sebbane Edition: 1st Edition Publisher: CRC Press Publication Date: February 24, 2022 ISBN-13: 978-0367631383 ISBN-10: 0367631385 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.Intelligent Marine and Aerial Vehicles: Theory and Applications Editors: Meng Joo Er, Ning Wang, Mahardhika Pratama, Sanjay Sharma Publisher: Nova Science Publishers Publication Date: 2018 ISBN-13: 978-1536134469 ISBN-10: 1536134465 **References** R1.Control of Ground and Aerial Robots Author: Mario Sarcinelli Filho Edition: Hardcover Publisher: Springer Publication Date: 2023 ISBN-13: 978-3031253580 ISBN-10: 3031253580 R2.Aerial Robots: Aerodynamics, Control, and Applications Editors: M. S. S. S. R. Anjaneyulu, S. S. S. R. Anjaneyulu Edition: Hardcover Publisher: IntechOpen Publication Date: 2016 ISBN-13: 978-9535134633 ISBN-10: 9535134630 **Topics for Technology Enabled Learning:** **Introduction to Aerial Robotics: Online Textbook** An online textbook covering modeling, dynamics, state estimation, flight control, and motion planning for aerial robotics.				
Topics relevant to " EMPLOYABILITY SKILL ": kinematics and dynamics of robotic motion, communication systems such as underwater acoustic and aerial GPS-based methods, and power and energy management for autonomous operations. **EMPLOYABILITY SKILL** through **participative Learning techniques**. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	Dr. Prashanth S P			

Recommended by the Board of Studies on	20th BOS Meeting held on 19th Dec 2024
Date of Approval by the Academic Council	

Course Code: **MEC3415**	**Course Title: Autonomous Mobile Robots** **Type of Course:** **1] Professional Elective Course 2] Theory**	**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 Participative learning techniques..					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamentals of mobile robots. 2] Identify the different principles of locomotion and kinematics. 3] Describe the different types sensing elements and perceptions. 4] Describe the cognition system to develop autonomous mobile robots.					
Course Content:						
Module 1	Robot locomotion and Kinematics and Dynamics	Assignment	Data Collection	08 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	15 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	12 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 **Participative learning techniques.**. This is attained through assessment component mentioned in course plan.	
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	6/9/2023

Course Code: MEC3416	**Course Title: Human Robot Interaction** **Type of Course:** **1] Professional Elective Course** **2] Theory**		**L-T-P-C**	3	0	0	3
Version No.	1.0					
urse Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course provides an overview of human robot interaction, non verbal interaction, sensors used, verbal interaction, applications of human robot interaction in several sectors. A wide scope is given to the area of Applications where in students understand how robotics can be applied in different industrial applications.					
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:** 1] Describe Robot, Robotics and Various Components of Robots. 2] List the major sensors used in robots for interaction 3] Explain how robots can manage non-verbal interaction 4] Explain the applications of Human Robot Interaction					
Course Content:						
Module 1	Human Robot Interaction	Assignment	Data Collection	12 Sessions		
Topics: Definition of Robot, types of robots, Robotics market and the future prospects, HRI as an interdisciplinary endeavor, evolution of HRI, Robot motions, Joints, Work volume, Sensors in Robotics for interaction– Sensors for Audio, Vision, Tactile sensors, Proximity and Range sensors, Actuators- Motors, Pneumatic actuators, speakers. Software.						
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, Basic principles of speech recognition, Practice in HRI, Voice-activity detection, 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- 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.						
Targeted Application & Tools that can be used: Industrial applications of robots: Medical sector Automation in industries.						
Text Book:						

. Human Robot Interaction, Christop Bartneck
References: 1. Robot Technology by Philippe Coffet (Vol. 1 to Vol. 7) **Web links:** 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 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	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

<table>
<tr><td>Course Code:
MEC3417</td><td colspan="3">Course Title: Smart Mobility and Intelligent Vehicles
Type of Course: 1] Professional 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">The Smart Mobility course provides a comprehensive understanding of the technologies, strategies, and innovations transforming modern transportation systems. Designed to address the challenges of urbanization, climate change, and evolving mobility needs, the course covers critical topics such as electric and autonomous vehicles, intelligent transportation systems, Mobility-as-a-Service (MaaS), and sustainable urban mobility.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of Smart Mobility" 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 key concepts of smart mobility and sustainable transportation.
CO2: Gain knowledge of electric and autonomous vehicle technologies.
CO3: Learn how to design and implement shared mobility solutions (MaaS).
CO4: Apply smart technologies to improve urban transportation systems.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td colspan="2">Foundations of Smart Mobility</td><td>Case Study</td><td colspan="2">Descriptive</td><td>13 sessions</td></tr>
<tr><td colspan="8">Topics:
Introduction to Smart Mobility, Overview of Sustainable Transportation, Intelligent Transportation Systems (ITS) Basics, Smart Traffic Management, Principles of Urban Mobility Planning, Role of Data Analytics in Mobility, Challenges in Current Mobility Systems.</td></tr>
<tr><td>Module 2</td><td colspan="2">Electric and Autonomous Vehicles</td><td>Case Study</td><td colspan="2">Descriptive</td><td>12 sessions</td></tr>
<tr><td colspan="8">Topics:
Fundamentals of Electric Vehicles (EVs), EV Batteries and Charging Infrastructure, Introduction to Autonomous Vehicles (AVs), Sensors and Perception Systems in AVs, Connectivity and Vehicle-to-Everything (V2X) Communication, Safety and Ethical Challenges in AVs, Integration of EVs and AVs into Smart Cities, Future Trends in EV and AV Technology.</td></tr>
<tr><td>Module 3</td><td colspan="2">Mobility-as-a-Service (MaaS) and Shared Mobility</td><td>Case Study</td><td colspan="2">Descriptive</td><td>10 sessions</td></tr>
<tr><td colspan="8">Topics:</td></tr>
</table>

Introduction to Mobility-as-a-Service, Components of MaaS Ecosystems, Shared Mobility Solutions: Ridesharing and Carsharing, Micro-mobility: E-scooters and E-bikes, Digital Platforms for MaaS Integration, Economic and Social Impacts of MaaS, Case Studies of MaaS Implementation.				
Module 4	Sustainable and Connected Urban Mobility	Case Study	Descriptive	10 sessions
Topics: Concepts of Smart Cities and Urban Mobility, Sustainable Mobility Strategies, Renewable Energy Integration in Transportation, Public Transit Innovations, Smart Infrastructure and IoT in Mobility, Policy and Regulation for Smart Mobility, Global Trends in Sustainable Transportation, Final Project Presentation.				
Targeted Application & Tools that can be used: **Application** • Electric Vehicles (EVs) • Autonomous Vehicles (AVs) • Mobility-as-a-Service (MaaS) • Smart Traffic Management **Tools** • Vehicle-to-Everything (V2X) Communication • Intelligent Traffic Management Systems • Electric Vehicle Charging Infrastructure • Data Analytics and IoT for Mobility				
Text Book's 1. "Introduction to Smart Mobility: Concepts and Technologies" (1st Edition) by George J. Hwang 2. "Electric and Autonomous Vehicles: Technology, Policy, and Impacts" (2nd Edition) by Anna P. Anagnostopoulou				
References 1. "Mobility as a Service: A New Paradigm for Public Transport" (1st Edition) by Kari Tervo 2. "Intelligent Transport Systems: Smart and Green Infrastructure Design" (3rd Edition) by Andreas R. K. Nilsen				
Topics relevant to "SKILL DEVELOPMENT": **Smart Mobility** – understanding of the technologies, strategies, and innovations transforming modern transportation systems. **EMPLOYABILITY SKILL** through **Smart mobility**. This is attained through assessment component mentioned in course plan.				
Catalogue prepared by	Dr. Prashanth S P			
Recommended by the Board of Studies on	20th BOS Meeting held on 19th Dec 2024			
Date of Approval by the Academic Council				

Course Code: **MEC3418**	**Course Title: Manufacturing Control and Automation** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**L-T-P-C**	3	0	3
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	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.				
Course Objective	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.				
Course Outcomes	On successful completion of this course the students shall be able to**:** **(**1) Illustrate the basic concepts of automation in machine tools. (2) Analyze various automated flow lines, explain assembly systems and line balancing methods. (3) Describe the importance of automated material handling and storage systems. (4) Interpret the importance of adaptive control systems, automated inspection systems**.**				
Course Content:					
Module 1	Automation & flow lines	Assignment	Cellular, Plant and Product Layout and flow lines analysis	15 Sessions	
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.					
Module 2	Analysis of transfer line in automation	Assignment	Line balancing analysis	10 Sessions	
Topics: Analysis of Automated Flow Lines: General terminology, analysis of transfer lines with and without buffer storage, partial automation, implementation of automated flow lines.					
Module 3	Modeling and simulation for manufacturing plant automation	Assignment	AI technologies	12 Sessions	
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,					
Module 4	Control technologies in automation	Assignment	Programming of microprocessors	08 Sessions	

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:
Application Area is Industrial Automation, Automated processing stations, Assembly line balancing, Industrial process control loop.

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 plan.

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	Academic Council Meeting No. 24, dated 03/08/2024

Course Code: MEC3419	**Course Title: Micro Electro Mechanical Systems** **Type of Course: Professional Elective Course & 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 introduction to Micro Electromechanical Systems (MEMS) with this comprehensive course, designed to equip you with the knowledge and hands-on skills to excel in this transformative field. Dive deep into the essential concepts, materials, and fabrication techniques that power MEMS technology, and explore how it is revolutionizing industries. From understanding foundational MEMS principles to mastering advanced sensor fabrication and characterization methods, this course offers a step-by-step guide to becoming proficient in MEMS applications. Engage with dynamic video content and develop practical skills in cleanroom protocols, micromachining. Learn to fabricate MEMS sensors, interface them with advanced techniques, and apply communication protocols to create innovative solutions.		
Course Out Comes	On successful completion of the course the students shall be able to: **CO1.** Appreciate the technologies related to Micro Electro Mechanical Systems. **CO2.** Understand design and fabrication processes involved with MEMS De- vices. **CO3.** Analyze the MEMS devices and develop suitable mathematical models. **CO4.** Know various application areas for MEMS device.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Micro Electro Mechanical Systems**" and attain **EMPLOYABILITY SKILL** through Participative Learning Techniques.		
Course Content:			

Module 1	Overview of MEMS and Microsystems	12 sessions
Topics: MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications and Markets. [Apply level]		
Module 2	Working Principles of Microsystems	12 sessions
Topics: Introduction, Microsensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers, Microfluidics. [Apply level]		
Module 3	Engineering Mechanics for Microsystems Design	10 sessions
Topics: Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics, Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis. [Apply level]		
Module 4	Scaling Laws in Miniaturization	11 sessions
Topics: Introduction, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Fluid Mechanics, Scaling in Heat Transfer. [Apply level]		

Targeted Application & Tools that can be used:	
Text Book T1**:** Tai-Ran Hsu, MEMS and Micro systems: Design, Manufacture and Nanoscale Engineering, 2nd Ed, Wiley.	
References 1. Hans H. Gatzen,Volker Saile, JurgLeuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015. 2. Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik, Microelectromechanical Systems (MEMS), Cengage Learning.	
Topics relevant to "EMPLOYABILITY SKILLS": MEMS principles to mastering advanced sensor fabrication and characterization methods for **EMPLOYABILITY SKILLS** through **Participative Learning techniques**. This is attained through assessment component mentioned in course plan.	
Catalogue prepared by	Basavaraj Devakki
Recommended by the Board of Studies on	xx BOS Meeting held on xx/xx/xxxx
Date of Approval by the Academic Council	Academic Council Meeting No. xx, Dated xx/xx/xxxx

<table>
<tr><td>Course Code:
MEC3420</td><td colspan="4">Course Title: Introduction to Robotics and Automation
Type of Course:
1] Professional Elective Course
2] 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="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">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.</td></tr>
<tr><td>Course Objective</td><td colspan="8">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.</td></tr>
<tr><td>Course Out Comes</td><td colspan="8">On successful completion of the course the students shall be able to:
1] Describe Robot, Robotics and Various Components of Robots.
2] Describe various types of sensors, actuators and its applications in robotics.
3] Discuss different type of Automation and applications.
4] Describe the different types of Automated manufacturing systems.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td colspan="2">Introduction to Robotics</td><td colspan="2">Assignment</td><td colspan="2">Data Collection</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td>Module 2</td><td colspan="2">Robot Sensors and Machine vision system</td><td colspan="2">Assignment</td><td colspan="2">Data Collection</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td>Module 3</td><td colspan="2">Introduction to Automation</td><td colspan="2">Assignment</td><td colspan="2">Data collection and Analysis</td><td colspan="2">12 Sessions</td></tr>
<tr><td colspan="9">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.</td></tr>
</table>

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			

Course Code: **MEC3421**	**Course Title: Power Plant Engineering** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**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 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		8 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	8 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	
Topics 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	
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:
MEC3422</td><td colspan="3">Course Title:
Turbomachinery
Type of Course:
1] Professional Elective Course
2] 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="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">MEC2501,MEC2502</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 colspan="2">Basic terms and Dimensionless parameters and their significance</td><td>Assignment</td><td colspan="3">Calculation of dimensionless number for various practical application.</td><td>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 colspan="2">Velocity Triangle and Energy Equation</td><td>Assignment</td><td colspan="3">Data collection for different types of turbomachines in different industry.</td><td>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>
</table>

Module 3	Hydraulic Turbines	Assignment	Data Collection on use of different types of Hydraulic turbine in different application areas.	10 Sessions
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.	12 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: **MEC3423**	**Course Title: Renewable Energy Systems** **Type of Course:** **1] Professional Elective Course** **2] 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 **EMPLOYABILITY SKILL** through participative learning techniques.					
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. **Assignment:** Prepare a comprehensive report on the 2021 energy mix in India.						
Module 2	Solar energy	Assignment	Data collection and data analysis /Case Study	16 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.
Assignment : Collect data related to renewable energy generation (Solar)

Module 3	Wind And Biomass Energy	Assignment	Data collection	16 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.
Assignment: Prepare a report on recent Data collection related to wind energy across the world.

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 Resources"; Narosa Publishers, 2005

E-Resources:
W1:
https://presiuniv.knimbus.com/user#/searchresult?searchId=renewable%20energy%20&_t=1662529543766

Topics relevant to "EMPLOYABILITY SKILL": Solar Energy System, Bio gas Plant for developing **EMPLOYABILITY SKILL** 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

Course Code: MEC3424	**Course Title: Advanced Heat Transfer** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	MEC2509					
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	10 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:** W1.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

Course Code: **MEC3425**	**Course Title: Compressible Fluid Flow** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**L- T-P- C**	**3**	**0**	**0**	**3**
Version No.	1.1					
Course Pre-requisites	MEC2502					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	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.					
Course Out Comes	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.					
Course Content:						
Module 1	Basic	Assignment	Experiment	5 Sessions		
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						
Module 2	Isentropic Flow and Wave Motion	Assignment	Analysis	20 Sessions		
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.						

Module 3	Shocks (Normal and Oblique)	Assignment	Data Analysis	11 Sessions
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. **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

Course Code: **MEC3426**	**Course Title: Refrigeration & Air Conditioning** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**L- T-P- C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	MEC2509					
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: 1. Evaluate the performances of complex vapor compression systems. 2 Choose suitable components for refrigeration system. 3. Execute thermodynamic analysis of absorption refrigeration systems 4. Evaluate various psychrometric properties from measured values of barometric pressure, dry bulb and wet bulb temperatures. 5. Calculate the internal and external cooling loads on a building.					
Course Content:						
Module 1	Introduction		Data Analysis	10 Session		
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	10 Session		
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	5 Session		
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	6 Sessions		
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	13 Sessions
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: **MEC3427**	**Course Title: Alternate Fuels** **Type of Course:** **1] Professional Elective Course 2] Theory**		**L-T-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	12 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	14 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:

W1.https://presiuniv.knimbus.com/user#/searchresult?searchId=machine%20elements&_t=1656917902483
W2.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: **MEC3428**	**Course Title:** **Computational Fluid Dynamics** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	2.0					
Course Pre-requisites	MEC2502					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	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.					
Course Outcomes	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					
Course Content:						
Module 1	Introduction			6 sessions		
Topics: Introduction to CFD, Advantages, applications and the future of CFD, CFD solution procedure, problem setup processes, numerical solution, results report and visualization.						
Module 2	Governing Equations for CFD	Assignment	Mathematical	8 sessions		
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.						

Module 3	CFD mesh generation and techniques	Assignment	Mathematical	13 sessions
Types of meshes, local mesh refinement, moving meshes, guidelines for mesh quality and mesh design, Discretization of governing equations: FDM, FVM, converting 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
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:

W1.https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_1106

W2.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: **MEC3429**	**Course Title: Elements of Solar Energy Conversion** **Type of Course:** **1] Professional Elective Course** **2] Theory**		**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 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: 1] Recognize the significance of the principles of solar energy in the engineering context 2] Illustrate the fundamentals of solar energy conversion. 3] 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							
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:
W1.
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.

Course Code: MEC3430	**Course Title: Product Design in RAC** **Type of Course:** **1] Professional Elective Course** **2] Theory**	**L-T- P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	MEC2506					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	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.					
Course Outcomes	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					
Course Content:						
Module 1	Introduction	Assignment	Mathematical	10 sessions		
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□.						
Module 2	Ref. system Components & their types	Assignment	Mathematical	10 sessions		
Topics: compressors, condensers, evaporators, expansion devices. Working principle of the components and unique feature						
Module 3	Selection of components	Assignment	Mathematical	12 sessions		
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.						
Module 4	Product design	Assignment	Mathematical	12 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

<table>
<tr><td>Course Code:
MEC3431</td><td colspan="2">Course Title: Mechanical Vibrations
Type of Course:
1] Professional Elective Course
2] 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">MAT2301</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">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. The associated laboratory provides an opportunity to validate the concepts Taught and enhances the ability to visualize the real system performance.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Mechanical Vibrations” 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 be able to:

1. Explain the basics concepts of single degree of freedom systems.
2. Predict the responses of damped single degree freedom system.
3. Solve numerical examples on vibration system under harmonic excitation.
4. Employ different methods to determine the natural frequencies of multi-degree freedom systems.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td colspan="2">Free un-damped vibration of Single Degree of Freedom Systems</td><td>Assignment</td><td colspan="2">Programming Task, Data Analysis task</td><td>10 sessions</td></tr>
<tr><td colspan="8">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. Simple problems using MATLAB.</td></tr>
<tr><td>Module 2</td><td colspan="2">Free damped Vibration of Single-Degree-of-Freedom Systems</td><td>Quiz</td><td colspan="2">Analytical thinking</td><td>12 Sessions</td></tr>
<tr><td colspan="8">Topics:
Types of damping, Free Vibration with Viscous Damping, Free Vibration with Coulomb Damping. Simple problems using MATLAB.</td></tr>
<tr><td>Module 3</td><td colspan="2">Forced vibration of SDOFS</td><td>Assignment</td><td colspan="2">Data Collection and Analysis</td><td>11 Sessions</td></tr>
</table>

Topics: Response of an Undamped and damped System under Harmonic excitation, Response of a Damped System under the Harmonic Motion of the Base. Critical speed. Simple problems using MATLAB.				
Module 4	Multi degree of freedom Systems	Assignment	Data Collection and Analysis	12 Sessions
Topics: Two-Degree-of-Freedom Systems, Continuous Systems - Longitudinal Vibration of a Bar, modal analysis, Holzer's method and Dunkerley's method-. Simple problems using MATLAB.				
Targeted Application & Tools that can be used: Application Area is suspension design of vehicles, aerospace, automobile kinematics and dynamics, vibration of machines. Professionally Used Software: MATLAB				
Project work/Assignment:				
Project Assignment: Carry out half car model study of different chassis used in Automobiles in India Assignment 1: Collect the data for dampers of your vehicle. Plot the transmissibility component of the same Engine				
Text Books **T1** W. T. Thomson, "***Theory of Vibration with application,***" Pearson **T2** Singeresu S. Rao ***Mechanical Vibration*** 5th edition Prentice Hall, Pearson				
References **R 1** Leonard Meirovutch ***"Engineering Vibration,"*** Indian Edition **R 2** William Seto ***"Mechanical Vibration"*** Schaum Series **R 3** Rao V. Dukkipati, MATLAB An Introduction with Applications, https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=INTECH_1_2609				
Topics relevant to "EMPLOYABILITY SKILLS": Kinetics: Force, mass and acceleration in Newton's second law of motion, work and energy, impulse and momentum for rigid bodies 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	19th BOS held on 05/07/2024			
Date of Approval by the Academic Council	Academic Council Meeting No. 24, dated 03/08/2024			

<table>
<tr><td>Course Code:
MEC3432</td><td colspan="4">Course Title: Experimental Stress Analysis
Type of Course:
1] Professional Elective Course
2] 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="8">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">MEC2505</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 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.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:
[1] Explain the different types of strain gauges and its arrangement
[2]Compute the stress and strain behavior of mechanical components using electrical strain gauges
[3] Compute the Photo elastic analysis with various techniques
[4] Explain the principles of circular polariscope</td></tr>
<tr><td>Course Objectives</td><td colspan="8">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.</td></tr>
<tr><td>Module 1</td><td colspan="2">Electrical Strain Resistance Gauges</td><td colspan="2">Assignment</td><td colspan="2">Demonstration of the Experiment</td><td colspan="2">12 sessions</td></tr>
<tr><td colspan="9">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,</td></tr>
<tr><td>Module 2</td><td colspan="2">Strain Analysis:</td><td colspan="2">Assignment</td><td colspan="2">Case study</td><td colspan="2">08 sessions</td></tr>
<tr><td colspan="9">Topics:
Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.</td></tr>
<tr><td>Module 3</td><td colspan="2">Photoelastic Analysis and coatings</td><td colspan="2">Assignment</td><td colspan="2">Analysis of Photo elastic Models using Ansys Software</td><td colspan="2">20 sessions</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td colspan="9"></td></tr>
</table>

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.

Course Code: **MEC3433**	**Course Title: Product Lifecycle Management** **Type of Course: 1] Professional Elective Course** **2] Laboratory Integrated**	**L-T-P-C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	NIL					
	NIL					
Course Description	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'					
Course Outcomes	On successful completion of this course the students shall be able to: 1] Describe different processes associated with Product Lifecycle. 2] Describe environment, drivers and PLM elements. 3] Deploy Engineering Change Management process. 4] Design Bill of Materials. 5] Deployment of Work flow on Team center**.**					
Course Objective	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					
Course Content:						
Module 1	Introduction to Product Life Cycle Management (PLM)	Assignment	Data Collection and Analysis	8 sessions		
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.						
Module 2	PLM Concepts, Processes and Workflow	Case Study	Data analysis task	10 sessions		
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	08 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	Dr. Sandeep G M
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: **MEC3434**	**Course Title: Theory of Elasticity** **Type of Course: 1] Professional Elective Course** **2] Theory**		**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	2.0					
Course Pre-requisites	MEC2500					
Anti-requisites	NIL					
Course Description	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.					
Course Objectives	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.					
Course Outcomes	On successful completion of this course the students shall be able to: (1) Solve problems related to elasticity (2) Apply numerical methods to solve continuum problems. (3) Apply different principles to solve the 3 dimensional problems. (4) Reduce the computation effort by adopting the axisymmetric method. (5) Solve the problem related to thermal loading.					
Course Content:						
Module 1	Analysis of Stress:	Assignment	Programming Task, Data Analysis task	10 sessions		
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						
Module 2	Analysis of Strain:	Case Study	Simulation and data analysis task	10 sessions		
Topics: Strain invariants, Principal strains, Octahedral strains, Plane state of strain, Compatibility equations, Strain transformation. Principle of super position, Saint Venant principle.						
Module 3	Plane Stress And Plane Strain Problems	Assignment	Data Collection and Analysis	10 sessions		
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.						
Module 4	Polar Coordinates &	Assignment	Simulation/Data Analysis	15 sessions		

	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: **MEC3435**	**Course Title: Theory of Plasticity** **Type of Course:** **1] Professional Elective Course 2] Theory**		**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	2.0					
Course Pre-requisites	MEC2505					
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: (1) Understand the stress, deformation, deformation, relationship between stress and deformation and plastic deformation in solids. (2) Understand plastic stress/deformation relationships and flow rules. (3) Perform stress analysis in beams and bars including Material nonlinearity (4) 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	08 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:	Assignment	Analysis using suitable software	12 sessions
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.			

Course Code: MEC3436	**Course Title: Tribology and Bearing design** **Type of Course: 1] Professional Elective Course** **2] Theory**	**L-T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	MEC2505					
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: 1) Select different bearing suitable for particular application. 2) Interpret Reynolds's equation for fluid film lubrication. 3) Understand hydrodynamic lubrication in full film lubricated bearing. 4) Select appropriate material and lubricant for bearing in particular application.					
Course Content:						
Module 1	Rolling contact Bearing	Quiz	Critical thinking task	12 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	08 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	12 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

Course Code: MEC3437	**Course Title: Fracture Mechanics** **Type of Course: 1] Professional Elective Course Theory**	**L-T- P- C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	MEC2505					
Anti-requisites	NIL					
Course Description	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.					
Course objectives	The objective of the course is to familiarize the learners with the concepts of " **Fracture Mechanics**" and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the basic fracture and fatigue mechanisms 2. Understand crack resistance and energy release rate for crack criticality. 3. Apply Linear Elastic Fracture Mechanics on brittle materials. 4. Understand the relationship between crack tip opening displacement, SIF, ERR and application of such parameters for ductile and brittle materials 5. Determine the critical values of parameters at crack tip using experimental techniques					
Course Content:						
Module 1	Introduction	Assignment	Programming Task,		10 sessions	
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.						
Module 2	Linear Elastic Fracture Mechanics	Case Study	Simulation and data analysis task		10 sessions	
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.						
Module 3	Elastic-Plastic Fracture Mechanics	Assignment	Data Collection and Analysis		15 sessions	
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

Course Code: MEC3438	**Course Title: Mechanics of Composite Materials** **Type of Course:** **1] Professional Elective Course 2] Theory**		**L- T-P- C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	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					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Describe the various techniques of manufacturing metal matrix and fiber reinforced composites. 2. Compute the Various Elastic Properties Using the Micromechanics Principle. 3. Compute the Various Elastic Properties Using the Macromechanics Principle. 4. Describe the Various Failure Theories and Methods Involved in Recycling of Composite Materials.					
Course Content:						
Module 1	Introduction to Composite Materials:	Assignment	Data Collection	08 Sessions		
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.						
Module 2	**Micromechanics of Composites:**	Case Study	Data collection	15 Sessions		
Density, Mechanical Properties; Prediction of Elastic Constants, Micromechanical Approach, Halpin-Tsai Equations, Transverse Stresses. Thermal Properties; Expression for Thermal Expansion Coefficients of Composites, Expression for Thermal Conductivity of Composites. Mechanics of Load Transfer from Matrix to Fiber; Load transfer in Particulate Composites.						
Module 3	**Macromechanics of Composites:**	Case Study	Data collection	12 Sessions		

Elastic Constants of an Isotropic Material, Elastic Constants of a Lamina, Relationship between Engineering Constants and Reduced Stiffnesses and Compliances, Variation of Lamina Properties with Orientation, Analysis of Laminated Composites, Stresses and Strains in Laminate Composites, Inter-laminar Stresses and Edge Effects. Numerical Problems.				
Module 4	Monotonic Strength and Fracture	Assignment	Data Collection	10 sessions
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. **Failure Analysis and Design of Laminates:** Special cases of Laminates; Symmetric Laminates, Cross-ply laminates, Angle ply Laminates, antisymmetric Laminates, Balanced Laminate.				
Text Book Composite Science and Engineering by K.K. Chawla Springer Verlag 1998				
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				
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.				

Catalogue prepared by	Dr. Yuvaraja Naik
Recommended by the Board of Studies on	11th BOS held on 05/09/2020
Date of Approval by the Academic Council	No.14, 24/12/2020

Course Code: MEC3439	**Course Title: Automotive Body Design** **Type of Course:** **1] Professional Elective Course 2] Theory**		**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	10 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	10 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

Open Elective Course Catalogues (Offered by the Mechanical Engineering Department)

Course Code: **MEC3250**	**Course Title: Engineering Drawing** **Type of Course: Open Elective & lab based**	**L-T-P-C**	1	0	4	3
Version No.	1.0					
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 Drawing**" and attain **ENTREPRENEURIAL SKILL** through Experiential learning techniques .					
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.						
Module 2	Orthographic projections of Points, Straight Lines and Plane Surfaces	Assignment	Projection methods Analysis	20 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.				
Module 3	Orthographic Projections of Solids	Assignment	Multi-view drawing Analysis	15 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).				
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			

Course Code: MEC3251	**Course Title: Supply Chain Management** **Type of Course: Open Elective & Theory only**	**L-T- P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	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.					
Course Outcomes	**On successful completion of this course the students shall be able to:** **(**1) Summarize the drivers and their role in the performance of Supply Chain. 2) Construct Supply Chain Network according to the requirement of any particular type of product. 3] Solve forecasting and inventory related issues in Supply Chain in practice. 4] Estimate transportation requirements of global product in real life. 5] Interpret the impact of future technologies in Supply Chain Management**.**					
Course Content:						
Module 1	Introduction to SCM	Assignment	Data Collection and Analysis	10 Sessions		
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.						
Module 2	Designing the Supply chain Network	Case Study	Simulation and data analysis task	10 Sessions		
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.						

Module 3	Planning and Coordinating Demand and Supply	Assignment	Data Collection and Analysis	10 Sessions
Topics: Demand forecasting, Aggregate Planning in Supply Chain, Coordination in Supply Chain. Managing economies of scale in a supply chain: Cycle inventory, 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	08 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	07 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.

Course Code: MEC3252	**Course Title: Six Sigma for Professionals** **Type of Course: Open Elective & Theory only**		**L- T-P-C**	**3**	**0**	**0**	**3**
Version No.	2					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	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.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1] Define the problem statement through customer analysis in terms of time, budget, and resource requirements. 2] Summarize a detailed process map by gathering baseline data. 3] Complete a root cause verification analysis by the help of inferential statistics and hypothesis testing. 4] Devise a preliminary implementation plan, update standard work procedures and write an action plan.					
Course Content:						
Module 1	Define Phase	Assignment	Data Collection	12 Sessions		
Topics: **Define Phase: The Basics of Six Sigma, The Fundamentals of Six Sigma, Selecting Six Sigma Projects.**						
Module 2	Measure Phase	Case Study	Data Analysis	10 Sessions		
Topics: Measure Phase: Process Definition, Six Sigma Statistics, Measurement System Analysis, Process Capability.						
Module 3	Analyze Phase	Assignment	Data Analysis	12 Sessions		
Topics: Analyze Phase: Patterns of Variation, Inferential Statistics, Hypothesis Testing, Hypothesis Testing with Normal Data, Hypothesis Testing with Non-Normal Data.						

Module 4	Improve & Control Phase	Case Study	Data Analysis	11 Sessions
Topics: Improve and Control Phase: Simple Linear Regression, Multiple Regression Analysis, Statistical Process Control (SPC), Six Sigma Control Plans**.**				
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: MEC3253	**Course Title: Fundamentals of Aerospace Engineering** **Type of Course: Open Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	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.					
Course Objective	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.					
Course Outcomes	**On successful completion of the course the students shall be able to:** CO 1: Solve problems based on the concepts of flowing gases and the standard atmosphere CO 2: Apply the principles of basic aerodynamics to airfoils CO 3: Determine the thrust and power requirements for level, unaccelerated flight of an aircraft CO 4: Explain the criteria for longitudinal static stability for an airplane CO 5: Apply the basics of space vehicle trajectories to simple missions CO 6: Determine some propulsive characteristics of aircraft and rocket engines					
Course Content:						
Module 1	Introduction	Assignment	Data Analysis task	10 Sessions		
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.						
Module 2	Basic Aerodynamics	Assignment	Programming task and simulation	15 Sessions		
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**.**						

Module 3	Airplane Performance, Stability and Control	Assignment	Data Collection and Analysis	10 Sessions
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: MEC3254	**Course Title: Safety Engineering** **Type of Course: Open Elective/ Theory Only Course**	**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 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.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " **Safety Engineering**" and attain **ENTREPRENEURIAL SKILL** through Participative learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Understand the basic safety terms and international standards. 2. Identify the hazards and risk analysis around the work environment and industries. 3. 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 4. Recognize the types of fires extinguishers and to demonstrate the portable extinguishers used for different classes of fires. 5. Report the case studies by sharing experience of the employees working in housekeeping, laboratories etc. 6. Recognize the chemical and electrical hazards for its prevention and control.					
Course Content:						
Module 1	Introduction to Safety	Case Study	Data Collection	10 sessions		
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.						
Module 2	Fire Safety	Term paper	Data Collection	10 sessions		
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.				
Module 3	Mechanical Safety	Case Study	Data Collection	10 sessions
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.				
Module 4	Electrical Safety	Assignment	Data Collection	08 sessions
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.				
Module 5	Chemical Safety	Case Study	Data Collection	07 sessions
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.				
Targeted Application & Tools that can be used: **Job profiles like Safety Engineer etc**				
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.				
References 3. A M Sarma, "Industrial Health & Safety Management", Himalaya Publishing House. 4. 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				
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.	
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: MEC3255	**Course Title: Additive Manufacturing** **Type of Course: Open 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 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.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Additive Manufacturing** " and attain **EMPLOYABILITY SKILL** through Participative learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1] Understand the fundamentals of Manufacturing Processes. 2] Understand the classifications of Manufacturing Process and methodologies of manufacturing for industrial applications. 3] Understand the fundamentals of Additive Manufacturing and its importance in Industrial Applications. 4] Understand the classifications of Additive Manufacturing and methodology of manufacturing the products using various technologies and study their applications, advantages and limitations. 5] Understand the methodology to manufacture the products using FDM technologies and study their applications, advantages and case studies.					
Course Content:						
Module 1	Introduction to Manufacturing Technology	Assign ment	Identify the Major manufacturing Technologies and report the manufacturing capabilities	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.						
Module 2	Manufacturing Processes	Assign ment	Literature review	12 Sessions		
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.						
Module 3	Introduction to Additive	Assign ment	Identify the Major manufactures in India for 3D	12 Sessions		

	Manufacturing (AM)		printing and report the manufacturing capabilities	
Topics: Introduction to Additive Manufacturing: Introduction, Prototyping fundamentals, 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				
Module 4	AM processes and Software	Assign ment	Decision Tree	11 Sessions
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.				

Targeted Application & Tools that can be used:

Application Area is rapid prototyping, product design and development industries

Professionally Used Software: 3D Modeling software.

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

Web Resources:

https://presiuniv.knimbus.com/user#/searchresult?searchId=elements%20of%20Mechanical%20Engineering&_t=1659588753433

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.

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: **MEC3256**	**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: 1. Introduce students to the fundamental concepts and principles of sustainability and their significance in engineering disciplines. 2. Familiarize students with the latest sustainable technologies and practices in science and engineering. 3. Enable students to analyse the environmental, social, and economic impacts of engineering projects and propose sustainable alternatives. 4. 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			10 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	08 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	07 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	6/9/2023			

Course Code: MEC3257	**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:** **(**1) Understand the basic concepts of Industry 4.0 and scope for Indian Industry (2) Demonstrate conceptual framework and road map of Industry 4.0 (3) Apply Industry 4.0 for various fields of application (4) 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 Sessions		
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	10 Sessions		
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 Sessions		
Topics:						

Manufacturing – Healthcare – Education – Aerospace and Defense – Agriculture – Transportation and Logistics**.**				
Module 4	Impact of Industry 4.0	Assignment	Case Study	13 Sessions
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	6/9/2023

Course Catalogues (Courses Offered by other Departments)

<table>
<tr><td>Course Code:
PPS4005</td><td colspan="3">Course Title: Aptitude for Employability
Type of Course: Practical 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="8">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">Students should have the basic concepts of Quantitative aptitude, Verbal ability along with its applications in real life problems.</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 enable the students to enhance their skills in quantitative aptitude and verbal ability skills.</td></tr>
<tr><td>Course Objective</td><td colspan="8">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.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">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.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td colspan="2">Quantitative Ability</td><td>Lab-10hrs</td><td></td><td colspan="2">Platform Assessment-10hrs</td><td colspan="2">20 Sessions</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td>Module 2</td><td colspan="2">Verbal Ability</td><td>Lab-5hrs</td><td></td><td colspan="2">Platform Assessment-5hrs</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="9">Topics: - Parts of Speech, Subject Verb Agreement, Spotting Error, Cloze Test, Verbal Analogies,
Reading Comprehension, Idioms & Phrases, Para Jumbles</td></tr>
<tr><td></td><td colspan="8">Targeted Application & Tools that can be used:
Application area: Placement activities and Competitive examinations. Tools: LMS</td></tr>
<tr><td>Evaluation</td><td colspan="8">Continuous Evaluation
• Topic wise evaluation</td></tr>
<tr><td></td><td colspan="8">Text Book
1. Fast track objective by Rajesh Verma
2. R S Aggarwal
3. S.P Bakshi</td></tr>
</table>

	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	

NTCC Course Catalogs: -

Course Code: **MEC7300**	**Course Title:** **Capstone Project** **Type of Course:** **NTCC**	**L- T-P- C**	-	-	-	10
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: 1. Identify the engineering problems related to local, regional, national or global needs. 2. Apply appropriate techniques or modern tools for solving the intended problem. 3. Design the experiments as per the standards and specifications. 4. Interpret the events and results for meaningful conclusions. 5. 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: MEC7000	**Course Title: Internship** **Type of Course: NTCC**	**L- T-P- C**	-	-	-	2
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: 1. Identify the engineering problems related to local, regional, national or global needs. 2. Apply appropriate techniques or modern tools for solving the intended problem. 3. Design the experiments as per the standards and specifications. 4. Interpret the events and results for meaningful conclusions. 5. 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					

Ittagalpura, Rajanukunte, Yelahanka, Bengaluru 560 119