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

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

School of Engineering

Bachelor of Technology Degree

Program Regulations and Curriculum 2020-2024

B.Tech. (Computer Science and Engineering-Artificial Intelligence and Machine Learning)

2020-2024

Regulations No: PU/AC-20.3/SOCSE01/CAI/2020-24

Resolution No. 3 of the 20th Meeting of the Academic Council held on 15th February 2023, and Ratified by the Board of Management in its 21st Meeting held on 22nd February 2023

February 2023

REGISTRAR

Bachelor of Technology Degree
Program Regulations and Curriculum 2020-2024

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, 2019, of the University, the Academic Council hereby makes the following Regulations, namely;

Preliminary:

Short Title and Commencement

(a) These Regulations shall be called the **Bachelor of Technology Degree Program Regulations and Curriculum 2020-2024**.

(b) These Regulations are subject to, and, pursuant to the Academic Regulations, 2019.

(c) These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2020-2024 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 2020-2021.

Définitions :

In these Regulations, unless the context otherwise requires:

a) *"Academic Council" means the Academic Council of the University;*

b) *"Academic Regulations" means the Academic Regulations, 2019, of the University;*

c) *"Academic Term" means a Semester or Summer Term;*

d) *"Act" means the Presidency University Act, 2013;*

e) *"Board of Examinations (BOE)" means the Board of Examinations of the University;*

f) *"Board of Management (BOM)" means the Board of Management of the University;*

g) *"CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations, 2019;*

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

i) *"Course" means, a specific subject usually identified by its Course Code and Course Name, with specified Credit Structure and Credits, Course Description/Content/Syllabus, a set of textbooks/references, taught by assigned Course Instructor(s) to a specific class (group of students) during a specific Academic Term;*

j) *"Course Instructor" means the faculty member who is the Teacher/Course Instructor for the concerned Course;*

k) *"DAC" means the Departmental Academic Committee;*

l) *"Dean" means the Dean of the concerned School;*

m) *"HOD" means the Head of the concerned Department;*

n) *"Parent Department" means the Department that offers the Degree Program that a student undergoes;*

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

p) *"Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum 2020-2024;*

q) *"Registrar" means the Registrar of the University;*

r) *"SGPA" means the Semester Grade Point Average as defined in the Academic Regulations, 2019;*

s) *"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;*

t) *"Section" means the duly numbered Section, with Clauses included in that Section, of these Program Regulations;*

u) *"Statutes" mean the Statutes of Presidency University;*

v) *"Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;*

w) *"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, and,*

x) *"University" means Presidency University, Bengaluru;*

1. **INTRODUCTION**:

1.1. The **Academic Regulations, 2019,** are applicable to all existing Degree Programs of the University. The Academic Regulations, and any amendments made therein, shall also be applicable to new Degree and Diploma Programs that may be offered by the University in future.

1.2. The **Bachelor of Technology Degree Program Regulations and Curriculum 2020-2024** are subject to, and, pursuant to the Academic Regulations, 2019.

1.3. These Program Regulations shall be applicable to the following **Bachelor of Technology (B. Tech.) Degree Programs of 2020-2024:**

1.3.1. Bachelor of Technology in Civil Engineering, abbreviated as B. Tech. (Civil Engineering);

1.3.2. Bachelor of Technology in Computer Engineering, abbreviated as B. Tech. (Computer Engineering);

1.3.3. Bachelor of Technology in Computer Science and Engineering, abbreviated as B. Tech. (Computer Science and Engineering);

1.3.4. Bachelor of Technology in Information Science and Engineering, abbreviated as B. Tech. (Information Science and Engineering);

1.3.5. Bachelor of Technology in Information Science and Technology, abbreviated as B. Tech. (Information Science and Technology);

1.3.6. Bachelor of Technology in Computer Science and Technology, abbreviated as B. Tech. (Computer Science and Technology);

1.3.7. Bachelor of Technology in Electronics and Computer Engineering, abbreviated as B. Tech. (Electronics and Computer Engineering);

1.3.8. Bachelor of Technology in Computer Science and Engineering (Cyber Security), abbreviated as B. Tech. (Computer Science and Engineering-Cyber Security);

1.3.9. Bachelor of Technology in Computer Science and Engineering (Artificial Intelligence and Machine Learning), abbreviated as B. Tech. (Computer Science and Engineering-Artificial Intelligence and Machine Learning);

1.3.10. Bachelor of Technology in Computer Science and Engineering (IoT), abbreviated as B. Tech. (Computer Science and Engineering-IoT);

1.3.11. Bachelor of Technology in Computer Science and Engineering (Block Chain), abbreviated as B. Tech. (Computer Science and Engineering-Block Chain);

1.3.12. Bachelor of Technology in Computer Science and Engineering (Data Science), abbreviated as B. Tech. (Computer Science and Engineering-Data Science);

1.3.13. Bachelor of Technology in Computer Science and Technology (DevOps), abbreviated as B. Tech. (Computer Science and Technology-DevOps);

1.3.14. Bachelor of Technology in Computer Science and Technology (Big Data), abbreviated as B. Tech. (Computer Science and Technology-Big Data);

1.3.15. Bachelor of Technology in Electronics and Communication Engineering, abbreviated as B. Tech. (Electronics and Communication Engineering);

1.3.16. Bachelor of Technology in Electrical and Electronics Engineering, abbreviated as B. Tech. (Electrical and Electronics Engineering);

1.3.17. Bachelor of Technology in Mechanical Engineering, abbreviated as B. Tech. (Mechanical Engineering); and,

1.3.18. Bachelor of Technology in Petroleum Engineering, abbreviated as B. Tech. (Petroleum Engineering).

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

1.5. These Program 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.

1.6. 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.

1.7. These Program Regulations are structured as follows:

1.7.1. **Part A:** Specific regulations relevant to the Bachelor of Technology (B. Tech.) Degree Programs in pursuant of the provisions in Section 6.0 of the Academic Regulations, 2019, of the University.

1.7.2. **Part B:** Program Curriculum for the specific ongoing Bachelor of Technology (B. Tech.) Degree Program of study as enumerated and named in Clause 1.3.

2. PART A: PROGRAM REGULATIONS

2.1. Program Description and Duration

B. Tech. Degree Programs are offered in the following branches/disciplines by the respective Parent Departments as indicated in Table 2.1.

S. No.	B. Tech. Program (Branch/Discipline)	Parent Department
	Table 2.1 **B. Tech. Degree Programs and Respective Parent Departments**	
1.	B. Tech. (Civil Engineering)	Department of Civil Engineering
2.	B. Tech. (Computer Engineering)	Department of Computer Science and Engineering
3.	B. Tech. (Computer Science and Engineering)	
4.	B. Tech. (Information Science and Engineering)	
5.	B. Tech. (Information Science and Technology)	
6.	B. Tech. (Computer Science and Technology)	
7.	B. Tech. (Electronics and Computer Engineering)	
8.	B. Tech. (Computer Science and Engineering-Cyber Security)	
9.	B. Tech. (Computer Science and Engineering-Artificial Intelligence and Machine Learning)	
10.	B. Tech. (Computer Science and Engineering-IoT)	
11.	B. Tech. (Computer Science and Engineering-Block Chain)	
12.	B. Tech. (Computer Science and Engineering-Data Science)	
13.	B. Tech. (Computer Science and Technology-DevOps)	
14.	B. Tech. (Computer Science and Technology-Big Data)	
15.	B. Tech. (Electronics and Communication Engineering)	Department of Electronics and Communication Engineering
16.	B. Tech. (Electrical and Electronics	Department of Electrical and

		Electronics Engineering
17.	B. Tech. (Mechanical Engineering)	Department of Mechanical Engineering
18.	B. Tech. (Petroleum Engineering)	Department of Petroleum Engineering

The 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.

2.2. Admission Criteria to the Four-Year Bachelor of Technology (B. Tech.) Degree Programs:

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 Programs are listed in the following Sub-Clauses:

2.2.1. An applicant who has successfully completed the 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 course.

2.2.2. 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.

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

2.2.4. 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.

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

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

2.2.7. 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.

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

2.3. 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:

2.3.1. Admission to the 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 recognised by the University), who have secured not less than forty-five percent (45%) marks in the final year examination (fifth and sixth 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%).

2.3.2. 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.

2.3.3. 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.

2.3.4. 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.

2.3.5. 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.

2.3.6. 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 2020-2024 minus the number of Credits prescribed for the 1st Year (total number of Credits

prescribed for the 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. (Computer Science and 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. Degree in Computer Science and Engineering for a student who joins the Program through the provision of the Lateral Entry shall be "N – M" Credits.

2.3.7. 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.

2.4. 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:

2.4.1. The concerned student fulfils the criteria specified in Sub-Clauses 2.3.1, 2.3.2 and 2.3.3.

2.4.2. 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) of the B. Tech. Program commencing on August 1 on the year concerned.

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

2.4.4. 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-year Degree Program from the concerned University, are declared equivalent and acceptable by a Committee constituted by the Vice Chancellor for this purpose. Further, the 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.

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

2.5. Change of Branch/Discipline

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 the 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.

2.5.1. 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 6.00 at the end of the 2nd Semester, shall be eligible for consideration for a change of Branch.

2.5.2. 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.

2.5.3. The student(s) 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.

2.5.4. 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.

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

2.5.5.1. The actual number of students in the third 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; and,

2.5.5.2. 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.

2.5.6. 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.

2.6. Professional Practice Courses

Professional Practice Courses (Professional Practice-I and Professional Practice-II) are practice based Courses with the objective to equip students with the skills of problem identification, root cause analysis and 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 Professional Practice Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations, 2019). The same shall be prescribed in the Course Handout.

2.7. Professional Practice–I

Professional Practice–I is a 5-Credit Course. This first level practice-based course is conducted after the 4th Semester of the B. Tech. Program, during the summer break (usually June-July), in accordance with the following options and guidelines:

2.7.1. Internship Program in an Industry/Company:

A student may undergo an Internship Program for a period of 6–8 weeks in an Industry/Company, subject to the following conditions.

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

2.7.1.2. 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 for award of the Internship to a student.

2.7.1.3. 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 providing the Internship, as stated in Sub-Clause 2.7.1.2 above.

2.7.1.4. A student may opt for Internship in an Industry/Company 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 offering such Internship confirms to the University that the Internship program shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

2.7.1.5. A student selected for an Internship in an Industry/Company shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

2.7.2. Project Work:

A student may opt to do a Project Work in an Industry/Company/Research Laboratory or the University Department(s) subject to the following conditions:

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

2.7.2.2. The student may do the project work in an Industry/Company/Research Laboratory of her/his choice subject to the above-mentioned condition (Sub-Clause 2.7.2.1). Provided further, that the Industry / Company / Research Laboratory 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.

2.8. Professional Practice–II

Professional Practice-II is an intensive practice-based course with 15 Credits offered during the final (4th) year of the B. Tech. Program. Students may register for Professional Practice–II in the 8th Semester of the B. Tech. Program, in accordance with the following guidelines:

2.8.1. Internship Program in an Industry/Company:

A student may undergo an Internship Program for a period of about 15 weeks in an Industry/Company, subject to the following conditions:

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

2.8.1.2. The selection criteria (minimum CGPA, pass in all Courses as on date, any other qualifying criteria) as applicable/stipulated by the concerned

Industry/Company for award of Internship to a student.

2.8.1.3. The number of Internships available for the concerned Academic Term: further, the available number of Internships will 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 providing the Internship, as stated in Sub-Clause 2.8.1.2 above.

2.8.1.4. A student may opt for Internship in an Industry/Company 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 offering such Internship confirms to the University that the Internship program shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

2.8.1.5. A student selected/awarded an Internship Program in an Industry / Company shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

2.8.2. Project Work with a Dissertation:

A student may do an extensive Project Work (with a Dissertation) in an Industry/Company/Research Laboratory or the University Department(s), subject to the following conditions:

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

2.8.2.2. The student may do the Project Work in an Industry/Company/Research Laboratory of her/his choice subject to the above-mentioned condition (Sub-Clause 2.8.2.1). Provided further, that the Industry / Company / Research Laboratory 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.

2.9. Social Immersion Courses

The objective of a Social Immersion Course (SIC) is to sensitize and inculcate commitment to social and environmental issues and make a contribution through service and experiential learning. The outcome is to produce graduates who are sensitized and committed to serving the social and environmental needs of society.

The SIC is a 1-Credit Course coordinated by the Parent Department or a group of Departments and the student is required to complete this course ideally during any of the Semesters of the 2nd or 3rd Year of the B. Tech. Program. The nature and details of the SIC shall be approved by the concerned Departmental Academic Committee (DAC). As per the Academic Regulations, the 'S' grade is awarded for "satisfactory completion" of the Course and the 'NC' grade is awarded for "non-completion" of the Course. The student who receives the 'NC' grade shall repeat the SIC (it may be another type of SIC as approved by the concerned DAC) until the concerned student secures the 'S' grade in the SIC. The 'S' and 'NC' grades do not carry grade points and, hence, are not included in the SGPA, CGPA computations.

2.10. Open Electives

Open Electives are Courses offered by any Department/School of the University. The primary objective of offering Open Electives is to provide interdisciplinary/transdisciplinary learning experiences. The outcome is a graduate with a fair exposure to disciplines beyond the chosen Branch in the B. Tech. Program.

Open Electives offered by any Department/School of the University are listed in the Course Structure under the Open Elective category and offered to students of any Department including the parent Department/School.

The Course details and method of evaluation shall be clearly prescribed in the concerned Course Handout.

2.11. Specific Regulations regarding Assessment and Evaluation

(Refer Sections 8.5 to 8.8 in the Academic Regulations, 2019)

The components of continuous assessments, weightage for each component and the method of evaluation shall be assigned considering the nature of the Courses in terms of the pedagogy and outcomes.

2.11.1. Normally, for the Courses that have only the Lecture and Tutorial or Lecture Credit Structure (L–T–0 or L–0–0), with no Practical component, the components of Continuous Assessment and the distribution of weightage

2.11.2. among the components of Continuous Assessment and duration of the examination/assessment shall be as detailed in Table 2.11.1 below:

S. No.	Components of Continuous Assessment	Weightage (% of Total Marks)	Duration of Assessment
	Table 2.11.1 Method of Assessment		
	for Courses with Credit Structures L–T–0 and L–0–0		
1	Mid Term Examination	30%	1.5 hours
2	Continuous Assessment 3: This component of Continuous Assessment shall consist of at least two (02) of the following: (1) Assignment(s), (2) Quiz, (3) Technical Seminar/Report, (4) Attendance/Class participation, (5) Assessment on the self-learning topic(s), or, (6) Any other type of assessment as prescribed in the concerned Course Handout.	20%	NA
3	End Term Examination	50%	3 hours
	Total	**100%**	

REGISTRAR

Note:

(i) An additional Test 3 may be conducted as an optional test to allow for improvement with approval of the Dean, School of Engineering. If a Test 3 is provided, then the higher marks obtained in any two tests shall be considered for evaluation.

(ii) Normally, the End Term Final Examination shall cover the entire course coverage as prescribed in the Course Handouts.

2.11.3. Normally, for Laboratory/Practice Based Courses with a Credit Structure of (0–0–P) or (L–0–P) the components of Continuous Assessment and the distribution of weightage among the components of Continuous Assessment and duration of the examination/assessment shall be as detailed in Table 2.11.2 that follows.

<table>
<tr><td colspan="4" align="center">Table 2.11.2 Method of Assessment
for Practical Courses with Credit Structures 0–0–P and L–0–P</td></tr>
<tr><td>S. No.</td><td align="center">Components of Continuous Assessments</td><td align="center">Weightage
(% of Total Marks)</td><td align="center">Duration of Assessment</td></tr>
<tr><td>1</td><td>Mid Term Examination: Laboratory Work/Practical exercises, conducted in every Laboratory/Practice session/activity, including Laboratory records, practice/project reports, attendance/class participation as applicable, and as prescribed by the Course Handout.</td><td align="center">30%</td><td align="center">NA</td></tr>
<tr><td>2</td><td>Continuous Assessment: Practical Test/Viva-Voce/Quiz/Practice Assignments/Presentations and other assessments as prescribed in the Course Handout.</td><td align="center">20%</td><td align="center">NA</td></tr>
<tr><td>3</td><td>End Term Practical Examination: Practical Experiment/Practice Test(s) with Viva-Voce, Jury or any other type of assessment as prescribed in the Course Handout.</td><td align="center">50%</td><td align="center">2 or 3 hours</td></tr>
<tr><td></td><td align="right">Total</td><td align="center">100%</td><td></td></tr>
</table>

2.11.4. Normally, for Practice/Skill based Courses, without a defined credit structure (L–T–P) but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations, 2019), 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 prescribed in the concerned Course Handout. There shall be no component of End Term Final Examinations for such Courses.

2.11.5. In case any exception is required for a particular Course, where the methods of assessment prescribed in the specific regulations mentioned above in Sub-Clauses 2.11.1, 2.11.2 and 2.11.3 are not suitable/relevant for assessing the performance in the concerned Course, the DAC shall recommend the appropriate method of assessment for approval by the BOS.

2.12. Course Handout

The Course Handout (Refer Clause 6.2 of the Academic Regulations, 2019) is a comprehensive document describing the Objectives/Outcomes of the Course, the detailed syllabus (with the prescribed Textbook(s) and Reference Material), the Lesson/Session-wise Plan, and all the relevant and necessary details regarding the pedagogy, expectation from the students regarding preparation, participation and self-learning, components of continuous assessment and respective weightage (in percentage (%) of the total marks of all components of assessment) given to the components, and the method of evaluation. The guidelines for preparation of the Course Handout, its approval and delivery are listed in the following Sub-Clauses:

2.12.1. The Course Handout will be prepared as per the Outcome Based Education Guidelines of the University.

2.12.2. Normally, the Course Handout is prepared by the Course Instructor(s) assigned to teach the Course. In cases of multiple sections of students registered for the same Course, an Instructor In-Charge, assigned by the DAC, shall prepare the Course Handout in consultation with the other Course Instructors assigned to the concerned Course.

2.12.3. The DAC shall examine each Course Handout and arrange for necessary deliberations as required. On acceptance of the completeness and quality of the Course Handout, the DAC shall approve the Course Handout.

2.12.4. A consolidated printed/soft copy of the Booklet of all Course Handouts corresponding to the concerned Semester of a particular Program of Study shall be provided to every student concerned on the first day/Registration Day of the concerned Semester.

2.12.5. The Course Handout Booklet is a very important guide for the students registered in the concerned course. The students are expected to use the Course Handout Booklet to prepare regularly and benefit from each session (Lecture/Tutorial/Practical) of the Course(s) and perform well in the Continuous Assessments and End Term Final Examinations, as applicable. Every student shall read and adhere to all the guidelines prescribed in the Course Handout Booklet.

2.13. Rules and Guidelines for Transfer of Credits from Massive Open Online Courses

(Refer Section 18.0 of the Academic Regulations, 2019.)

The provisions and rules pertaining to the transfer of credits through Massive Open Online Courses are outlined in Section 18.0 of the Academic Regulations, 2019.

With reference to Clause 18.2 of the Academic Regulations, the rules and guidelines for transfer of credits specifically from Study Webs of Active-Learning

for Young Aspiring Minds-National Program on Technology Enhanced Learning (SWAYAM-NPTEL) are as stated in the following Sub-Clauses:

2.13.1. A student may complete SWAYAM-NPTEL courses 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 and/or the mandatory credit requirements of Management Sciences Courses as prescribed in the concerned B. Tech. Program Regulations and Curriculum. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses, the Open Elective Courses and the Management Sciences Courses as prescribed by the Program Regulations and Curriculum of the concerned B. Tech. Program.

2.13.2. Approved SWAYAM-NPTEL Courses shall be included as annexes to the Program Regulations and Curriculum for the concerned B. Tech. Program and shall be announced through University Notifications to the students from time to time. A student shall only request for transfer of credits from such approved/notified SWAYAM-NPTEL Courses as published by the concerned Departments.

2.13.3. SWAYAM-NPTEL Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM-NPTEL Course(s) and obtained the SWAYAM-NPTEL Certificate to this effect.

2.13.4. A student cannot transfer credits from SWAYAM-NPTEL Courses to earn the mandatory credits assigned for any other type of Courses (other than Discipline, Open Elective Courses and Management Sciences Courses) as prescribed in the concerned Program Regulations and Curriculum. However, a student may complete SWAYAM-NPTEL Courses and transfer equivalent credits in excess of the required mandatory Credits (and Courses). In the case of such transfers beyond the mandatory Credits the transferred Credits will be included in the calculations of SGPA and CGPA.

2.13.5. Before the commencement of each Semester or during Pre-Registration schedule as per the Academic Calendar, Parent Departments may release a list of SWAYAM-NPTEL courses approved as Discipline Elective courses for each B. Tech. Program offered by them. In addition, Departments may also release a list of Open Elective courses offered for all B. Tech. Programs.

2.13.6. Students may Pre-Register for the approved SWAYAM-NPTEL Courses in the respective Departments and register for the SWAYAM-NPTEL Courses as per the schedule announced by SWAYAM-NPTEL.

2.13.7. The credit equivalence of the SWAYAM-NPTEL Courses are based on course durations and/or as recommended by SWAYAM-NPTEL. The Credit Equivalence mapped to SWAYAM-NPTEL course durations for transfer of credits is summarized in Table 2.13.1 below.

Table 2.13.1 SWAYAM-NPTEL Course Durations and Credit Equivalence		
S. No.	Course Duration	Credit Equivalence for Transfer of Credits
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

2.13.8. A student who has successfully completed the approved SWAYAM-NPTEL Course(s) and wants to avail the provision of transfer of equivalent credits to fulfil (partially or fully) the mandatory credit requirements of the Discipline Electives and/or Open Electives and/or Management Sciences Courses as prescribed in the concerned Program Regulations and Curriculum, must submit the original SWAYAM-NPTEL Course Certificates to the Head of the Parent Department concerned, with a written request for the transfer of the equivalent credits. On verification of the SWAYAM-NPTEL Course Certificates and approval by the Head of the Department concerned, the SWAYAM-NPTEL Course(s) and equivalent Credits will be included in Course (with associated Credits) Registration of the concerned student in the Semester immediately following the completion of the SWAYAM-NPTEL Course(s).

2.13.9. The grading system for such SWAYAM-NPTEL Courses with transfer of credits is specified in Table 2.13.2 below.

Table 2.13.2 Grading System for SWAYAM-NPTEL Courses		
S. No.	Final Score on the SWAYAM-NPTEL Certificate	Grade Awarded
1	90% and above	O
2	From 80% to 89%	A+
3	From 70% to 79%	A
4	From 60% to 69%	B+
5	From 50% to 59%	B
6	From 40% to 49%	C

2.13.10. A student may submit a request for credit transfer from SWAYAM-NPTEL Courses before the last instruction day of the seventh (7th) Semester of the B. Tech. program as specified in the Academic Calendar. Requests for credit transfers shall not be permissible in the eighth (8th) semester.

2.13.11. The maximum permissible number of credits that a student may request for transfer in a Semester is ten (10) credits.

2.13.12. The University shall not reimburse any fees/expense, a student may incur for the SWAYAM-NPTEL Courses.

3. **PART B: PROGRAM CURRICULUM**

BACHELOR OF TECHNOLOGY DEGREE PROGRAM IN
COMPUTER SCIENCE AND ENGINEERING - AI & ML
B. TECH (CSE-AI and ML)
2020-2024

B. Tech in Computer Science and Engineering-AI and ML is a program that is offered by the Department of CSE, SOE. The faculty work with motivation and dedication to impart the best knowledge to the budding thoughts admitted in our department. A wide range of courses is offered to students to help them in the understanding of the various intricacies involved in computing. The courses are designed in a way to invoke students' ability to think originally and creatively. The faculty members of CS department are trained to produce computer engineers with the ability to design and develop systems involving the integration of software and hardware devices. The department is equipped with modern computer labs with well-trained lab assistants to empower students with a better understanding of the theory lecture sessions and to give them an exposure to practical problem solving.

The program will also prepare students for postgraduate studies and helps in cracking different national and international aptitude tests for getting admission to IITs, NITs as well as different top ranked Universities in countries like USA, Australia, Singapore and Europe. The students are encouraged to take online courses, from SWAYAM, NPTEL at national level and MOOCs from Harvard, MIT, Microsoft and other top universities and institutions across the World. The program also includes value added courses like SIC and NSS activities that help the students to build moral and ethical standards and also to inherit qualities such as integrity, transparency, respect, professionalism and teamwork.

The Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Learning Objectives of the B.Tech. Program in Computer Science and Engineering at Presidency University are as follows.

Program Educational Objectives (PEO)

After the completion of B.Tech. Program in Computer Science and Engineering from Presidency University, the graduates shall:

PEO1: Demonstrate success as a Computer Engineer with innovative skills, having 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 and/ or entrepreneurship.

Program Outcomes (PO)

Graduates of the B. Tech. Program in Computer Science and Engineering will acquire:

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 analyze 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
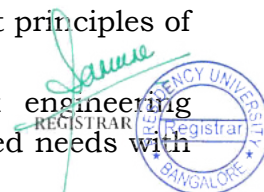
appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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.

Program Specific Outcomes (PSO)

At the end of the B. Tech. Program in Computer Science and Engineering the students shall:

PSO1: Design and develop computer programs/computer-based systems in the areas related to algorithms, networking, web design, cloud computing, IoT and data analytics of varying complexities.

PSO2: Apply standard software engineering practices and strategies in real-world project development.

PSO3: Exhibit professional ethics, effective communication skills and excellent team work in their professional career.

Learning Outcome (LO)

LO1: To gain recognition as a Department of Excellence.

LO2: To provide opportunity to students to excel in curricular, extra-curricular and co-curricular activities.

LO3: To provide students an environment of innovation and train students to pursue research.

LO4: To equip students to face societal challenges.

PROGRAM CURRICULUM

3.1.1 Mandatory Courses and Credits

The B.Tech (Computer Science and Engineering-AI and ML) Program structure (2020-2024) consists of a minimum of 61 Courses totaling 182 Credits.

Table 3.1.1 summarizes the type of Courses, number of Courses under each type and the associated Credits that are mandatorily required for the completion of the Degree.

3.1.1.1 Students have an option of obtaining a specialization in any of the prescribed minors by earning 15 credits from the Course Basket listed under that particular minor within the Discipline Elective Courses.

<table>
<tr><td colspan="4">TABLE 3.1.1
B.Tech (Computer Science and Engineering- AI and ML) 2020-2024: Mandatory Courses and Credits</td></tr>
<tr><td>S. No.</td><td>TYPE OF COURSES</td><td>NO. OF COURSES</td><td>CREDITS</td></tr>
<tr><td>1</td><td>Humanities (HS)</td><td>3</td><td>6</td></tr>
<tr><td>2</td><td>Management Sciences (MS)</td><td>2</td><td>6</td></tr>
<tr><td>3</td><td>Basic Sciences (BS)</td><td>8</td><td>24</td></tr>
<tr><td>4</td><td>Engineering Sciences (ES)</td><td>8</td><td>24</td></tr>
<tr><td>5</td><td>Core (Professional) Course (CC)</td><td>20</td><td>63</td></tr>
<tr><td>6</td><td>Discipline (Professional) Elective (DE)</td><td>10</td><td>30</td></tr>
<tr><td>7</td><td>Open Elective (OE)</td><td>3</td><td>9</td></tr>
<tr><td>8</td><td>Professional Practice (PP)</td><td>2</td><td>20</td></tr>
<tr><td>9</td><td>Personal and Professional Skills (PPS) (Compulsory to be audited.)</td><td>4</td><td>0</td></tr>
<tr><td>10</td><td>Social Immersion Course (SIC)</td><td>1</td><td>0</td></tr>
<tr><td colspan="2">TOTAL</td><td>Minimum of 61</td><td>182</td></tr>
<tr><td colspan="4">The mandatory minimum Credits required for the award of the B. Tech. (Computer Science and Engineering-AI and ML) Degree is 182 Credits.</td></tr>
</table>

The Table 3.1.1 is indicative of various components such as Foundation Courses (Basic Sciences, Engineering Sciences, Humanities, Social Sciences and Management Sciences), Professional Core, Discipline and Open Elective Courses. The unique feature of this Program is Professional Practice - I of 6-8 weeks during the end of 4th Semester and before the commencement of 5th Semester for the student to have industry exposure. The Professional Practice - II will be during their 7th / 8th Semester for about 15 weeks. Social Immersion Course, which is mandatory, is introduced in the curriculum for the student to give value of social service such as community service, clean and green, NSS, Protection of environment and health hazards, etc.

Table 3.1.1 lists the mandatory Courses, type of Courses, number of type of Courses and the associated credits required for the completion of the B.Tech (Computer Science and Engineering-AI and ML) Program.

3.1.2 B. Tech. (Computer Science and Engineering-AI and ML) Program Suggested Year Wise Structure

First Year			Second Year			Third Year			Fourth Year	
Physics Cycle Sem. 1/2	Chemistry Cycle Sem. 1/2	SUMMER TERM	Sem 3	Sem 4	SUMMER TERM / PP-I	Sem 5	Sem 6	SUMMER TERM	Sem 7	Sem 8
BS-3 ES-4 HS-2 PPS-1	BS-4 ES-3 HS-1 PPS-1		MAT BS-1 OE-1 DE-1 PPS-1Core-4	MAT BS-1 OE-1 DE-1 PPS-1Core-5		DE-1 MS-1 PP-1 Core-6	DE-2 SIC-1 MS-1 Core-5		DE-5 OE-1 Core-1	PP-II

Mandatory Minimum Credits required for the award of the B.Tech (Computer Science and Engineering-AI and ML) Degree: 182

Nomenclature:

BS - Basic Sciences

ES - Engineering Sciences

HS - Humanities

MS - Management Sciences

CC - Core Course

DE - Discipline/Professional Electives

OE - Open Electives

PP-I/PP-II - Professional Practice

PPS - Personal and Professional Skills

SIC - Social Immersion Course

In the entire Program, the practical and skill based Course component contribute to an extent of approximately 30% out of the total credits of 182 for B.Tech (Computer Science and Engineering-AI and ML) Program of four years duration.

3.2 SUGGESTED PROGRAM STRUCTURE

Sl. No	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Course Addresses To
**I SEM - PHYSICS CYCLE (Aug-Dec) ***									
1	MAT105	Calculus and Linear Algebra	3	1	0	4	4	F[1]	-
2	PHY101	Engineering Physics	4	0	0	4	4	F	-
3	EEE101	Elements of Electrical Engineering	3	0	0	3	3	P[2]	-
4	CIV101	Elements of Civil Engineering	3	0	0	3	3	P	Env[4]
5	MEC152	Engineering Graphics	2	0	4	4	6	P	-
6	ENG103	Technical Written Communication	2	1	0	3	3	F/E[3]	-
7	KAN101	Kannada Kali	1	0	0	1	1	F	-
8	PHY151	Engineering Physics Lab	0	0	2	1	2	F	-
9	MEC151	Workshop Practice	0	0	2	1	2	P	-
10	PPS105	Building Self Confidence	0	0	2	0	2	E	-
		TOTAL	**18**	**2**	**8**	**24**	**30**		

[1] Foundation Course
[2] Professional Skills
[3] Employability Skills
[4] Environmental Issues

Sl. No	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Course Addresses To
**I SEM - CHEMISTRY CYCLE (Aug-Dec) #**									
1	MAT105	Calculus and Linear Algebra	3	1	0	4	4	F	-
2	CHE101	Engineering Chemistry	4	0	0	4	4	F	-
3	ECE101	Elements of Electronics Engineering	3	0	0	3	3	P	-
4	MEC101	Elements of Mechanical Engineering	3	0	0	3	3	P	-
5	CIV102	Environmental Science and Disaster Management	3	0	0	3	3	F	Env
6	ENG104	Technical Spoken Communication	1	0	2	2	3	E	-
7	CSE151	Computer Programming	2	0	4	4	6	E	-
8	CHE151	Engineering Chemistry Lab	0	0	2	1	2	F	-
9	PPS105	Building Self Confidence	0	0	2	0	2	F	PE5/S6
		TOTAL	**19**	**1**	**8**	**24**	**30**		

[5] Professional Ethics
[6] Sustainability Issues

SL. No	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Course Addresses To
II SEM - PHYSICS CYCLE (Jan-May)*									
1	MAT106	Calculus, Differential Equations and Complex Variables	3	1	0	4	4	F1	-
2	PHY101	Engineering Physics	4	0	0	4	4	F	-
3	EEE101	Elements of Electrical Engineering	3	0	0	3	3	P2	-
4	CIV101	Elements of Civil Engineering	3	0	0	3	3	P	Env
5	MEC152	Engineering Graphics	2	0	4	4	6	P	-
6	ENG103	Technical Written Communication	2	1	0	3	3	F/E3	-
7	KAN101	Kannada Kali	1	0	0	1	1	F	-
8	PHY151	Engineering Physics Lab	0	0	2	1	2	F	-
9	MEC151	Workshop Practice	0	0	2	1	2	P	-
10	PPS106	Effective Communication	0	0	2	0	2	E	-
		TOTAL	**18**	**2**	**8**	**24**	**30**		

Note: At the end of the 1st year (Common to all B. Tech. Programs) the total credits offered is 48.

The 1st year B.Tech Program structure is executed in two cycles.

* The students undergoing the "Physics" cycle shall take the Courses as indicated.

\# The students undergoing "Chemistry" cycle shall take the Courses as indicated

SL. No	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Course Addresses To
II SEM - CHEMISTRY CYCLE (Jan-May)#									
1	MAT106	Calculus, Differential Equations and Complex Variables	3	1	0	4	4	F	-
2	CHE101	Engineering Chemistry	4	0	0	4	4	F	-
3	ECE101	Elements of Electronics Engineering	3	0	0	3	3	P	-
4	MEC101	Elements of Mechanical Engineering	3	0	0	3	3	P	-
5	CIV102	Environmental Science and Disaster Management	3	0	0	3	3	F	Env
6	ENG104	Technical Spoken Communication	1	0	2	2	3	E	-
7	CSE151	Computer Programming	2	0	4	4	6	E	-
8	CHE151	Engineering Chemistry Lab	0	0	2	1	2	F	-
9	PPS106	Effective Communication	0	0	2	0	2	F	PE5/S6
		TOTAL	**19**	**1**	**8**	**24**	**30**		

Sl. No	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill
		III SEMESTER						
1	MAT2001	Transform Techniques and Partial Differential Equations	3	0	0	3	3	F
2	CSE2006	Data Structures	2	0	4	4	6	S
3	CSE2018	Theory of Computation	3	0	0	3	3	S
4	ECE2002	Digital Electronics	3	0	2	4	5	S
5	CSE2016	Discrete Mathematical Structures	3	0	0	3	3	P/E
6	CSEXXXX	Discipline Elective – I	3	0	0	3	3	E
7	XXXXXXX	Open Elective – I	3	0	0	3	3	S
8	PPS107	Design Thinking and Team Building	0	0	2	0	2	S/EM
		TOTAL	**20**	**0**	**8**	**23**	**28**	

*Student has to register for Social Immersion Course in any one semester 3/ 4/ 6 to earn the mandatory credits

Sl. No	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill
		IV SEMESTER						
1	MAT2002	Numerical Methods, Probability & Sampling Techniques	3	0	0	3	3	F
2	CSE2007	Design and Analysis of Algorithms	2	0	2	3	4	S
3	CSE2008	Programming in Java	1	0	4	3	5	S
4	CSE2009	Computer Organization and Architecture	3	0	0	3	3	S
5	CSE2017	Graph Theory and Combinatorics	3	0	0	3	3	S
6	CSEXXXX	Discipline Elective – II	3	0	0	3	3	S
7	XXXXXXX	Open Elective – II	3	0	0	3	3	P/E
8	PPS108	Being Corporate Ready	0	0	2	0	2	E
		TOTAL	**18**	**0**	**8**	**21**	**26**	

** Note Students will undergo professional practice I during the summer break between the fourth and fifth semester and the credits earned will be accounted in the fifth semester.

Sl. No	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill
1	CSE2011	Data Communication and Computer Networks	3	0	0	3	3	S
2	CSE2012	Database Management Systems	2	0	4	4	6	S
3	CSE2014	Software Engineering	3	0	0	3	3	S
4	CSE2010	Operating Systems	3	0	0	3	3	S
5	CSE3001	Artificial Intelligence and Machine Learning	2	0	2	3	4	S
6	CSE2013	Cloud Computing	3	0	0	3	3	EM
7	CSEXXXX	Discipline Elective – III	3	0	0	3	3	S/EM
8	MGT112/MGT113	Engineering Economics/Digital Entrepreneurship	3	0	0	3	3	P/E
9	PIP101	Professional Practice I	-	-	-	5	-	P/E
		TOTAL	22	0	6	30	28	

VI SEMESTER

Sl. No	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill
1	CSE2067	Web Technologies	2	0	2	3	4	EM
2	CSE3008	Machine Learning Techniques	2	0	2	3	4	S
3	CSE3014	Fundamentals of Natural Language Processing	3	0	0	3	3	S
4	CSE2027	Fundamentals of Data Analytics	3	0	0	3	3	S
5	CSE3010	Deep Learning Techniques	3	0	0	3	3	S
6	CSEXXXX	Discipline Elective IV	1	0	4	3	5	S/EM
7	CSEXXXX	Discipline Elective – V	1	0	0	3	5	S/EM
8	MGT112/MGT113	Engineering Economics/Digital Entrepreneurship	3	0	0	3	3	P/E
9	SIC501	Social Immersion Course	-	-	-	0	-	S/EM
		TOTAL	21	0	8	24	30	

VII SEMESTER

REGISTRAR
Registrar

Sl. No	Course Code	Course Name	Credit Structure				Contact Hours	Type of Skill
			L	T	P	Credits		
1	CSE3011	Reinforcement Learning	3	0	0	3	3	S
2	CSEXXXX	Discipline Elective – VI	3	0	0	3	4	S/EM
3	CSEXXXX	Discipline Elective – VII	3	0	0	3	3	S/EM
4	CSEXXXX	Discipline Elective – VIII	3	0	0	3	3	S/EM
5	CSEXXXX	Discipline Elective – IX	3	0	0	3	3	S/EM
6	CSEXXXX	Discipline Elective – X	3	0	0	3	3	S/EM
7	XXXXXXX	Open Elective – III	3	0	0	3	3	
		TOTAL	**18**	**0**	**6**	**21**	**21**	

VIII SEMESTER								
Sl. No	Course Code	Course Name	Credit Structure				Contact Hours	Type of Skill
			L	T	P	Credits		
1	PIP102	Professional Practice- II	-	-	-	15	-	P/E
		TOTAL	-	-	-	**15**	-	

TABLE — 3.2.1

LIST OF MANAGEMENT SCIENCES COURSES

SL. NO	COURSE CODE	COURSE NAME	L	T	P	CREDITS	CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
1	MGT113	Digital Entrepreneurship	3	0	**0**	3	3	S/EM/EN	MBA2007
2	MGT112	Engineering Economics	3	0	**0**	3	3	S	MBA2003

TABLE — 3.2.1

Discipline Elective

SL. NO	COURSE CODE	COURSE NAME	L	T	P	CREDITS	CONTACT HOURS	TYPE OF SKILL
1.	CSE3006	Artificial Intelligence and Neural Networks	3		0	3	3	S/ EM
2.	CSE3007	Introduction to Fuzzy Logic	3		0	3	3	S/ EM
3.	CSE3069	Introduction to Bioinformatics	3		0	**3**	3	S/ EM
4.	CSE3073	Game Design and Development	3		0	**3**	3	S/ EM
5.	CSE3082	Object Oriented Analysis and Design	3		0	**3**	3	S/ EM
6.	CSE3086	Information Theory and Coding	3		0	**3**	3	S/ EM
7.	CSE2066	Computer Graphics	3		0	**3**	3	S/ EM
8.	CSE3092	Programming in Python and its Applications	1		4	**3**	5	S/ EM
9	CSE2027	Fundamentals of Data Analysis	3		0	3	3	S/ EM
10	CSE2021	Data Mining	3	0	0	3	3	S/ EM
11	CSE3150	Front End Full Stack Development	2	0	2	3	4	S/ EM
12	CSE3151	Java Full Stack Development	2	0	2	3	4	S/ EM
13	CSE3152	.Net Full Stack Development	2	0	2	3	4	S/ EM
14	CSE3146	Advanced Java Programming	1	0	4	3	5	S/ EM
15	CSE2036	Programming in C++	1	0	4	3	5	S/ EM

16	CSE3068	Advanced Database Management Systems	2	0	2	3	4	S/ EM
17	CSE3070	Advanced Computer Networks	3	0	0	3	3	S/ EM
18	CSE3071	Computer Vision	2	0	2	3	3	S/ EM
19	CSE3072	Wireless Sensor Networks	3	0	0	3	3	S/ EM
20	CSE3074	Microprocessors and Microcontrollers	3	0	0	3	3	S/ EM
21	CSE3075	Mobile Application Development	1	0	4	3	5	S/ EM
22	CSE3077	Compiler Design	2	0	2	3	4	S/ EM

SL. NO	COURSE CODE	COURSE NAME	CREDIT STRUCTURE				CONTACT HOURS	TYPE OF SKILL
			L	T	P	CREDITS		
1	CSE 395	Image Processing	3		0	3	3	S/EM
2	CSE 296	Data Structures Using C	3		0	3	3	S/EM
3	CSE 396	Software Testing and Quality Assurance	2		2	3	3	S/EM
4	CSE 397	Digital and Mobile Forensics	3		0	3	3	S/EM
5	CSE 298	Database Management Systems	3		0	3	3	S/EM
6	CSE 398	Multimedia and Animation	2		2	3	3	S/EM
7	CSE 299	Data Analytics Using R	2		2	3	3	S/EM
8	CSE2002	Programming in Java	2		2	**3**	3	S/EM
9	CSE2003	Social Network Analytics	3		0	**3**	3	S/EM
10	CSE2004	Python Application Programming	2		2	**3**	3	S/EM
11	CSE2005	Web design fundamentals	2		2	**3**	3	S/EM

TABLE — 3.2.3								
OPEN ELECTIVES OFFERED BY THE DEPARTMENT OF CIVIL ENGINEERING								
SL. NO	COURSE CODE	COURSE NAME	CREDIT STRUCTURE				CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	CREDITS			

1	CIV380	Geographical Information Systems	3	0	0	3	3	P/E	Env/S
2	CIV280	Environmental Impact Assessment	3	0	0	3	3	P	Env/S
3	CIV281	Sustainable Materials and Green Buildings	3	0	0	3	3	P	Env/S
4	CIV381	Construction Project Management	3	0	0	3	3	P/E	PE
5	CIV282	Hazardous Waste Treatment	3	0	0	3	3	P/E	Env/S/PE
6	CIV283	Elements of Construction Management	3	0	0	3	3	P	PE
7	CIV382	System Design for Environment and Sustainability	3	0	0	3	3	P/Ent[8]	Env/S/PE
8	CIV383	Infrastructure Systems for Smart Cities	3	0	0	3	3	P/Ent	Env/S/PE

[8] Entrepreneurship

SL. NO	COURSE CODE	COURSE NAME	CREDIT STRUCTURE				CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	CREDITS			

OPEN ELECTIVES OFFERED BY THE DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SL. NO	COURSE CODE	COURSE NAME	L	T	P	CREDITS	CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
1	CSE395	Image Processing	3	0	0	3	3	P	-
2	CSE296	Data Structures Using C	3	0	0	3	3	P	-
3	CSE396	Software Testing and Quality Assurance	3	0	0	3	3	P/E	-
4	CSE297	Social Network Analytics	3	0	0	3	3	P/E	-
5	CSE397	Digital and Mobile Forensics	3	0	0	3	3	P	-
6	CSE298	Database Management Systems	3	0	0	3	3	P	-
7	CSE398	Multimedia and Animation	3	0	0	3	3	P	-
8	CSE299	Data Analytics Using R	3	0	0	3	3	P/E	-
9	CSE399	Data Visualization	3	0	0	3	3	P/E	-

OPEN ELECTIVES OFFERED BY THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SL. NO	COURSE CODE	COURSE NAME	L	T	P	CREDITS	CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
1	EEE221	Energy Audit	3	0	0	3	3	P/E/Ent	E/P
2	EEE222	Research Methodology	3	0	0	3	3	P	-
3	EEE223	Smart Grid Technology	3	0	0	3	3	P/E	S
4	EEE103	Professional Ethics in Engineering	3	0	0	3	3	-	P
5	EEE224	Soft Computing Techniques	3	0	0	3	3	P/E	
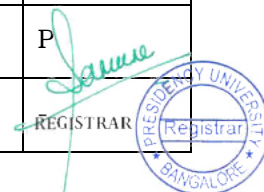
6	EEE104	Control Systems	3	0	0	3	3	P	-
7	EEE225	Fundamentals of Robotics	3	0	0	3	3	P/E	-
8	EEE105	Electrical Engineering Lab	2	0	2	3	4	P/E	-
9	EEE226	Nanotechnology Fundamentals and Applications	3	0	0	3	3	P	-

OPEN ELECTIVES OFFERED BY THE DEPARTMENT OF ELECTRONICS AND COMMUNCATION ENGINEERING

SL. NO	COURSE CODE	COURSE NAME	CREDIT STRUCTURE				CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	CREDITS			
1	ECE295	Artificial Neural Networks	3	0	0	3	3	R^9	-
2	ECE296	Biomedical Instrumentation	3	0	0	3	3	K^{10}	-
3	ECE297	IOT: Internet of Things	3	0	0	3	3	E	-
4	ECE298	Industrial Automation and Control	3	0	0	3	3	E	-
5	ECE299	Computational Intelligence and Machine Learning	3	0	0	3	3	R	-

[9] Research Skills
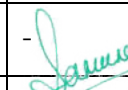
[10] Knowledge Enhancement

OPEN ELECTIVES OFFERED BY THE DEPARTMENT OF MECHANICAL ENGINEERING

SL. NO	COURSE CODE	COURSE NAME	CREDIT STRUCTURE				CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	CREDITS			
1	MEC102	Automotive Vehicles	3	0	0	3	3	E	-
2	MEC103	Nanotechnology	3	0	0	3	3	-	-
3	MEC328	Engineering Optimization	3	0	0	3	3	-	-
4	MEC329	Operations Research for Engineers	3	0	0	3	3	E	-
5	MEC104	Operations Management	3	0	0	3	3	E	-
6	MEC105	Work Study	3	0	0	3	3	E	-
7	MEC106	Project Management	3	0	0	3	3	E	-
8	MEC107	Organizational Behavior	3	0	0	3	3	E	-
9	MEC330	Renewable Energy Systems	3	0	0	3	3	-	Env/S
10	MEC331	Design of Automatic Control Systems	3	0	0	3	3	-	-

OPEN ELECTIVES OFFERED BY THE DEPARTMENT OF MECHANICAL ENGINEERING

SL. NO	COURSE CODE	COURSE NAME	CREDIT STRUCTURE				CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	CREDITS			
1	PET231	Computational Methods in Chemical Engineering	3	0	0	3	3	P	-
2	PET232	Computational Fluid Dynamics	3	0	0	3	3	P	

REGISTRAR

3	PET233	Petroleum Corrosion Technology	3	0	0	3	3	P/E	-
4	PET234	Polymer Technology	3	0	0	3	3	P/E	-
5	PET235	Oil and Gas Quality Management	3	0	0	3	3	P/E	-
6	PET236	Oil and Gas Transportation and Marketing	3	0	0	3	3	P/E	-
7	PET237	Material Science and Engineering	3	0	0	3	3	P	-

OPEN ELECTIVES OFFERED BY THE DEPARTMENT OF MECHANICAL ENGINEERING									
SL. NO	COURSE CODE	COURSE NAME	CREDIT STRUCTURE				CONTACT HOURS	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	CREDITS			
1	PSY101	Social Psychology	3	0	0	3	3	P/E/Ent	PE/S
2	ENG105	Literature Appreciation	3	0	0	3	3	P/E	G/S
3	CHE201	Composite Materials	3	0	0	3	3	P/E	Env/S
4	CHE202	Catalysis Technology	3	0	0	3	3	P/E	Env/S
5	CHE203	Surface Coating Technology and Corrosion Science	3	0	0	3	3	P/E/Ent	Env/S
6	CHE204	Bioenergy	3	0	0	3	3	P/E	Env/S
7	CHE205	Advanced Separation Technology	3	0	0	3	3	P/E	Env/S
8	PHY201	Elements of Nuclear Radiation and Technology	3	0	0	3	3	P/E	Env/S
9	PHY202	Amorphous Semiconductors for Technological Applications	3	0	0	3	3	P/E/Ent	-
10	PHY203	Nano Structured Materials	3	0	0	3	3	P/E/Ent	-

Note: However, these are only indicative. Depending upon the need and availability of expertise new electives can be offered.

3.3 COURSE DESCRIPTION AND SYLLABUS

Course Name:	Calculus and Linear Algebra				
Course Code:	MAT 105	Credit Structure:	L	T	P	C
			3	1	0	4

Course Description: This course aims to introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions. Also introduces the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems. Develops the tool of power series and Fourier series for learning advanced Engineering Mathematics. Familiarize the student with functions of several variables that is essential in most branches of engineering and develop the essential tool of matrices and

linear algebra in a comprehensive manner.

Textbooks:

1. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. B. S. Grewal,' *Higher Engineering Mathematics*", Khanna Publishers, 36th Edition 2010.

2. Cengage, Mathematics – I (Calculus & Linear Algebra), ITL Education Solutions Ltd., 2018.

Course Name:	Engineering Physics					
Course Code:	PHY 101	Credit Structure:	L	T	P	C
			4	0	0	4

Course Description: The main objective of this course is to study the basic concepts of physics that helps developing the ability to identify, formulate and apply to engineering applications. This course covers the areas, namely, applied physics and modern physics. The course includes the concepts of free electron theory, electrical properties and applications of contemporary and useful materials such as semiconductors, superconductors and dielectric materials are discussed in detailed manner. It also emphasizes on modern concepts such as the concepts of lasers and its applications in the field of optical fiber communication system and other areas. Finally, the need of quantum mechanics, the quantum approach concepts like, matter waves, Heisenberg's uncertainty principle, Schrodinger's time independent equation and application of Schrodinger's wave equation are discussed.

Textbooks:

1. Wiley, *Engineering Physics*, 2014 Wiley India.

Reference Books:

1. G Aruldhas, *Engineering Physics*,2014 PHI Learning Pvt. Ltd, Delhi.

2. M.N Avadhanulu, P G Kshirsagar, *Engineering Physics*, 2010 S Chand & Co. Pvt. Ltd.

3. Md. N. Khan, S Panigrahi, *Principles of Engineering Physics* 1 & 2, 2014 Cambridge Univ. Press.

4. Serway Raymond and Jewett John, *Physics for Scientists and Engineers with Modern Physics*, 2003 Cengage.

5. Arthur and Beiser Concepts of Modern physics 2017 7th Edition McGraw Hill Education.

Course Name:	Elements of Electrical Engineering					
Course Code:	EEE 101	Credit Structure:	L	T	P	C
			3	0	0	3

Course Description: The course aims at nurturing the students with the significance of Electrical Engineering. The course provides exhaustive knowledge about the basic laws of electrical sciences, AC/ DC circuit analysis, AC & DC machines. It also includes Measuring Instruments, Earthing, Electrical wiring and safety measures.

Textbook:

1. John Hiley, Keith Brown and Ian McKenzie Smith, *"Hughes Electrical and Electronic Technology",* Pearson.

Reference Books:

1. K Uma Rao and A Jayalakshmi, *"Basic Electrical Engineering"* 2016 Revised Edition, I K International Publishing House Pvt. Ltd.

2. D.P. Kothari, I. J. Nagrath, *"Basic Electronics",* McGraw Hill Education.

3. Smarajit Ghosh*, "Fundamentals of Electrical and Electronics Engineering",* PHI.

Course Name:	Elements of Civil Engineering				
Course Code:	CIV 101	Credit Structure :	L	T	P	C
			3	0	0	3

Course Description: The objective of this Course is to make students learn the basics of Civil Engineering concepts, role of civil engineers, infrastructure development, sustainability, and solve problems involving forces, loads and moments and know their applications in allied subjects. It is a pre-requisite for several Courses involving Forces and Moments.

The students should have a prior knowledge of basic mathematics and physics to pursue the Course. The Course consists of an introduction of civil engineering through an exposition of its disciplines, types of Infrastructure, different types of construction materials, composition of forces, concepts of resultants and equilibrium of forces.

After successful completion of the Course, the students would acquire knowledge on the basics of Civil Engineering, its scope of study, knowledge about green buildings, roads, airports, bridges and dams. They would be able to comprehend the action of Forces, Moments and other loads on systems of rigid bodies; Compute the reactive forces and the effects that develop as a result of the external loads.

Textbooks:

1. M.N. Shesha Prakash, Ganesh B. Mogaveer, "Elements of Civil Engineering and Engineering Mechanics", PHI Learning.

2. Mimi Das Saikia, Bhargab Mohan Das and Madan Mohan Das, "Elements of Civil Engineering", PHI Learning Pvt Ltd.

Reference Books:

3. Shrikrishna A Dhale and Kiran M Tajne, "Basics of Civil Engineering", S Chand Publication.

4. S. S. Bhavikatti, "Basic Civil Engineering", New Age International Publication

5. Satheesh Gopi, "Basic Civil Engineering", Pearson Publication

Course Name:	Engineering Graphics				
Course Code:	MEC 152	Credit Structure :	L	T	P	C
			2	0	4	4

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 computerised drafting tools. Computerised 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.

Textbook:

1. N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.

Reference Books:

1. D. A. Jolhe, "Engineering Drawing: With an Introduction to AutoCAD," Tata McGraw Hill.

2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall.

Course Material:

"Engineering Graphics Lab Manual," Presidency University

Course Name:	Technical Written Communication					
Course Code:	ENG 103	Credit Structure :	L	T	P	C
			2	1	0	3

Course Description: A course on Technical Written Communication facilitates writing skills; letters, emails, notice, agenda, minutes of the meeting, reports, etc. The course will train the students to write better English and face the corporate wold with determination and self belief. The course includes theoretical session on communication, reading and writing skill with special emphasis on letters, emails and reports. Practical sessions in form of tutorials will help the students to practice vocabulary, reading, common errors, sentence transformations, etc.

Reference Books:

1. Greg Satell. *"Why Communication is Today's Most Important Skill."* FORBES. Feb 6, 2015.

2. Bacon, Francis. *"Of Studies." Selected Writings of Francis Bacon.* Ed. Hugh G. Dick. New York. Random House, 1955. P. 22.

3. Bovee, Courtland L. Thill, John V, Chatterjee. Abha. *Business Communication Today.* 10th Edition. Pearson.

4. Raman, Meenakshi. Sharma, Sangeetha. *Technical Communication: Principles and Practice.* Oxford University Press, New Delhi. 2015.

5. Hart, Steve. Nari, Aravind R. and Bhambhani, Veena. Embark: *English for Undergraduates.* New Delhi; Cambridge University Press, 2016.

6. Online Resources: a.Globarena Online Language Learning Software

Course Name:	Engineering Physics Lab					
Course Code:	PHY 151	Credit Structure :	L	T	P	C
			0	0	2	1

Course Description: This Course includes the laboratory sessions on determination of the wave length of Laser, rigidity modulus, Planck's constant, dielectric constant, radius of curvature by Newton's rings, calculation of Numerical Aperture, Resistivity by four probe method, Fermi energy of copper and acceleration due to gravity by simple pendulum. It also includes experiments on characteristics of Zener diode.

Course Material: "*Engineering Physics Lab manual***"** Presidency University (2020-21).

Course Name:	Calculus, Differential Equations and Complex Variables					
Course Code:	MAT 106	Credit Structure :	L	T	P	C
			3	1	0	4

Course Description: This course aims to acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage. Also to introduce effective mathematical tools for the solutions of differential equations that model physical processes and introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

Textbooks:

1. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. B. S. Grewal, '*Higher Engineering Mathematics*", Khanna Publishers, 44th Edition, 2007.

2. Cengage, Mathematics – II (Calculus, Ordinary Differential Equations & Complex Variables), ITL Education Solutions Ltd., 2018.

Course Name:	Workshop Practice					
Course Code:	MEC 151	Credit Structure :	L	T	P	C
			0	0	2	1

Course Description: The primary objective of this course is to expose students to the basic skills in handling various tools in a workshop and cover some of the processes used for converting raw materials to finished products.

The course involves a hands on approach to fitting of metal components, concept of development of surfaces through sheet metal work, usage of engineering measurement devices, metal joining by arc welding, and an introduction to plumbing and electrical connections.

Course Material:

"Engineering Workshop Lab Manual," Presidency University, 2017-18.

Reference Books:

1. B. S. Nagendra Parashar, R. K. Mittal, "Elements of Manufacturing Processes," Prentice Hall of India.

2. S. K. Hajra Choudhury, "Elements of Workshop Technology - Volume I - Manufacturing Processes," Media Promoters and Publishers Pvt. Ltd.

Course Name:	Building Self Confidence

Course Code:	PPS 105	Credit Structure :	L	T	P	C
			0	0	2	0

Course Description: Developing right attitude, effective communication skills and confidence to be successful in this highly competitive environment is of utmost importance. This course helps the students to develop their personality and drives them to create their personal brand. The students are exposed to various fun-filled activities to gain confidence in facing people, facing crowd and expressing their ideas.

Textbooks:

Building Self Confidence Training Manual

Reference Books:

1. Prakash Iyer, *"The Habit of Winning"*, 2nd Edition, Penguin Books Ltd., 2016.

2. Jack Canfield, *"The Success Principles"*, 8th Edition, HarperCollins Publishers India, 2015.

3. Shiv Khera, 3d Edition, "You Can Win", Bloomsbury India, 2014.

Course Name:	Engineering Chemistry					
Course Code:	CHE 101	Credit Structure :	L	T	P	C
			4	0	0	4

Course Description: The primary objective of the course is to introduce the students to the concepts and applications of chemistry in Engineering. It should cultivate in them an ability to identify chemistry in each piece of finely engineered products used in households and industry. It aims to strengthen the fundamental concepts of chemistry and then builds an interface with their industrial applications. It deals with applied and industrially useful topics, such as Water Technology, Engineering materials such as Polymers & Liquid crystals, Introduction to Computational Chemistry, Electrochemistry principles & its application to batteries, Corrosion and its control, Fuels and combustion.

Textbooks:

1. Wiley, "Engineering Chemistry", Wiley.

Reference Books:

1. Dr. K. Pushpalatha, "Engineering Chemistry", Revised Edition, Wiley.

2. F Jain and Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company. New Delhi, 2019.

3. Koch, W., & Holthausen, M. C. (2015). A chemist's guide to density functional theory. John Wiley & Sons.

4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, 2015.

5. Principles of Physical Chemistry B.R.Puri, L.R. Sharma & M.S. Pathania, S. Nagin Chand & Co., 41 Ed., 2004.

6. F.W. Billmeyer, Text Book of Polymer Science, John Wiley & Sons, 4th Edition, 1996.

7. M.G. Fontana, N. D. Greene, Corrosion Engineering, McGraw Hill Publications, New York, 3rd Edition, 1996.

8. Jurs, P.C., 1996. Computer software applications in chemistry. John Wiley & Sons.

9. Stephen Wilson (auth.) - Chemistry by Computer: An Overview of the Applications of Computers in Chemistry-Springer US (1986).

Course Name:	Elements of Electronics Engineering					
Course Code:	ECE 101	Credit Structure :	L	T	P	C
			3	0	0	3

Course Description: The course aims at nurturing the students with the fundamental principles of electronics engineering, prevailing in various engineering applications. The course begins with the fundamentals of electronic systems and some basic laws of electricity. The topics include: classification of materials, types of Semiconductor materials, p-n Junction, Diodes, Characteristics, Rectifiers, Junction Transistor, BJT Configurations, Characteristics, BJT Biasing basics, Transistor Applications. Subsequently the student is introduced to Digital Electronics – Codes and Number systems – viz. Decimal, Binary and hexadecimal systems, conversions. 1's and 2's complements, binary addition. Boolean logic, basic gates and Universal Gates, and laws for reduction of the logic expressions, implementation using basic gates. Basics of communication systems, introduction to microprocessors and its applications.

Textbooks:

1. John Hiley, Keith Brown and Ian McKenzie Smith, *"Hughes Electrical and Electronic Technology",* Pearson.

Reference Books:

1. Smarajit Ghosh, *"Fundamentals of Electrical and Electronics Engineering"*, PHI.
2. D.P. Kothari, I. J. Nagrath, *"Basic Electronics",* McGraw Hill Education.
3. Rajendra Prasad, *"Fundamentals of Electronics Engineering",* Cengane Learning.

Course Name:	Elements of Mechanical Engineering					
Course Code:	MEC 101	Credit Structure :	L	T	P	C
			3	0	0	3

Course Description: This course is designed to acquaint students with the fundamentals of mechanical engineering by covering some basics of thermal engineering, design engineering and manufacturing processes.

The discussion on thermal engineering includes the study of different forms of energy, the laws of thermodynamics, properties of steam, heat engines, heat pumps, steam boilers and an introduction to fluid properties and machinery. The discussion on design engineering covers transmission of motion and power. The discussion on manufacturing processes includes metal cutting and machines tools.

Textbooks:

1. K. P. Roy, S. K. Hajra Choudhury, Nirjhar Roy, *"Elements of Mechanical Engineering,"* Media Promoters and Publishers Pvt. Ltd. Mumbai.

Reference Books:

1. Pravin Kumar, *"Basic Mechanical Engineering,"* Pearson.

2. V. K. Manglik, *"Elements of Mechanical Engineering,"* PHI.

3. Dr. D. S. Kumar, *"Elements of Mechanical Engineering,"* S. K. Kataria & Sons.

Course Name:	Kannada Kali				
Course Code:	KAN 101	Credit Structure :	L	T	P	C
			1	0	0	1

Course Description: This course aims to help the non Kannada speaking students to converse in Kannada for their day-to-day life activities. It supports to develop strong cognitive skills, use of local language, helps to mingle with the local society, ensures security, facilitates interaction with auto and cab drivers, shop owners, employees of local government, etc. It also helps Law students to understand local client's complaints and also to the students of Engineering for a better communication. Furthermore, this course is offered to all the students, irrespective of their domain.

Text Books:

1. G Kannada Kali – Linga Devaru Hale Mane, Publication – Prasaranga Kannada Vishvavidyalaya, Hampi.

2. Spoken Kannada – Publication – Kannada Sahitya parishath Bengaluru.

3. Kannada Kirana – Publication – Bangaore Institute of Languages, Bangalore.

Course Name:	Environmental Science and Disaster Management				
Course Code:	CIV 102	Credit Structure :	L	T	P	C
			3	0	0	3

Course Description: The overall objective of the course is to provide clear understanding of natural resources, environment, its maintenance and the basic concepts of disaster management. The course consists of the concepts of renewable and non-renewable resources, conservation of these resources, ecosystems, role of human being in maintaining a clean and useful environment for the future generations, maintaining ecological balance and conservation of biodiversity. It includes causes of environmental deterioration and its control; human environmental disturbances, water and air pollution, mitigation measures, disaster and waste management etc. After successful completion of the course, the students would be able to understand the various types of natural resources and problems due to over exploitation. Also gain knowledge about the different components of the ecosystem, their interrelation, various hazards, natural disasters, their effects and management.

Textbooks:

1. Benny Joseph, *"Environmental Studies",* McGraw-Hill.

Reference Books:

1. R. Rajagopalan, *"Environmental studies–From Crisis to Cure",* Oxford University Press.

2. P. Anandan and R. Kumaravelan, *"Environmental Science and Engineering",* Scitech.

3. ErachBharucha, *"Environmental Studies for Undergraduate courses",* Universities Press.

4. R.B. Singh (Ed), *"Disaster Management",*Rawat.

5. MahuaBasuand S. Xavier "*Fundamentals of Environmental Studies*" Cambridge University Press.

Course Name:	Technical Spoken Communication						
Course Code:	ENG 104	Credit Structure :	L	T	P	C
			1	0	2	2

Course Description: A Course on Technical Spoken Communication in the field of technical education will train the students to speak better English and face the corporate world with determination and self-belief. The theoretical and practical sessions on pronunciation, listening, conversation, narration, speech presentation, will make the target audience to stand out in the forefront of their field of operation. At the end of the course, the students will have better skills, and the students will also be able to excel in middle-higher level management in the corporate world.

Reference Books:

1. Tomson, Robert. *"The Interview."* Stories of Work, Life and the Balance in Between. The Write Place.

2. Daniel. J. C. "Unforgettable Salim Ali.*" Inspiring People: Fifty People Who Made a Difference.* Readers Digest Selection.

3. Bovee, Courtland L. Thill, John V, Chatterjee. Abha. *Business Communication Today.* 10th Edition. Pearson

4. Carmine, Gallo. "*11 Presentation Lessons You Can Still Learn From Steve Jobs."* FORBES, October 12, 2012.

5. Thrishna's: *How to Do well in GDs and Interview.* New Delhi: Pearson 2013

6. Raman, Meenakshi. Sharma, Sangeetha. *Technical Communication: Principles and Practice.* Oxford University Press, New Delhi. 2015.

7. Hart, Steve. Nari, Aravind R. and Bhambhani, Veena. Embark: *English for Undergraduates.* New Delhi; Cambridge University Press, 2016.

8. J. K. Gangal, *A Practical course in Spoken English*, PHL Learning Private Limited, Delhi-2014.

Course Name:	Computer Programming						
Course Code:	CSE 151	Credit Structure :	L	T	P	C
			2	0	4	4

Course Description: This course will provide an introduction to foundational concepts of computer programming to students of all branches of Engineering. This module includes a mix of traditional lectures and laboratory sessions. Each meeting starts with a lecture and finishes with a laboratory session. Topics covered in this course are problem formulation and development of simple programs, Pseudo code, Flow Chart, Algorithms, data types, operators, decision making and branching, looping statements, arrays, functions, pointers, structures, union and basic file operations. In the lab secession students are required to solve problems based on the above concepts to illustrate the features of the structured programming.

Textbook:

1. E. Balagurusamy, "*Programming in ANSI C*", Tata McGraw Hill.

Reference Books:

1. Yale Patt, Sanjay Patel, "*Introduction to Computing Systems: From bits and gates to C and beyond*", McGraw Hill.

2. Ehrouz A Forouzan, Richard F Gilberg, "*Computer science: A structured programming approach using C*", Cengage Learning.

Course Name:	Engineering Chemistry Lab					
Course Code:	CHE 151	Credit Structure :	L	T	P	C
			0	0	2	1

Course Description: The lab course intends to train the students to develop their experimental skills and apply fundamental chemical principles in problems related to chemistry in engineering. The experiments are designed to support the theory lectures and the hands-on experience will thus enhance students' in understanding the concepts.

The course includes the estimation of total hardness of water by EDTA complexometric method, determination of the total alkalinity of a given water sample, estimation of Iron (II) in Mohr's salt, estimation of calcium oxide in cement, determination of Chemical Oxygen Demand (COD) of Industrial Waste Water sample, determination of pKa value of weak acid using pH meter, Estimation of copper colorimetrically, determination of Iron (II) by potentiometry, determination of viscosity co-efficient of a liquid using Ostwald's Viscometer, estimation of strength of mixture of acids by conductometry method.

Course Material: *"Engineering Chemistry Lab Manual",* Presidency University.

Course Name:	Calculus, Differential Equations and Complex Variables					
Course Code:	MAT 102	Credit Structure :	L	T	P	C
			3	1	0	4

Course Description: This course is also commonly designed for all engineering branches and the contents learned in the previous semester are the prerequisite for this course. Probability theory is of great use in understanding and modeling phenomena that exhibit random behavior and the emphasis is on real-world applications to engineering problems. The topics covered include basic concepts of probability and conditional probability, Baye's law and correlation analysis, Linear Regression and method of least square, Solution of second and higher order, linear ordinary differential equations with constant and variable coefficients. Formation of Partial Differential Equations (PDE), solution of homogeneous and non-homogeneous PDEs and the application of PDEs. Evaluation of double and triple integrals, change of order of integration, change of coordinates, beta and gamma functions, line integral, surface integral and volume integral of vector and scalar functions. Laplace transforms of functions and properties; Laplace transform of periodic and unit step functions. Inverse Laplace Transforms, Application of Laplace transforms and solution of differential equations.

Textbooks:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 10th edition, John Wiley-India Publishers, 2014.

2. Ronald E. Walpole, Raymond H. Myers, Sharon. L. Myers and Keying E. Ye, *Probability and Statistics for Engineers and Scientists*, Pearson Education, Delhi. 9th Edition, 2012.

Reference Books:

1. Peter V. O'Neil, Advanced Engineering Mathematics, 7th Edition, Cengage Learning, 2012.

2. B. S. Grewal, Higher Engineering Mathematics, 43rd edition, Khanna Publishers, 2014.

Course Name:	Effective Communication				
Course Code:	PPS 106	Credit Structure :	L	T	P	C
			0	0	2	0

Course Description: In order to succeed in the world that has become more global than being confined to smaller areas, we need to be very good in communication. This programme introduces students to different techniques of communication that makes them communicate clearly and effectively. During this programme, students are given a lot of exercises to inculcate better flow of thought and speech with emphasis on being effective in communication.

Text Book:

1. Presidency University *"Effective Communication"* Training Manual

Course Name:	Data Structures				
Course Code:	CSE 201	Credit Structure :	L	T	P	C
			3	0	0	3

Course Description: The purpose of this Course is to provide the students with solid foundations in data structures and algorithms. It focuses on logical structures of data, their physical representation, design of algorithms and techniques for program development and debugging. Emphasis is placed on the appropriate use and choice of standard data structures.

Topics include: ADT, lists, stacks, queues, trees, heaps, hash tables, and graphs.

Text Book(s):

Richard F Gilberg and Behrouz A Forouzan, *"Data Structures: A Pseudocode Approach with C"*, Cengage learning.

Reference Book(s):

1. Robert L Kruse, Bruce P Leung and Clovis L Tondo, *"Data Structures and Program Design in C"*, Pearson.

2. Seymour Lipschutz, "*Data Structures with C(Schaum's Outline Series)*", McGraw Hill Education.

Course Name:	Digital Design

Course Code:	CSE 202		Credit Structure :	L	T	P	C
				3	0	0	3

Course Description: This Course will provide the fundamental background needed to understand how digital systems work and how to design digital circuits. Students will gain experience with several digital systems, from simple logic circuits to programmable logic devices.

Topics include: Number systems and codes, Boolean algebra, logic circuits and minimization, Combinational and sequential logic circuits, Programmable Logic devices, State table and state diagrams, Counters and shift registers, Arithmetic operations and algorithms, fault diagnosis and tolerance.

Text Book(s):

1. Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
2. Biswas N N ,*"Logic design Theory"*,Seagull Publishing.

Reference Book(s):

1. Jain, R. P., *"Modern Digital Electronics"*, McGraw Hill Education.

2. Roth, Charles H., Jr and Kinney Larry L., *"Fundamentals of logic Design"*, Cengage Learning.

3. Floyd T l ,*"Digital fundamentals"*,Pearson.

Course Name:	Transfer Techniques, Partial Differential Equations and Probability						
Course Code:	MAT 107		Credit Structure :	L	T	P	C
				3	1	0	4

Course Description: This course aims to introduce Fourier transform, z-transform and Laplace transform. The topics include the applications of Laplace transform in LCR circuits and solution of difference equations using z-transform. This course is commonly designed for all engineering branches and the contents learned in the previous semester are the prerequisite for this course. Solution of second and higher order, linear ordinary differential equations with constant and variable coefficients. Formation of Partial Differential Equations (PDE), solution of homogeneous and non-homogeneous PDEs and the application of PDEs. Laplace transforms of functions and properties; Laplace transform of periodic and unit step functions. Inverse Laplace Transforms, Application of Laplace transforms and solution of differential equations.

The course aims at introducing students to quantitative uncertainty analysis and risk assessment for engineering applications. Probability theory is of great use in understanding and modeling phenomena that exhibit random behavior and the emphasis is on real-world applications to engineering problems. The topics covered include basic concepts of probability and conditional probability, Baye's law and correlation analysis, Linear Regression and method of least square.

Textbooks:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons (India), 2014.

2. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2014.

Reference Books:

1. Peter V. O'Neil, Advanced Engineering Mathematics, 7th Edition, Cengage Learning, 2012.

2. Ronald E. Walpole, Raymond H. Myers & Sharon L. Myers, "Probability & Statistics for Engineers & Scientists", Ninth Edition.

Course Name:	**Numerical Methods, Probability and Sampling Distribution**					
Course Code:	MAT 108	Credit Structure :	L	T	P	C
			3	1	0	4

Course Description: The objective of Engineering Mathematics – IV is to equip the students with adequate knowledge of basic mathematics that will enable them in formulating problems and solving them analytically as well as numerically in their Engineering programme. The course enables students to incorporate the knowledge of complex variables and their significance in engineering, Numerical methods and sampling theory to support their concurrent, subsequent engineering studies to explore complex systems, physicists, engineers and mathematicians require computational methods since mathematical models are rarely solvable analytically. This course provides an introduction to basic numerical methods such as fitting of various curves, interpolation, differentiation, integration. This course also provides an introduction to numerical solution of algebraic and transcendental equations, ordinary differential equations such as Taylor's series method, modified Euler's method and Runge-Kutta Methods. The course aims at introducing students to quantitative uncertainty analysis and risk assessment for engineering applications. Probability theory is of great use in understanding and modeling phenomena that exhibit random behavior and the emphasis is on real- world applications to engineering problems. sampling distributions of means and variances, chi- squared, t and F distributions, methods of estimation, estimating means, proportions and variances, maximum likelihood estimation, tests of hypothesis on means, proportions and variances, chi- squared test of goodness of fit.

Textbooks

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons (India), 2014.

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. Ronald .E. Walpole, Raymond. H. Myers, Sharon. L Myers, and Keying E.Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.

Reference Books

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd edition, Khanna Publishers.

2. B.S. Grewal, Numerical methods in engineering and science, 10th Edition, Khanna publishers, 2016.

Kishor S Trivedi, "Probability ansd Statistics with reliability, Queuing and Computer Science Applications", John Wiley & Sons, 2nd edition, 2008.

Course Name:	Discrete Mathematics					
Course Code:	CSE 203	Credit Structure :	L	T	P	C
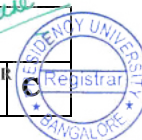
			3	1	0	4

Course Description: Discrete Mathematics must be a core subject in computer Science as per ACM and IEEE. In contrast to calculus (for all engineering Courses), Discrete Mathematics is the back bone for Computer Science.

Topics include: Prepositional logic, Predicate logic, Sets, functions, sequences and sums, Basic and Advance counting techniques, Induction and Recursion, Fundamental Algorithms, the integers, Matrices and Relations

Text Book(s):

Kenneth H Rosen *"Discrete Mathematics and its Applications"*,McGraw Hill.

Reference Book(s):

1.S.EPP, *"Discrete Mathematics"*, Academic Press.

2. Thomas Kochy,*"Discrete Mathematics"*, Academic Press

Course Name:	Design Thinking And Team Building					
Course Code:	PPS 107	Credit Structure :	L	T	P	C
			0	0	2	0

Course Description: This Course is directed towards making students perform in teams, become an asset for a team and develop the Leadership Skills needed for today's time. It gives participants an understanding of their self-esteem level and how to have high self-esteem. The Course helps the participants to understand their level of assertiveness and helps them to develop their assertiveness in different situations. This Course also includes training on how to connect to team people, how to resolve conflicts among team members and how to lead oneself and a group of people. It covers details about different types of leadership, situational leadership and the situations where these different types of leadership are applicable.

Course Material: "*Professional and Business Skills - I training material*", Presidency University.

Course Name:	Social Immersion Course					
Course Code:	SIC 501	Credit Structure :	L	T	P	C
			-	-	-	1

Course Description: Social Immersion Course is one credit Course which includes the knowledge, skills and competencies embedded within every aspect of the college to inspire and enhance each student's transferable learning skills. It represents the broad categories of competence that enable students to be successful in further education, careers, as citizens and in their personal lives. Students will effectively express and exchange ideas through listening, speaking, reading, writing and other modes of interpersonal expression. Students will be able to gather and synthesize relevant information, evaluate alternatives and implement creative and effective solutions. Students will be prepared to practice community engagement that addresses environmental responsibility, social justice and cultural diversity. Students will become independent learners who understand

and express the lifelong skills necessary for physical, social, economic, mental and emotional health.

Course Name:	Being Corporate Ready				
			L	**T**	**P**	**C**
Course Code:	PPS 108	Credit Structure :	**0**	**0**	**2**	**0**

Course Description: This Course is directed towards making students perform in teams, become an asset for a team and develop the Leadership Skills needed for today's time. It gives participants an understanding of their self-esteem level and how to have high self-esteem. The Course helps the participants to understand their level of assertiveness and helps them to develop their assertiveness in different situations. This Course also includes training on how to connect to team people, how to resolve conflicts among team members and how to lead oneself and a group of people. It covers details about different types of leadership, situational leadership and the situations where these different types of leadership are applicable.

Course Name:	Professional Practice – II				
			L	**T**	**P**	**C**
Course Code:	PIP 102	Credit Structure :	**-**	**-**	**-**	**15**

Course Description: Professional Practice- II is the necessary for the subsequent problem solving experience after PP-I. 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.

Course Name:	Calculus, Differential Equations and Complex Variables				
			L	**T**	**P**	**C**
Course Code:	MAT 106	Credit Structure :	**3**	**1**	**0**	**4**

Course Description: This course aims to acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage. Also to introduce effective mathematical tools for the solutions of differential

equations that model physical processes and introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

Textbooks:

3. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 9th Edition, John Wiley & Sons, 2006.

Reference Books:

4. B. S. Grewal, *' Higher Engineering Mathematics*", Khanna Publishers, 44th Edition, 2007.

5. Cengage, Mathematics – II (Calculus, Ordinary Differential Equations & Complex Variables), ITL Education Solutions Ltd., 2018.

Course Name:	Transform Techniques, Partial Differential Equations					
			L	**T**	**P**	**C**
Course Code:	**MAT 2001**	**Credit Structure :**	**3**	**0**	**0**	**3**

Course Description: This course aims to introduce Fourier transform, z-transform and Laplace transform. The topics include the applications of Laplace transform in LCR circuits and solution of difference equations using z-transform. This course is commonly designed for all engineering branches and the contents learned in the previous semester are the prerequisite for this course. Solution of second and higher order, linear ordinary differential equations with constant and variable coefficients. Formation of Partial Differential Equations (PDE), solution of homogeneous and non-homogeneous PDEs and the application of PDEs. Laplace transforms of functions and properties; Laplace transform of periodic and unit step functions. Inverse Laplace Transforms, Application of Laplace transforms and solution of differential equations.

The course aims at introducing students to quantitative uncertainty analysis and risk assessment for engineering applications. Probability theory is of great use in understanding and modeling phenomena that exhibit random behavior and the emphasis is on real-world applications to engineering problems. The topics covered include basic concepts of probability and conditional probability, Baye's law and correlation analysis, Linear Regression and method of least square.

Textbooks:

3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons (India), 2014.

4. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2014.

Reference Books:

1. Peter V. O'Neil, Advanced Engineering Mathematics, 7th Edition, Cengage Learning, 2012.

2. Ronald E. Walpole, Raymond H. Myers & Sharon L. Myers, "Probability & Statistics for Engineers & Scientists", Ninth Edition.

Course Name:	Numerical Methods, Probability Distributions and Sampling Techniques					
Course Code:	**MAT 2002**	**Credit Structure :**	**L**	**T**	**P**	**C**
			3	0	0	3

Course Description: The objective of Engineering Mathematics – IV is to equip the students with adequate knowledge of basic mathematics that will enable them in formulating problems and solving them analytically as well as numerically in their Engineering programme. The course enables students to incorporate the knowledge of complex variables and their significance in engineering, Numerical methods and sampling theory to support their concurrent, subsequent engineering studies to explore complex systems, physicists, engineers and mathematicians require computational methods since mathematical models are rarely solvable analytically. This course provides an introduction to basic numerical methods such as fitting of various curves, interpolation, differentiation, integration. This course also provides an introduction to numerical solution of algebraic and transcendental equations, ordinary differential equations such as Taylor's series method, modified Euler's method and Runge-Kutta Methods. The course aims at introducing students to quantitative uncertainty analysis and risk assessment for engineering applications. Probability theory is of great use in understanding and modeling phenomena that exhibit random behavior and the emphasis is on real- world applications to engineering problems. sampling distributions of means and variances, chi- squared, t and F distributions, methods of estimation, estimating means, proportions and variances, maximum likelihood estimation, tests of hypothesis on means, proportions and variances, chi- squared test of goodness of fit.

Textbooks

4. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons (India), 2014.

5. 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.

6. Ronald .E. Walpole, Raymond. H. Myers, Sharon. L Myers, and Keying E.Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.

Reference Books

3. B.S. Grewal, "Higher Engineering Mathematics", 43rd edition, Khanna Publishers.

4. B.S. Grewal, Numerical methods in engineering and science, 10th Edition, Khanna publishers, 2016.

Kishor S Trivedi, "Probability ansd Statistics with reliability, Queuing and Computer Science Applications", John Wiley & Sons, 2nd edition, 2008.

Course Name:	Engineering Chemistry					
		Credit Structure :	**L**	**T**	**P**	**C**
Course Code:	CHE 101		4	0	0	4

Course Description: The primary objective of the course is to introduce the students to the concepts and applications of chemistry in Engineering. It should cultivate in them an ability to identify chemistry in each piece of finely engineered products used in households and industry. It aims to strengthen the fundamental concepts of chemistry and then builds an interface with their industrial applications. It deals with applied and industrially useful topics, such as Water Technology, Engineering materials such as Polymers & Liquid crystals, Introduction to Computational Chemistry, Electrochemistry principles & its application to batteries, Corrosion and its control, Fuels and combustion.

Textbooks:

2. Wiley, "Engineering Chemistry", Wiley.

Reference Books:

10. Dr. K. Pushpalatha, "Engineering Chemistry", Revised Edition, Wiley.
11. F Jain and Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company. New Delhi, 2019.
12. Koch, W., & Holthausen, M. C. (2015). A chemist's guide to density functional theory. John Wiley & Sons.
13. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, 2015.
14. Principles of Physical Chemistry B.R.Puri, L.R. Sharma & M.S. Pathania, S. Nagin Chand & Co., 41 Ed., 2004.
15. F.W. Billmeyer, Text Book of Polymer Science, John Wiley & Sons, 4th Edition, 1996.
16. M.G. Fontana, N. D. Greene, Corrosion Engineering, McGraw Hill Publications, New York, 3rd Edition, 1996.
17. Jurs, P.C., 1996. Computer software applications in chemistry. John Wiley & Sons.
18. Stephen Wilson (auth.) - Chemistry by Computer: An Overview of the Applications of Computers in Chemistry-Springer US (1986).

REGISTRAR

Course Name:	Elements of Electronics Engineering					
Course Code:	ECE 101	Credit Structure :	**L**	**T**	**P**	**C**
			3	0	0	3

Course Description: The course aims at nurturing the students with the fundamental principles of electronics engineering, prevailing in various engineering applications. The course begins with the fundamentals of electronic systems and some basic laws of electricity. The topics include: classification of materials, types of Semiconductor materials, p-n Junction, Diodes, Characteristics, Rectifiers, Junction Transistor, BJT Configurations, Characteristics, BJT Biasing basics, Transistor Applications. Subsequently the student is introduced to Digital Electronics – Codes and Number systems – viz. Decimal, Binary and hexadecimal systems, conversions. 1's and 2's complements, binary addition. Boolean logic, basic gates and Universal Gates, and laws for reduction of the logic expressions, implementation using basic gates. Basics of communication systems, introduction to microprocessors and its applications.

Textbooks:

6. John Hiley, Keith Brown and Ian McKenzie Smith, *"Hughes Electrical and Electronic Technology"*, Pearson.

Reference Books:

7. Smarajit Ghosh, *"Fundamentals of Electrical and Electronics Engineering"*, PHI.

8. D.P. Kothari, I. J. Nagrath, *"Basic Electronics"*, McGraw Hill Education.

9. Rajendra Prasad, *"Fundamentals of Electronics Engineering"*, Cengane Learning.

Course Name:	Elements of Mechanical Engineering					
Course Code:	MEC 101	Credit Structure :	**L**	**T**	**P**	**C**
			3	0	0	3

Course Description: This course is designed to acquaint students with the fundamentals of mechanical engineering by covering some basics of thermal engineering, design engineering and manufacturing processes.

The discussion on thermal engineering includes the study of different forms of energy, the laws of thermodynamics, properties of steam, heat engines, heat pumps, steam boilers and an introduction to fluid properties and machinery. The discussion on design engineering covers transmission of motion and power. The discussion on manufacturing processes includes metal cutting and machines tools.

Textbooks:

10. K. P. Roy, S. K. Hajra Choudhury, Nirjhar Roy, *"Elements of Mechanical Engineering,"* Media Promoters and Publishers Pvt. Ltd. Mumbai.

Reference Books:

11. Pravin Kumar, *"Basic Mechanical Engineering,"* Pearson.

12. V. K. Manglik, *"Elements of Mechanical Engineering,"* PHI.

13. Dr. D. S. Kumar, *"Elements of Mechanical Engineering,"* S. K. Kataria & Sons.

Course Name:	Environmental Science and Disaster Management					
			L	**T**	**P**	**C**
Course Code:	CIV 102	Credit Structure :	3	0	0	3

Course Description: The overall objective of the course is to provide clear understanding of natural resources, environment, its maintenance and the basic concepts of disaster management. The course consists of the concepts of renewable and non-renewable resources, conservation of these resources, ecosystems, role of human being in maintaining a clean and useful environment for the future generations, maintaining ecological balance and conservation of biodiversity. It includes causes of environmental deterioration and its control; human environmental disturbances, water and air pollution, mitigation measures, disaster and waste management etc. After successful completion of the course, the students would be able to understand the various types of natural resources and problems due to over exploitation. Also gain knowledge about the different components of the ecosystem, their interrelation, various hazards, natural disasters, their effects and management.

Textbooks:

1. Benny Joseph, *"Environmental Studies",* McGraw-Hill.

Reference Books:

2. R. Rajagopalan, *"Environmental studies–From Crisis to Cure",* Oxford University Press.

3. P. Anandan and R. Kumaravelan, *"Environmental Science and Engineering",* Scitech.

4. ErachBharucha, *"Environmental Studies for Undergraduate courses",* Universities Press.

5. R.B. Singh (Ed), *"Disaster Management",*Rawat.

6. MahuaBasuand S. Xavier "*Fundamentals of Environmental Studies*" Cambridge University Press.

Course Name:	Technical Spoken Communication					
Course Code:	**ENG 104**	Credit Structure :	**L**	**T**	**P**	**C**
			1	0	2	2

Course Description: A Course on Technical Spoken Communication in the field of technical education will train the students to speak better English and face the corporate world with determination and self-belief. The theoretical and practical sessions on pronunciation, listening, conversation, narration, speech presentation, will make the target audience to stand out in the forefront of their field of operation. At the end of the course, the students will have better skills, and the students will also be able to excel in middle-higher level management in the corporate world.

Reference Books:

1. Tomson, Robert. *"The Interview."* Stories of Work, Life and the Balance in Between. The Write Place.
2. Daniel. J. C. "Unforgettable Salim Ali.*" Inspiring People: Fifty People Who Made a Difference.* Readers Digest Selection.
3. Bovee, Courtland L. Thill, John V, Chatterjee. Abha. *Business Communication Today*. 10th Edition. Pearson
4. Carmine, Gallo. "*11 Presentation Lessons You Can Still Learn From Steve Jobs."* FORBES, October 12, 2012.
5. Thrishna's: *How to Do well in GDs and Interview*. New Delhi: Pearson 2013
6. Raman, Meenakshi. Sharma, Sangeetha. *Technical Communication: Principles and Practice.* Oxford University Press, New Delhi. 2015.
7. Hart, Steve. Nari, Aravind R. and Bhambhani, Veena. Embark: *English for Undergraduates*. New Delhi; Cambridge University Press, 2016.
8. J. K. Gangal, *A Practical course in Spoken English*, PHL Learning Private Limited, Delhi-2014.

Course Name:	Kannada Kali					
Course Code:	KAN 101	Credit Structure :	**L**	**T**	**P**	**C**
			1	0	0	1

Course Description: This course aims to help the non Kannada speaking students to converse in Kannada for their day-to-day life activities. It supports to develop strong cognitive skills, use of local language, helps to mingle with the local society, ensures security, facilitates interaction with auto and cab drivers, shop owners, employees of local government, etc. It also helps Law students to understand local client's complaints and also to the students of Engineering for a better communication. Furthermore, this course is offered to all the students, irrespective of their domain.

Text Books:
4. G Kannada Kali – Linga Devaru Hale Mane, Publication – Prasaranga Kannada Vishvavidyalaya, Hampi.
5. Spoken Kannada – Publication – Kannada Sahitya parishath Bengaluru.
6. Kannada Kirana – Publication – Bangaore Institute of Languages, Bangalore.

Course Name:	Computer Programming					
Course Code:	CSE 151	Credit Structure :	**L**	**T**	**P**	**C**
			2	0	4	4

Course Description: This course will provide an introduction to foundational concepts of computer programming to students of all branches of Engineering. This module includes a mix of traditional lectures and laboratory sessions. Each meeting starts with a lecture and finishes with a laboratory session. Topics covered in this course are problem formulation and development of simple programs, Pseudo code, Flow Chart, Algorithms, data types, operators, decision making and branching, looping statements, arrays, functions, pointers, structures, union and basic file operations. In the lab secession students are required to solve problems based on the above concepts to illustrate the features of the structured programming.

Textbook:

1. E. Balagurusamy, "*Programming in ANSI C*", Tata McGraw Hill.

Reference Books:

1. Yale Patt, Sanjay Patel, "*Introduction to Computing Systems: From bits and gates to C and beyond*", McGraw Hill.

2. Ehrouz A Forouzan, Richard F Gilberg, "*Computer science: A structured programming approach using C*", Cengage Learning.

Course Name:	Engineering Chemistry Lab					
Course Code:	CHE 151	Credit Structure :	**L**	**T**	**P**	**C**
			0	0	2	1

Course Description: The lab course intends to train the students to develop their experimental skills and apply fundamental chemical principles in problems related to chemistry in engineering. The experiments are designed to support the theory lectures and the hands-on experience will thus enhance students' in understanding the concepts.

The course includes the estimation of total hardness of water by EDTA complexometric method, determination of the total alkalinity of a given water sample, estimation of Iron (II) in Mohr's salt, estimation of calcium oxide in cement, determination of Chemical Oxygen Demand (COD) of Industrial Waste Water sample, determination of pKa value of weak acid using pH meter, Estimation of copper colorimetrically, determination of Iron (II) by potentiometry, determination of viscosity co-efficient of a liquid using Ostwald's Viscometer, estimation of strength of mixture of acids by conductometry method.

Course Material: *"Engineering Chemistry Lab Manual",* Presidency University.

Course Name:	Calculus, Differential Equations and Complex Variables					
			L	**T**	**P**	**C**
Course Code:	**MAT 102**	Credit Structure :	3	1	0	4

Course Description: This course is also commonly designed for all engineering branches and the contents learned in the previous semester are the prerequisite for this course. Probability theory is of great use in understanding and modeling phenomena that exhibit random behavior and the emphasis is on real-world applications to engineering problems. The topics covered include basic concepts of probability and conditional probability, Baye's law and correlation analysis, Linear Regression and method of least square, Solution of second and higher order, linear ordinary differential equations with constant and variable coefficients. Formation of Partial Differential Equations (PDE), solution of homogeneous and non-homogeneous PDEs and the application of PDEs. Evaluation of double and triple integrals, change of order of integration, change of coordinates, beta and gamma functions, line integral, surface integral and volume integral of vector and scalar functions. Laplace transforms of functions and properties; Laplace transform of periodic and unit step functions. Inverse Laplace Transforms, Application of Laplace transforms and solution of differential equations.

Textbooks:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 10th edition, John Wiley-India Publishers, 2014.

3. Ronald E. Walpole, Raymond H. Myers, Sharon. L. Myers and Keying E. Ye, *Probability and Statistics for Engineers and Scientists*, Pearson Education, Delhi. 9th Edition, 2012.

Reference Books:

1 Peter V. O'Neil, Advanced Engineering Mathematics, 7th Edition, Cengage Learning, 2012.

2 B. S. Grewal, Higher Engineering Mathematics, 43rd edition, Khanna Publishers, 2014.

Course Name:	Effective Communication					
			L	**T**	**P**	**C**
Course Code:	PPS 106	Credit Structure :	**0**	**0**	**2**	**0**

Course Description: In order to succeed in the world that has become more global than being confined to smaller areas, we need to be very good in communication. This programme introduces students to different techniques of communication that makes them communicate clearly and effectively. During this programme, students are given a lot of exercises to inculcate better flow of thought and speech with emphasis on being effective in communication.

Text Book:

1. Presidency University *"Effective Communication"* Training Manual

Course Name:	Design Thinking and Team Building					
			L	**T**	**P**	**C**
Course Code:	PPS 107	Credit Structure :	**0**	**0**	**2**	**0**

Course Description: Developing right attitude, effective communication and problem solving skills along with confidence is very essential in this highly competitive environment. This course helps the students to develop the necessary attitudes and traits of problem solving coupled with thinking out of the box, brainstorming, root cause analysis etc. and adds to the students' overall personality and drives them to solve problems and innovate. The students are exposed to various type of problem solving techniques followed by simulation exercises, group brainstorming and other activities like discussions, case-studies etc.The students get the right guidance from the faculty to develop and polish their skills which will make them successful in the corporate world.

Text Book:

(i) Textbook(s)
Design Thinking & Team Building Training Manual

(ii) Reference Book(s)
Emrah Yayici, "Design Thinkking Methodology Book"
Diane Deacon and Mike Vance, "Think Out Of The Box"
John Adair, "Decision Making and Problem Solving Strategies"
John Adair "The Art Of Creative Thinking"

Course Name:	Being Corporate Ready					
			L	T	P	C
Course Code:	PPS 108	Credit Structure :	0	0	2	0

Course Description:

Presentation Skills

In this ever transforming corporate world, making an effective presentation to various audiences and stakeholders – teams, peers, clients, senior management etc., - is an extremely essential skill. Here the students are exposed to various nuances of presentation like usage of Powerpoint, verbal and non-verbal skills needed for a presentation. The course provides practical hands-on experience in presentation skills so as to be able to engage the audience and speak effectively on any given topic.

Group Discussion

To be able to express thoughts/ opinions, with proper understanding and the necessary confidence so that the participant in a GD comes across as possessing good leadership and communication skills. The future Engineers need to possess these essential skills because communicating in a group will be very much required in a day-to-day situation. This session focuses on equipping the future engineers to quickly think on their feet, be able to align and gather their thought process to confidently express themselves in a group discussion. The course also includes practically simulated group-discussion exercises to drive home the concepts for easy understandability.

E-mail writing tips

Communicating via e-mail is the most crucial skill of the 21st century. Email is an essential tool for future engineers to effectively communicate the challenges, needs, difficulties, and solutions of the work place. This module focuses on equipping the future engineers with the acceptable netiquette, know-how to formally present an e-mail, and understand general acceptable do's and don'ts. The course also includes practical hands-on e-mail writing exercises to drive home the concept.

Resume Building

Resume is the ticket to an employment interview and an essential tool for being professional in a corporate environment. This module focuses on the best practices of resume building by giving practical tips to the students to be able to prepare a resume of their own.

Personal Interview

It is undisputed that acing the interview is an absolute must to be able to get an employment in the corporate world. Students need to possess the required skills to able to showcase their skills, talents and convince the employer that s/he is the best fit for the job. In this module, the students are familiarized with various types of interviews and interview

facing situations through a step-by-step approach. The course also includes real-life hands on exercises to drive home the concepts.

Text Book:

(i)   Being Corporate Ready Training Manual

Reference Book(s)

(i)   "Group Discussion and Interview Skills by Pataki, Priyadarshi, Cambridge University Press: 2016"

(ii)   Prakash Iyer, "The Habit of Winning', Second Ed, Penguin Books Ltd, 2016.

(iii)   Jack Canfield, "The Success Principles", 8th Edition, Harper Collins India, 2015

Course Code: CSE1002	Course Title: Programming using Python Type of Course: School Core Theory & Integrated Laboratory		L- P- C	1	2	2
Version No.	1.0					
Course Pre-requisites	Basic knowledge of Computers and Mathematics					
Anti-requisites	**NIL**					
Course Description	The purpose of this course is to enable the students to develop python scripts using its basic programming features and also to familiarize the Python IDLE and other softwares. This course develops analytical skills to enhance the programming abilities. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to build real time applications.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Summarize the basic Concepts of python. 2. Demonstrate proficiency in using data structures. 3. Illustrate user-defined functions and exception handling. 4. Identify the various python libraries.					
Course Content:						

Module 1	Basics of Python programming	Assignment	Programming	**14 Classes**

Topics: Data types, operators and Expressions, Input and Output Statements. Control Structures – Selective and Repetitive structures

Module 2	Indexed and Associative Data Structures	Simple applications	Programming	**20 Classes**

Topics: Strings, Lists, Sets, Tuples, Dictionaries

Module 3	Functions, Exception handling and libraries	Case study	Programming	**10 Classes**

Topics: User defined functions, exception handling, Introduction to python built-in libraries

List of Laboratory Tasks:

Sl. No.	Experiment Name
1	PROGRAMS ON OPERATORS AND EXPRESSIONS Level - 1 : Basic programs on Operators and Expressions Level - 2 : Develop applications to solve mathematical equations

2	PROGRAMS ON CONTROL STRUCTURES Level - 1 : Basic programs on Control structures Level - 2 : Create applications to solve the real time problems
3	PROGRAMS ON SELECTIVE AND REPETITIVE STRUCTURES Level - 1 : Basic programs on Selective and Repetitive structures Level - 2 : Create applications to solve the real time problems
4	PROGRAMS ON STRINGS Level - 1 : Basic programs on Strings and its manipulation Level - 2 : Develop Real world applications that involves string matching
5	PROGRAMS ON LISTS, TUPLES and SETS Level - 1 : Basic programs on lists, Tuples and Sets Level - 2 : Create applications that involves sequential and Random access of data
6	PROGRAMS ON DICTIONARIES Level - 1 : Basic programs on dictionaries Level - 2 : Create applications that involves structuring of data.
7	PROGRAMS ON FUNCTIONS Level - 1 : Basic programs on Functions Level - 2 : Develop Real world applications using functions
8	PROGRAMS ON EXCEPTION HANDLING Level - 1 : Basic programs on exception handling Level - 2 : Develop applications that involves exception handling
9	BASIC PROGRAMS ON BUILT-IN LIBRARIES Level - 1 : Basic programs on python modules Level – 2: Develop applications using python libraries

Targeted Application & Tools that can be used:
Targeted Application : Web application development, AI, Operating systems
Tools: Python IDLE, ANACONDA

- **Application Areas:**
- Web Development
- Game Development
- Scientific and Numeric Applications
- Artificial Intelligence and Machine Learning
- Software Development

- Enterprise-level/Business Applications
- Education programs and training courses
- Language Development
- Operating Systems
- Web Scrapping Applications
- Image Processing and Graphic Design Applications

Professionally Used Software: Python IDLE, Spyder, Jupyter Notebook, Google Colab

Project work/Assignment:
Project Assignment: Developing python scripts using built in methods and functions

Text Books:
- Charles Dierbach, "Introduction to Computer Science Using Python", Wiley India Edition,2015.

References:
1. E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", Tata McGraw-Hill, 2016
2. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2017
3. Python Tutor - Visualize Python, Java, C, C++, JavaScript, TypeScript, and Ruby code execution
4. https://practice.geeksforgeeks.org/courses/Python-Foundation

Topics relevant to development of "FOUNDATIONS SKILLS"- Solve the real time problems by analyzing and visualizing the data.
Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS"- Data collection and its arrangement

Skill Level: Foundation, Skill Development, Employability

Catalogue prepared by	Prof. Isaac Joel Raj. S, Ms. GANGA V C, Ms. PALLAVI M, Ms.AKSHATHA Y, Mr.JOBIN THOMAS, Ms. POORNIMA GALIVEETI
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

REGISTRAR

Course Code: CSE2006	Course Title: Data Structures Type of Course: Program Core Theory &Integrated Laboratory	L- P- C	3	4	5
Version No.	1.0				
Course Pre-requisites	Pre requisites: One week Orientation classes on Foundations, Revisiting C Language, Arrays, Loops, Functions.				
Anti-requisites	NIL				
Course Description	The purpose of this Course is to provide the students with solid foundations in data structures. It focuses on logical structures of data, their physical representation, design of algorithms and techniques for program development and debugging. Emphasis is placed on the appropriate use and choice of standard data structures. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments. The associated laboratory provides an opportunity to validate the concepts Taught and enhances the ability to visualize and analyze the Data Structures Results.				

Course Outcomes	On successful completion of this course the students shall be able to:
	   1. Implement modularized solutions for given problem using structures and pointers.
	   2. Apply an appropriate linear data structure for a given computation.
	   3. Apply an appropriate non-linear data structure for a given computation
	   4. Identify the need for heap and hash functions for given computational scenario				

Course Content:					
Module 1	Introduction to Programming Fundamentals	Continuous Assessment	Programming Task	**12 classes**	
Topics:					

Structures and Unions: Introduction, Defining a Structure, Declaring Structure Variables, Accessing Structure Members, Structure Initialization, Size of Structures, Array of Structures, Arrays within Structures, Structures within Structures, Structures and Functions, Unions. Pointers: Introduction, Understanding Pointers, Accessing the Address of a Variable, Declaring Pointer Variables, Initialization of Pointer Variables, Accessing a Variable through the Pointer, Pointer Increments, Pointers and Arrays, Pointer as Function Arguments, Functions Returning Pointers, Pointers and Structures, Enumerations, ADT, Recursion: Recursive Definition and Processes, Recursion in C – factorial, Fibonacci numbers, Towers of Hanoi.

Module 2	Application of Linear Data Structure	Continuous Assessment	Programming Task and choose an appropriate linear data structure task	**12.Hours**	
Topics:					

Dynamic Memory Allocation: Introduction, Dynamic Memory Allocation, Allocating a Block of Memory: Malloc, Allocating a Multiple Blocks of Memory: Calloc, Releasing the Used Space: Free, Altering a size of Block: Realloc, Linked Lists: Inserting and Removing Nodes from a List, Linked Implementation of Stacks, push and pop Operations, Stack application, Linked Implementation of Queues, C Implementation of Queues using array, Circular Queue, Priority Queue, Doubly Linked lists.

Module 3	Application of Non Linear Data Structure	Continuous Assessment	Programming Task and choose an appropriate non-linear data structure task	**8.Hours**

Topics:
Introduction to Graphs and Trees, Operations on Binary Trees, Applications of Binary Trees, BST, Implementation and Tree Traversal.

Module 4	Introduction to Heaps and Hashing Techniques	Continuous Assessment	Programming Task	**4 Hours**

Topics: Introduction to Heaps , Hash Tables

List of Laboratory Tasks:
Lab sheet 1:
Programs on arrays
Programs on Functions
Programs on Structures
Programs on Pointers

List of skill set:
   i. Analyze the problem and draw the flowchart
  ii. Selecting the suitable data type, category of function
 iii. Develop the program.
 iv. Identifying errors and rectifying them.

Lab sheet 2:

Programs on Linked List
Programs on Stack and queues
List of skill set:
   i.   Analyze the problem and draw the flowchart
  ii.   Selecting the appropriate linear data structure and performing operations
 iii.   Develop the program.
 iv.   Identifying errors and rectifying them.

Lab sheet 3:
Programs on Trees and Traversals
List of skill set:
   i.   Analyze the problem and draw the flowchart
  ii.   Developing the solution using trees
Identifying errors and rectifying them.

Lab sheet 4:

Programs on Heaps and Hashing	
List of skill set:	
i. Analyze the problem and draw the flowchart	
ii. Developing the solution to the problem using heap and storing and retrieval using hashing	
iii. Identifying errors and rectifying them.	

Targeted Application & Tools that can be used:
System and Application Programming
C compilers

Project work/Assignment:
Continuous Assessment 1- Module 1
Continuous Assessment 2- Module 2
Continuous Assessment 3- Module 3
Continuous Assessment 4- Module 4

REFERENCE MATERIALS: Text
Book(s):
Richard F Gilberg and Behrouz A Forouzan, *"Data Structures: A Pseudocode Approach with C", Second Edition, Cengage learning.* ISBN-13: 978-0-534-39080-8, ISBN-10: 0-534-39080-3.

References
1. Robert L Kruse, Bruce P Leung and Clovis L Tondo, *"Data Structures and Program Design in C"*, Pearson.
2. Seymour Lipschutz, "*Data Structures with C (Schaum's Outline Series)"*, McGraw Hill Education.

:	Mention the Weightages like, Test 1 25%, Test 2 : 25%, Assignment 25%, Term End Exam 25%
Catalogue prepared by	Dr. Nagaraja S R Asst.Professor,Dept of CSE
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

REGISTRAR

Course Code: CSE2007	Course Title: Design and Analysis of Algorithms					
	Type of Course:1] Program Core 2] Theory – Laboratory integrated		L-P-C	2	2	3
Version No.	2.0					
Course Pre-requisites	• **C programming** • **Discrete mathematics.** • **Data structure.**					
Anti-requisites	Nil					
Course Description	The main goal of this course is to study the fundamental techniques to design and analyze the efficient of algorithms and their running time. After a brief review of prerequisite material (search, sorting, asymptotic notation), solving various real time problems through various algorithmic techniques such as divide and conquer algorithms, dynamic programming, greedy algorithm etc.					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Analyze the asymptotic performance of algorithms. 2) Analyze the time and space complexity of an algorithm. 3) Apply the different techniques of algorithm in solving real world problems. 4) Summarize the performance of various real time problems using different algorithmic techniques.					
Course Content:						

Module 1	Design of basic Tree and Graph problems	Assignment	Problem Solving	**08 Hours**

Topics:
Fundamentals of Algorithmic Problem Solving, Important Problem Types-Sorting, Searching, String Processing, Graph Problems, Combinatorial Problems, Fundamental Data Structures -Linear Data Structures, Graphs, Trees, Sets and Dictionaries. [Blooms 'level selected: **Comprehension**]

Module 2	Analysis of Recursive and Non-recursive algorithms	Term paper/Assignment	Programming/ Problem Solving	**06Hours**

Topics:

Algorithm Design paradigms - motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Recurrences- substitution method. [Blooms 'level selected: **Comprehension**]				
Module 3	Divide-and-conquer	Term paper /Assignment	Programming/Problem Solving	**06 Hours**
Topics: Structure of divide-and-conquer algorithms: examples; Binary search, quick sort, Merge sort, Binary Tree Traversals and Related Properties, Strassen's Multiplication. [Blooms 'level selected: **Application**]				
Module 4	Greedy Algorithms and Dynamic Programming	Term paper /Assignment	Problem Solving	**08Hours**
Topics: **Greedy Algorithms :** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm. **Dynamic Programming :** The Knapsack Problem, Binomial coefficient, Warshall's and Floyd's Algorithms, Travelling sales person problem. [Blooms 'level selected: **Application]**				
Module 5	Backtracking and Limitations of Algorithm	Term paper /Assignment	Problem Solving	**06Hours**
Backtracking – n-Queens problem. Lower-Bound Arguments, Decision Trees, P , NP , and NP-Complete Problems, [Blooms 'level selected: **Comprehension**]				
List of Laboratory Tasks: **Experiment No 1:** Apply non recursive algorithmic designing technique to solve Linear Search, finding max element problem and calculate the time efficiency (best, average & worst). **.[2 hours : Application Level]** **Level 1: understanding and designing the algorithm.** **Level 2: Implementing the algorithm and finding its efficiency.** **Experiment No. 2:** Apply Brute force algorithmic designing technique to sort elements using selection algorithm and calculate time (Best, average & worst) efficiency. .**[2 hours : Application Level]** **Level 1: understanding and designing the algorithm.** **Level 2: Implementing the algorithm and finding its efficiency.**				

Experiment No. 3: Apply divide and conquer algorithmic designing technique to sort elements using merge sort algorithm and calculate time (Best, average & worst) efficiency.**[2 hours : Application Level]**
Level 1: Understanding merge sort using divide and conquer and designing the algorithm.
Level 2: Implementing the algorithm and finding its efficiency.

Experiment No. 4: Apply dynamic programming algorithmic designing technique to find binomial coefficient of a given number i.e nCr and calculate time (Best, average & worst) efficiency **[2 hours : Application Level]**
Level 1: understanding dynamic problem, solve nCr problem and designing the algorithm.
Level 2: Implementing the algorithm and finding its efficiency.

Experiment No. 5: Apply dynamic programming algorithmic designing technique to find All pair Shortest Path for a given graph using Warshall's and Floyd's algorithm **[2 hours : Application Level]**

Level 1: understanding and designing the algorithm.
Level 2: Implementing the algorithm and finding its efficiency.

Experiment No.6: Apply dynamic programming algorithmic designing technique for Solving 0/1 knapsack problem and find its efficiency   **[2 hours : Application Level]**
Level 1: understanding and designing the algorithm.
Level 2: Implementing the algorithm and finding its efficiency.

Experiment No. 7 Apply greedy algorithmic designing technique for Solving MST and single source shortest path problem by using – Dijkstra's algorithm **[2 hours : Application Level]**
Level 1: understanding and designing the algorithm.
Level 2: Implementing the algorithm and finding its efficiency.

Experiment No. 8: Apply greedy algorithmic designing technique for constructing minimum spanning tree using prim's algorithm and Kruskal's algorithm **[2 hours : Application Level]**
Level 1: understanding and designing the algorithm.
Level 2: Implementing the algorithm and finding its efficiency.

Experiment No. 9: Apply backtracking algorithmic designing technique for solving queen's problems for 4, 8 and 16 inputs. **[2 hours : Application Level]**
Level 1: understanding and designing the algorithm.
Level 2: Implementing the algorithm and finding its efficiency.

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Targeted Application & Tools that can be used:
Application Area is to Design and Analyzing the efficiency of Algorithms. **Tools/Simulator used: GCC compiler.**

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
1. **Problem Solving: Design of Algorithms and implementation of programs.** 2. **Programming: Implementation of given scenario using C.**

Text Book
1.Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, *"Introduction to* *Algorithms",* **PHI Learning Private Limited.**

References
1. **Anany Levitin,** *"Introduction to the Design and Analysis of Algorithms",* **Pearson Education.**

Topics relevant to development of "Foundation, skill Development, Employability": Asymptotic Notations, Order of growth, P,NP Problems.

Topics relevant to " HUMAN VALUES &PROFESSIONAL ETHICS": Solving real time Problems & Data collection for an assignment.

Catalogue prepared by	Dr.A.Jayachandran, Mr. Sunil Kumar R.M, Mr.Mrutunjaya, Mrs Preethi, Mrs Prakruthi,Mrs Smitha patil
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

Course Code: CSE2008	Course Title: Programming in Java			
	Type of Course: Integrated	**1-4-3**		
Version No.	1.0			
Course Pre-requisites	Basic knowledge of programming and data structure concept.			
Anti-requisites	NIL			
Course Description	This Course is designed for students who have prior programming experience. It introduces the concepts of object-oriented programming by focusing on the definition and use of classes along with the fundamentals of object-oriented design.Topics include: Control structures and data types, Object-oriented design- encapsulation and information-hiding, classes, objects, Constructor, Array, String, Inheritance, Polymorphism, Packages, Exception Handling, Thread, GUI			
Course Out Comes	On successful completion of the course the students shall be able to: 1) Use control structures and object oriented concepts. 2) Apply the concept of arrays, strings, polymorphism & inheritance to solve problems. 3) Use interface, packages for applications. 4) Demonstrate the concepts of error handling mechanism and multithreading. 5) Illustrate GUI applications and Collections to solve problems.			
Course Content:				

Module 1	INTRODUCTION	Assignment	Programming	**No. of Hours:15**

Topics: Introduction to Object Oriented Programming, Java Evolution, and How Java differs from C++, Features of Java,

Java Environment: Installing JDK (JVM, JRE), Java Source File Structure, Compilation and Execution of Java Programs.

TOKENS: Data types, Variables, Operators, Control Statements, Command Line Arguments.

CLASSES, OBJECTS, AND METHODS:Defining a class, access specifiers, instantiating objects, reference variable, accessing class members and methods, constructors, method overloading, static members, static methods, inner class, Wrapper class

Module 2	Arrays, Strings, inheritance and Polymorphism	Assignment	Programming	**No. of Hours:12**

Topics:Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array.

Operation on String, Mutable & Immutable String, Creating Strings using StringBuffer or StringBuilder.

REGISTRAR

Defining a subclass, types of Inheritance, method overriding, super keyword, dynamic method invocation, dynamic polymorphism, usage of final abstract and this keyword.

Module 3	Interfaces, Packages and Exception Handling	Assignment	Programming	No. of Hours:15

Topics:Defining interfaces, extending an interface, Implementing interfaces. Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining a Package, Library Packages, import packages.

Exception handling: Introduction to Exceptions, Difference between Exceptions & Errors, Types of Exception. Handling Exceptions: Use of try, catch, finally, throw, throws. User Defined Exceptions, Checked and Un-Checked Exceptions.

Module 4	MULTITHREADED PROGRAMMING:	Assignment	Programming	No. of Hours:10

Topics: Introduction to threads, life cycle of a thread, creating threads, extending the Thread Class, Implementing the "runnable" interface. Thread Priority, Thread synchronization, Inter communication of Threads

Module 5	Collections and Graphic Programming	Assignment	Programming	No. of Hours:13

Introduction to Collections, Classification of Collection. List Interface, ArrayList Implementation, ArrayList without Generics, Generic ArrayList, Iteration and Boxing, Autoboxing and Unboxing, Set Interface, Map Interface.
Introduction to the abstract window toolkit (AWT), Frames, Event-driven programming: Mouse and Key Event handling, Drawing geometric figures.

List of Laboratory Tasks:
Experiment N0 1:
Level 1: Programming assignment with basic control structures.

Level 2: Programming assignment with class, objects & methods.

Experiment No. 2:

Level 1: Programming assignment using Arrays and Strings.

Level 2: Programming assignment using Inheritance and Polymorphism

Experiment No. 3:

Level 1: Programming assignment using Interface and Packages

Level 2: Programming assignment using Exception Handling

Experiment No. 4:

Level 1: Programming assignment using MultiThreading

Experiment No. 5:

Level 1: Programming assignment using Collections

Level 2: Programming assignment using Awt.

Targeted Application & Tools that can be used:

JDK (Java Development Tool kit),NETBEANS IDE

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

After completion of each module a programming based Assignment/Assesment will be conducted. A scenario will be given to the student to be developed as a Java Application.

Text Book
1) **Cay S Horstmann and Cary Gornell, *"CORE JAVA volume I-Fundamentals"*, Pearson.**
2) **Cay S Horstmann and Cary Gornell, *"CORE JAVA volume II-Advanced Features"*, Pearson.**

References

1)Herbert Schildt, *"The Complete Reference Java 2",* Tata McGraw Hill Education.

2)James W. Cooper, *"Java TM Design Patterns – A Tutorial",* Addison-Wesley Publishers.

Catalogue prepared by	Vinitha Dominic
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

REGISTRAR

Course Code: CSE 2009	Course Title: Computer Organization and Architecture Type of Course: Program Core & Theory only	L- P-C	3	0	3

Version No.	1.0
Course Pre-requisites	**Digital Design**
Anti-requisites	**NIL**
Course Description	This course covers basics of modern computer architecture and organization. The emphasis is on understanding the interaction between computer hardware and software at various levels. The students will learn the operational concepts of computer technology, performance evaluation, instruction set architecture, computer arithmetic, data path and control unit design of basic processing unit and enhancing performance with pipelining. The course concludes with a study of multiprocessors and multicores.
Course Outcomes	On successful completion of the course the students shall be able to: 1] Explain the basic components of a computer, their interconnections, and machine instructions 2] Apply appropriate techniques to carry out selected arithmetic operations 3] Appreciate the organization of components such as processing unit and memory system 4] Explain the concept of pipelining, multicores and multiprocessors
Course Content:	

Module 1	Basic Structure of computers	Assignment	Analysis, Case Study	**9 Hours**

Topics:
Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Performance, Generation of Computers. Numbers, Arithmetic Operations and Characters.

Module 2	Instruction Set Architecture and I/O Units	Assignment	Analysis, Case Study, Data Collection	**10 Hours**

Topics:
Instruction Set Architecture: Instructions and Instruction Sequencing, Instruction formats, Memory Instructions, Addressing Modes, Stacks and Subroutines.
Input/output Design: Accessing I/O Devices, I/O communication, Interrupts, DMA.

Module 3	Arithmetic Unit	Assignment	Analysis, Case Study, Data Collection	**7 Hours**

Topics:
Design of Fast Adders, Signed-Operand Multiplication, Fast Multiplication, Integer Division, and Floating point operations.

Module 4	BPU and Memory Organization	Assignment	Analysis, Case Study, Data Collection	**10 Hours**

Topics:
Basic Processing Unit: Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization.
Memory System: Basic Concepts, Internal Organization of Memory chips, Read Only Memories, Memory Hierarchy, Cache Memories.

Module 5	Pipelining and Multiprocessing	Assignment	Analysis, Case Study, Data Collection	**6 Hours**

Topics:
Pipelining: Overview of pipelining, 5 stage instruction pipeline, Hazards.
Multicores and Multiprocessors: Introduction to multicores and multiprocessors, Shared memory multiprocessors, Cluster and other message passing multiprocessors.

Targeted Application & Tools that can be used:

Tools:
- EasyCPU for the Intel 80X86 family of computer architecture
- RTLsim a data-path simulator for a MIPs like CPU
- RISC-V for ARM like RISC processors

Target Applications are System engineering and programming.

Project work/Assignment:

Term Assignments:

- **Comparative analysis of instruction set architecture (ISA) of CISC and RISC processors**

  Carry out a thorough analysis of the internal organization and Instruction set Architecture of state-of the art CISC processors like VAX, PDP-11, Motorola 68k, Intel's x86 and the best in the market RISC architectures including DEC Alpha, ARC, AMD 29k, Atmel AVR, Intel i860, Blackfin, i960, Motorola 88000, MIPS, PA-RISC, Power, SPARC, SuperH, and ARM too.

- **A short survey of the recent trends in the Cache memory design**

  Study and analyze few important present day cache memory design issues like the levels used, the mapping technique employed, read and write policies, coherency scenarios etc.

- **A case study on modern multi-core processors**

  A deep look through into the architecture and working principles of modern multicore processors like MPC8641, Intel CE 2110 Media that consists of an Intel Xscale processor core and an Intel Micro Signal Architecture (MSA) DSP core etc., for example.

Text Book
1. "Computer Organization"- Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Fifth Edition, McGraw-Hill
    Higher Education, 20016 reprint.
2. "Computer Organization and Design - The Hardware/Software Interface" - David A. Patterson &
    John L. Hennessy, Fifth Edition, Morgan Kaufmann, Elsevier Publications, 2017.

References
1. "Computer Organization & Architecture – Designing for Performance" - William Stallings, 9th
    Edition, Prentice Hall, Pearson Education Inc., 2015

Catalogue prepared by	Prof. Tapas Guha
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

Course Code: CSE 2066	Course Title: Computer Graphics	L-P-C	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE 1002 - Innovation Project -Arduino using C				
Anti-requisites	NIL				
Course Description	The purpose of this introductory course is to discuss the basics of graphics and visualization in computer science, enabling students to appreciate how the computer system displays graphics and visual effects on a display device. This course includes Theoretical elements, and addresses basic knowledge of high school geometry and Linear Algebra. The course uses assignments to develop visualization skills of the students. The key topics covered in this course include algorithms for drawing basic primitives, transformations, viewing and clipping for both 2D and 3D objects along with Bezier curves and Surfaces.				

Course Objective	The objective of the course is to develop skill for students on learning algorithms on transformation / Viewing/ Clipping on 2Dd and 3D objects by using Participative Learning techniques.
Course Out Comes	On successful completion of the course the students shall be able to: CO 1: Illustrate algorithms for drawing basic primitives like Point, Line and Polygon. CO 2: Illustrate algorithms for performing 2D Geometric Transformations, viewing and clipping. CO 3: Illustrate algorithms for performing 3D Geometric Transformations, clipping. CO 4: Demonstrate plane Bezier curves and Bezier surfaces.
Course Content:	

Module 1	Overview: Basics of Computer Graphics:	Assignment	No. of Classes : 15

Topics: An Introduction Graphics System : Computer Graphics and Its Types, Application of computer graphics, Graphics Systems : Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors and Work Stations, Input Devices, Graphics tools and software, Introduction to Visual Studio 17.0 and OpenGL.

Mathematics for Computer Graphics, Introduction to linear algebra, Matrix, Matrix Equations, Linear equation, Quadratic equation, Calculus, differential geometry. Line drawing algorithms (DDA, Bresenham's), circle generation algorithms (Bresenham's). Basics of 2D and 3D objects.

Assignment: Numerical problems based on Matrix equations, Linear equation, Quadratic equation, Calculus, differential geometry.

Module 2	2D Geometric Transformations, viewing and clipping:	Assignment	No. of Classes : 12

2DGeometric Transformations: Basics of translation, scaling and rotation. Matrix representations and homogeneous coordinates for translation, scaling and rotation. 2D Composite transformations, General pivot point rotation and scaling, OpenGL geometric transformations functions.

Basics of 2D viewing and Clipping: Basics of viewing and Clipping, 2D viewing pipeline, Viewing Transformation systems, Types of clipping: point, Line and polygon clipping, 2D line clipping algorithms: cohen-sutherland line clipping, Liang-Barsky line clipping algorithm, polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm, OpenGL 2D viewing and clipping functions.

Module 3	3D Geometric Transformations, clipping:	Assignment	No. of Classes : 9

3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, OpenGL 3D geometric transformations functions.

Basics of 3D Viewing and Clipping: 3D viewing concepts, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, Three dimensional line and polygon clipping.

Assignment: Numerical problems based on 2D and 3D transformations.

Module 4	Plane curves and surfaces	Assignment	No. of Classes : 9

Plane Curves: Plane Curves representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Parametric Representation of a Hyperbola, A Procedure for using Conic Sections, The General Conic Equation,

Basics of Surfaces Curve: Representation of Space Curves, Cubic Splines, Bezier Curves, Parametric Cubic Curves, Quadric Surfaces, Bezier Surfaces.

Targeted Application & Tools that can be used:
Application Area: Game design and Animation
Tools/Simulator/Software used: Visual Studio 17.0

Text Book:

T1: Donald D. Hearn, M. Pauline Baker and Warren Carither, Computer Graphics with OpenGL, Pearson Education, 4th Edition, 2021

Reference Books:

R1. John F Hughes, Andries van Dam, Steven K. Feiner, James D. Foley, Morga, Computer Graphics: Principles and Practice, Pearson Education India, Third Edition, 2013

R2. John Kessenich, Graham Sellers, Dave Shreiner , OpenGL Programming guide , Addison-Wesley Ninth Edition,2016

R3. Edward Angel and Dave shreiner, Interactive Computer Graphics, A top down approach with shader based OpenGL, Pearson Education, 6th Edition, 2018

Catalogue prepared by	Prof. Uday Kumar Singh
Recommended by the Board of Studies on	BOS NO: 13th BOS, held on 08/12/2021
Date of Approval by the Academic Council	Academic Council Meeting No. 17, Dated 11/12/2021

Course Code: CSE3082	Course Title: Object Oriented Analysis and Design with UML Type of Course: Program Core and Theory	L- P- C	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE 1001 Java Programming				
Anti-requisites	NIL				

Course Description	This course covers the analysis and design methodology in sufficient depth to convey a good understanding of object-oriented analysis and design using the unified process. Students will be able to design a use case model, identify the classes and their responsibilities, use interaction models to capture the interdependence among objects/classes and design an efficient solution. The application of the design axioms and the iterative nature of the process are emphasized. This course will enable students to apply object oriented concepts in all the stages of the software development life cycle.
Course objective	This course is designed to improve the learners " SKILL DEVELOPMENT "by using EXPERIENTIAL LEARNING techniques.
Course Outcomes	On successful completion of the course the students shall be able to: 1]Describe the basics of object oriented system development **[Knowledge]** 2]Identify the various techniques for object-oriented analysis techniques [**Comprehension**] 3] Apply the design axioms to create appropriate UML diagrams. [**Application**] 4]Apply the design process to develop implementation models. **[Application]**
Course Content:	

Module 1	Introduction to Object oriented system	Assignment	Identify problem domain objects for an application domain	**8 Classes**

Topics:
Object Basics-Object Oriented System Development Life Cycle- Use case driven approach-Rumbaugh Object Model- Booch Methodology-Jacobson Methodology-Unified Approach, Static and Dynamic Modeling-Unified Modeling Language

Module 2	Object oriented analysis	Assignment	Identification of candidate classes using various approaches	**10 Classes**

Topics:
Identifying use cases-Object Analysis-Classification: Theory-Approaches for Identifying Classes: Noun Phrase approach, Common Class pattern approach, Use case driven approach, Classes, Responsibilities and Collaborators- Identifying Object relationships: Associations, Super–sub class relationships, Aggregation. UML diagrams: Use case Diagram , Class diagram.

Module 3	Introduction to axiomatic design	Assignment	Apply axioms to create class diagram	**10 Classes**

Topics:

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Object Oriented Design Axioms-Designing Classes -Class visibility -Redefining attributes -Designing methods and protocols -Packages and managing classes, UML Diagrams: Interaction diagram, Sequence diagram, Collaboration diagram, State-chart diagram, Activity diagram

Module 4	Object oriented Design process	Assignment	Apply the design process and develop a component and deployment diagram.	10 Classes

Topics:

 Access Layer- Object Storage Persistence - Object oriented Database System-Designing view layer classes -Macro level process -Micro level process- Prototyping the user interface UML diagrams: component diagram, Deployment diagram, Quality Assurance Tests-Testing Strategies.

Tools that can be used:

Tools:

- Microsoft visio, Rational software architect(RSA)
- ArgoUML, Rational Rose, StarUML, Umbrello

Project work/Assignment:

Term Assignments:

- **identify Use Cases and develop the Use Case model**

- **Identity the conceptual classes and develop a UML Class diagram**

- **Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams**

- **Identify the business activities and develop an UML Activity diagram**

Text Book

 1. Ali Behrami, "Object Oriented Systems Development using Unified Modeling Language" McGraw Hill International Edition, July 2017.

References

  1.Craig Larman, "Applying UML and Patterns", Pearson Education.
  2.Grady Booch, "Object Oriented Analysis and Design with Applications", Addison-Wesly.
  3.Simon Bennett, Steve McRobb, Ray Farmer, "Object Oriented Systems Analysis and Design using UML", McGrawHill Education

Topics related to development of "FOUNDATION": Object Basics-Object Oriented System Development Life Cycle- Use case driven approach-Rumbaugh Object Model- Booch Methodology-Jacobson Methodology-Unified Approach, Static and Dynamic Modeling-Unified Modeling Language

Topics related to development of " SKILL DEVELOPMENT": UML diagrams: Use case Diagram, Class diagram, Interaction diagram, Sequence diagram, Collaboration diagram, State-chart diagram, Activity diagram, component diagram, Deployment diagram using the tool StarUML software

Catalogue prepared by	Dr. Clara Kanmani A
Recommended by the Board of Studies on	BOS NO: 12th BOS, held on 04/08/2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16, Dated 23/10/2021

REGISTRAR

Course Code: CSE2010	Course Title: Operating Systems			3	0	3
	Type of Course: Program Core and Theory Only		L- P-C			

Version No.	1.0
Course Pre-requisites	[1] Programming fundamentals: Pseudocode, Data Types and Operators, Selection Control Structures, Functions, Loops, Arrays, Structures. [2] C programming syntax and semantics [3] Data Structures: pointers, stacks, queues, linked lists
Anti-requisites	**NIL**
Course Description	**The purpose of this course is to enable the students to understand the need for Operating systems and to develop the basic concepts of process management, Synchronization and memory management. The course is both conceptual and analytical in nature towards Managing the Process and Memory and needs fair knowledge of programming fundamentals, C programming and data structures. The course develops the critical thinking and analytical skills on allocating and managing resources. The course also enhances the problem solving and systems programming abilities through assignments.**
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamental concepts of Operating Systems. 2] Solve problems on various CPU Scheduling Algorithms. 3] Apply different techniques on to a various synchronization problems. 4] Discuss various memory management techniques.
Course Content:	

Module 1	Introduction	Assignment	Programming/Data Collection	9 Hours

Topics:
Introduction to OS – Computer System Architecture , Operating System Structure, Operations,– Different management activities handled by the OS, Computing environments, Operating System Services, User and OS interface, System Calls and its types, System Programs[loaders, linkers...], Overview of OS design and implementation.

Module 2	Process Management	Coding Assignment/Case Study	Pseudocode/Programming	9 Hours

Topics:
Process Concept, Operations on Processes, Inter Process Communication, Introduction to threads - Multithreading Models, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue.

Module 3	Process Synchronization and Deadlocks	Coding Assignment/Case Study	Pseudocode/Programming	9 Hours

Topics:
The Critical-Section Problem- Peterson's Solution, Synchronization hardware, Mutex locks, Semaphores, Monitors, Classical Problems of Synchronization. Introduction to Deadlocks, Deadlock Characterization, Methods for handling deadlock: Deadlock Prevention- Deadlock Avoidance- Deadlock detection & Recovery from Deadlock.

Module 4	Memory Management	Assignment/Case Study	Programming/Simulation/Data Collection	**9 Hours**

Topics:
Introduction, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Demand Paging – Page Replacement, Allocation of Frames – Thrashing.

Targeted Application:
Real time Applications such as traffic management system, banking system, health care and many more systems where there are entities that use and manage the resources.

Software Tools:
1. Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install and work on multiple guest Operating Systems on top of a host OS.

2. Intel Processor identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.

Project work/Assignment

1> **Develop programs to demonstrate the below concepts.**
   Process creation using fork() system call in Linux OS.
   IPC using POSIX shared memory API.
   Process synchronization using POSIX API.
   Monitors usage in JAVA/C#.
   Process creation using CreateProcess() system call in Windows OS.
2> **Develop your own CLI/Shell for Linux OS[like a mini BASH].**
3> **Download the Linux/ Fuchsia Kernel and compile and run.**
4> **Using POSIX Semaphores solve the below synchronization problem.**
   There are 3 processes [P1, P2, P3] having 3 statements S1, S2, S3. The requirement is that irrespective of the order of execution of the processes the statements should execute in the order S1, S2, and S3.
5> **Using POSIX Semaphores demonstrate the scenario where in deadlock happens because of incorrect use of the semaphores.**
6> **Write a C#/Java program to implement the algorithm you studied to solve the Dining Philosopher problem using Monitors.**
7> **Simulation of memory management techniques.**
8> **Simulating synchronization issues in banking system transactions and traffic management.**
9> **Installation of Windows 10, Linux.**

Text Book

1. Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 9th edition Wiley, 2013.

References

1. Operating Systems | Internals and Design Principles | Ninth Edition | By Pearson Paperback – 1 March 2018. by William Stallings (Author)

2. https://www.os-book.com/OS9/

Topics relevant to development of "Foundation Skill" and "Skill Development": Processes, Threads, CPU Scheduling, Synchronization, Memory Management.

Topics relevant to "Environment and Sustainability": Concepts of Multithreading, Deadlocks.

Catalogue prepared by	Mr Sunilkumar Teggihalli, Mr Asif Mohamed H B, Mrs Sneha S Bagalkot, Mr Rupam Bhagawati.
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

Course Code: CSE2011	Course Title: Data Communications and Computer Networks Type of Course: Program Core Theory–Laboratory integrated	L-P-C	2	2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The objective of this course is to provide the knowledge in data communications and computer networks, its organization and its implementation, and gaining practical experience in installation, monitoring, and troubleshooting of LAN systems. . The associated laboratory is designed to implement and simulate various networks using cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the network traffic.				
Course Out Comes	On successful completion of the course the students shall be able to: 1. Explain the concepts of Computer Networks and Working Principles of Application Layer and Transport Layer (Comprehension) 2. Apply the Knowledge of IP Addressing and Routing Mechanism in Computer Networks. (Application) 3. Discuss the functionalities of Data Link Layer (Comprehension) 4. Explain the Basic Concepts of Data communication. (Comprehension)				

Course Content:				
Module 1	**Overview, Application and Transport Layers.**	Assignment	Problem Solving	**13 Classes**

Introduction: Computer Networks, Topologies, OSI Reference Model, TCP/IP model. Principles of Network Applications, The Web and HTTP, DNS—The Internet's Directory Service, Socket Programming: Creating Network Applications. Introduction and Transport-Layer Services, Connection-less Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.

Module 2	**Network Layer**	Assignment	Problem Solving	**12 Classes**

Overview of Network Layer, Forwarding and Routing, The Data and Control Planes.The Internet Protocol (IP): IPv4, Addressing, IPv6, IPv4 Datagram Format, IPv4 Addressing, Network Address Translation (NAT), IPv6. Introduction Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Intra-AS Routing in the Internet, OSPF Routing Among the ISPs: BGP, Introduction to BGP. ICMP: The Internet Control Message Protocol.

Module 3	**Data Link Layer**	Assignment	Problem Solving	**10 Classes**

Introduction to the Link Layer, The Services Provided by the Link Layer, Error-Detection and -Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols. Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs),DHCP,UDP,IP and Ethernet.

Module 4	**Physical Layer with Data Communication**	Assignment	Problem Solving	**07 Classes**

Data communications: Components, Data Representation, Data Flow, Analog and Digital Signals**,** Periodic Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals, Transmission Impairment, Data Rate Limits: Noiseless Channel, Nyquist Bit Rate, Noisy Channel: Shannon Capacity, Performance: Bandwidth, Throughput, Latency (Delay), Bandwidth-Delay Product, Parallel/Serial Transmission, Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing.

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Targeted Applications & Tools that can be used: Cisco Packet Tracer, Wireshark, and NS2.

Case Study/Assignment: Choose and analyze a network from any organization/Assignment proposed for this course in CO1-CO4

1. **Problem Solving: Choose and appropriate devices and implement various network concepts.**
2. **Programming: Simulation of any network using NS2.**

Text Book
T1. James F. Kurose, Keith W. Ross, "*Computer Networking A Top down Approach",* 8th Edition, Pearson, 2021.
T2. Behrouz A. Forouzan, "*Data Communications and Networking*", 6th Edition, Tata McGraw-Hill, 2021.

References
R1. William Stallings: "*Data and Computer Communication*", 10th Edition, Pearson Education, 2017.
R2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2012.

Web Based Resources and E-books:
Digital Learning Resources (Library Resources)
W1. https://puniversity.informaticsglobal.com/login

Catalogue prepared by	1. Dr. Shamugarathinam 2. Dr. Ashish Kumar Srivastava 3. Ms. Prema Sindhuri 4. Ms. Bhavana A
Recommended by the Board of Studies on	BOS NO: 12th BOS, held on 04/08/2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16, Dated 23/10/2021

REGISTRAR

Course Code: CSE2012	Course Title: Database Management Systems					
	Type of Course:Program Core Theory–Laboratory integrated		L-P-C	2	4	4
Version No.	1.0					
Course Pre-requisites	Data Structures and Algorithms – Different ways of organizing the data and Selection methods.					
Anti-requisites	NIL					
Course Description	This course introduces the core principles and techniques required in the design andimplementation of database systems. This introductory application-oriented course covers therelational database systems[RDBMS].More emphasis is set on how to organize, maintain and retrieve the information efficiently. It helps the students to learn and practice data modeling and database designs. The associated laboratory is designed to implement database design using structured query languages in information technology applications. All theexercises will focus on the fundamentals for creating sophisticated, interactive, and secure database applications.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the core concepts of relational database management systems. 2] Illustrate the design principles for Database design, ER Models and Normalization. 3]. Demonstrate query evaluation and query optimization techniques. 4] .Describe the concepts of Transaction management. 5] Develop a commercial relational database system.					
Course Content:						

Module 1	Introduction to databases and Relational Algebra	Assignment	Programming task	8 Classes

Introduction to Database: Characteristics of database approach, Codd's Rules, Data Models, Schemas, and Instances, Data Modelling using Entities and Relationships, Relational database design using ER-Relational mapping, Query By Example(QBE).
Relational Algebra: Relational algebra operators, relational operations from set theory, binary relational operations: JOIN and DIVISION, examples of queries in relational algebra.

Module 2	Schema Refinement	Assignment	Problem Solving	8 Classes

Normal Forms based on Primary Keys- (1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Module 3	Query Processing And Optimization	Assignment	Programming Task	4 Classes

Query Processing and Optimization: Query interpretation, Equivalence of expressions, Algorithm for executing query operations.

Module 4	Transaction Management.	Assignment	Problem Solving	6Classes

Transaction and System concepts, Desirable properties of Transactions, Concurrency control and recovery techniques-characterizing schedules based on recoverability and Serializability, Deadlock Prevention Schemes.

List of Laboratory Tasks:
Experiment No 1: To study and implement Data Definition Language commands of SQL.**[4 Classes]**
Level 1: Perform operations using Data Definition Language commands like Create**,** Alter and Drop on Student DB.
Level 2: Identify the given requirements; valid attributes and data types and Perform DDL operations on a given scenario. [Movie Databases]

Experiment No. 2: To implement Data Manipulation Language commands of SQL**. [4 Classes**
Level 1: Perform operations using Data Manipulation Language commands like INSERT, UPDATE and DELETE on Student DB.
Level 2: identify valid DML operations to manipulate the data inside the tables to achieve expected requirement. [Movie Databases]

Experiment No. 3. To implement different types of SQL constraints. **[4 Classes]**
Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and Other Constraints.

Level 2: Identify different types of data and referential integrity constraints based on the requirement and create the tables as per the given scenario.[Music Databases]

Experiment No. 4: To study and implement SQL data retrieval using SELECT**, FROM and WHERE clause. [4 Classes]**

Level 1: Illustrate the working of SELECT, FROM and WHERE clause on Banking Database.
Level 2: Implement SQL queries for Data Retrieval for a given Database using SQL clauses as per the given scenario**.**[Music Databases]

Experiment No. 5: To Retrieve Data from Database using different types of operators. [4 Classes]
Level 1: Demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Banking Database.
Level 2: Implement SQL queries for Data Retrieval on a given Database using different types of operators.
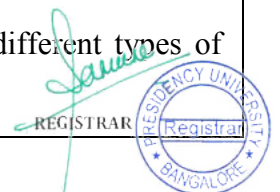
Experiment No. 6: To study and implement aggregating Data using Group by, HAVING and sort data using Order By Clauses. [4 Classes]

Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database**.**

Level 2: Implement SQL queries for Data Retrieval on a given Database using appropriate clauses and aggregate functions**.**[Library databases]

Experiment No. 7: To study and implement different types of Set and Join Operations **[4 Classes]**

Level 1: Demonstrate different types of Set Operations (UNION,UNION ALL,INTERSECT,MINUS) and Join Operations (INNER JOINs,OUTER JOINS,CROSS JOIN,NATURAL JOIN).Use Bank Database.

Level 2: Use Set and Join operations to retrieve the data from two or more relations as per the given scenario..[Library databases]

Experiment No. 8: To Retrieve Data from a given Database using Nested queries, Correlated queries. **[4 Classes]**

Level 1: Implement Data Retrieval using Nested and Correlated queries on a given Database.[Airline Database]

Level 2: Analyze the difference between nested query, correlated query choose the appropriate one as per the Mini Project domain

Experiment No. 9: To study and implement Views, Procedures, Functions and Triggers in SQL **[4 Classes]**

Level 1: Implement SQL Views, Procedures, Functions and Triggers in SQL on Employee database.

Level 2: Analyze the requirement and construct views, Procedures, Functions and Triggers- Mini Project Domain.

Targeted Application & Tools that can be used:
Application Area: Relational database systems for Business, Scientific and Engineering Applications.

Tools/Simulator used: Mysql.

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

1. **Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra.**
2. **Programming: Implementation of given scenario using SQL.**
3. **Mini project:** B**uild a real time database application using suitable frontend tool. Indicative areas include; health care, education, industry, Library, Transport and supply chain, etc.**

Text Book
1. **Elmasri R and Navathe S B, "Fundamentals of Database System", 7th Edition, 2016 Pearson Publication.**

References
1.   **Database systems, the complete book- 2nd edition- Hector Garcia Molina, Jeffery D Ullman, Jennifferwidom. Pearson publication.**
2.   **Database System Concepts 7th Edition, 2019, AviSilberschatz · Henry F. Korth · S. Sudarshan. McGraw-Hill**

Topics relevant to development of "FOUNDATION SKILLS":   S - Skill Development: Relational database design using ER- Relational mapping, Query By Example (QBE). Implementation of given scenario using SQL.

Topics relevant to development of Employability: Administer, test and implement computer databases, creating sophisticated, interactive and secure database applications

Topics relevant to " HUMAN VALUES &PROFESSIONAL ETHICS: Nil

Catalogue prepared by	1. Dr.R.Mahalakshmi 2. Mr. Mrutyunjaya M S. 3. Dr. Manujakshi B C. 4. Ms. Napa lakshmi. 5. Mr. James Mathew. 6. Ms. Shaleen Bhatnagar.
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

Course Code: CSE 2014	Course Title: Software Engineering Type of Course: School Core [Theory Only]	L- P- C	3	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.				
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)				

Module 1	Introduction to Software Engineering and Process Models (Knowledge level)	Quiz		09 Hours

Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle

Models: Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.

Module 2	Software Requirements, Analysis and Design (Comprehension level)	Assignment	Development of SRS documents for a given scenario	11 Hours

Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling-Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment.

Design: Design concepts, Architectural design, Component based design, User interface design.

Module 3	Agile Principles & Devops (Knowledge level)	Quiz		09 Hours

Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method.

Devops: Introduction, definition, history, tools.

Module 4	Software Testing and Maintenance (Application Level)	Assignment	Apply the testing concepts using Programing	12 Hours

Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.

Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).

Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.

Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools

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

1. Identification of Software Process Models for a given scenario
2. Development of SRS documents for a given scenario
3. Apply the white box and black box testing concepts using Programing
4. Installing Selenium/GitHub software and exploring the functionality

Text Book

1. 1] Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, McGraw-Hill, 2017.
2. 2] Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, McGraw-Hill, 2018.

References

1. 1] Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 2015.
2. 2] Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011.
3. 3] Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002

Catalogue prepared by	Dr. S. Pravinth Raja, Associate Professor, CSE, SOE. Ms. Sweet Subhashree, Assistant Professor, CSE, SoE.

Recommended by the Board of Studies on	BOS NO: 12th BOS, held on 04/08/2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16, Dated 23/10/2021

Course Code: CSE2013	Course Title: Cloud Computing Type of Course: Theory		L- P- C	3	0	3

Version No.	1.0
Course Pre-requisites	[1] Data Communication and Computer Networks (CSE2011)
Anti-requisites	NIL
Course Description	This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). It dives into all of the details that a student needs to know in order to plan for developing applications on the cloud and what to look for when using applications or services hosted on a cloud.
Course Objective	This course is designed to improve the learner's EMPLOYABILITY SKILLS using EXPERIENTIAL LEARNING techniques.
Course Outcomes	Upon successful completion of the course the students shall be able to: 1. **Understand** the significance of Cloud computing technologies 2. **Identify** appropriate Virtualization techniques to virtualize infrastructures 3. **Discuss** Cloud mechanisms to optimize the QoS parameters 4. **Develop** applications using Cloud services and VM instances

Course Content:

Module 1	Introduction to Cloud services	Assignment	Theory	No. of Classes:10
Topics: Evolution of cloud computing, Computing Platforms and Technologies, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, Cloud Computing Environments.				
Module 2	Virtualization Techniques	Assignment	Theory	No. of Classes:10
Topics: Basics of Virtualization - Types of Virtualizations, Taxonomy of Virtualization Techniques, Implementation Levels of Virtualization.				
Module 3	Cloud QoS and Management	Assignment	Theory	No. of Classes:10
Topics: Cloud Infrastructure Mechanisms, SLAs, Specialized Cloud Mechanisms, Cloud Management Mechanisms, Cloud Security Mechanisms				
Module 4	Application development in Cloud	Assignment	Case Study	No. of Classes:10

Topics: Programming Models for Cloud Computing - Software Development in Cloud - Service creation environments to develop cloud-based applications. Development environments for service development (Demonstration using AWS Cloud); Dockers and Containers.

Targeted Application & Tools that can be used:

Targeted Applications:
Developing applications on Cloud Platforms via Virtual machines
Cloud Tools:
- CloudSim
- VMWare
- Amazon EC2
- Google Compute Engine
- Microsoft Azure

Project work/Assignment:

1. **Automation of performance analysis of students through the Cloud**
2. **Chatbots development using Cloud resources**
3. **Blog creation using Cloud computing**

Analysis of Case Studies: When deciding to adopt cloud computing architecture, decide if the cloud is right for your requirements (for the application identified).

Suggested List of Hands-on Activities:

Sl. No	Title
1	**Install Virtualbox/VMware Workstation with different flavors of Linux or Windows OS on top of windows 11**
2	**Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.**
3	**Install Google App Engine (GAE). Create a "hello world" application and other simple web applications using python/java**
4	**Use GAE launcher to launch the web applications.**
5	**Simulate a cloud scenario using CloudSim and run a scheduling algorithm**
6	**Find a procedure to transfer the files from one virtual machine to another virtual machine.**
7	**Find a procedure to launch a virtual machine using Openstack**
8	**Demonstrate Migration, Cloning, and Snapshots within and across VMs**

Text Book(s)

1. **Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "*Mastering Cloud Computing*", McGraw Hill Education, 2013 edition.**
2. **John Rittinghouse and James Ransome, "*Cloud Computing, Implementation, Management and Security*", CRC Press, 2010 edition.**

References
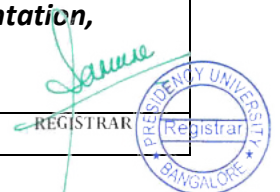
1.   **Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "*Cloud Computing Concepts, Technology & Architecture*", PHI publisher 2013 edition.**
2.   **Anthony T Velte, Toby J Velte, Robert Elsenpeter, "*Cloud Computing: A Practical Approach*", Tata McGraw-Hill, 2010 edition.**
3.   **David E.Y. Sarna, "*Implementing and Developing Cloud Applications*", CRC Press, 2018 edition.**
4.   **Manvi, Sunilkumar, and Gopal K. Shyam. "*Cloud Computing: Concepts and Technologies*". CRC Press, 2021.**

Web Resources and Research Articles links:

1. **IEEE Transactions on Cloud Computing-** https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519

2. **International Journal of Cloud Computing**- https://www.inderscience.com/jhome.php?jcode=ijcc
3. **CloudSim Resources**- https://javadoc.io/doc/org.cloudsimplus/cloudsim-plus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html

4. **Journal of Network and Computer Networking**- https://www.journals.elsevier.com/journal-of-network-and-computer-applications
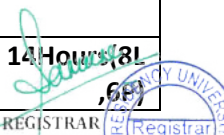
Catalogue prepared by	Dr. Gopal K. Shyam, Dr. Murali P., Mr. G Nagarajan
Recommended by the Board of Studies on	BOS NO: 19th BOS, held on 04/08/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/8/2022.

Course Code: CSE3001	**Course Title: Introduction to Artificial Intelligence and Machine Learning** **Type of Course:1]Program Core** **2] Laboratory integrated**	**L-P-C**	**2**	**2**	**3**
Version No.	1.0				
Course Pre-requisites	CSE1003 Innovation Project - Raspberry Pi Using Python				
Anti-requisites	**NIL**				
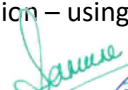
Course Description	This course introduces the basic concepts of artificial intelligence. It introduces students to the basic concepts and techniques of Machine Learning (ML), a subset of Artificial Intelligence (AI), is an important set of techniques and algorithms used for solving several business and social problems. The objective of this course is to discuss machine learning model development using Python. Topics include: Working with Collections and Data Frames; Regression algorithms; Classification algorithms; Optimization techniques – Gradient Descent algorithm, Gradient Descent for simple Linear Regression; Ensemble Learning – Random Forest, Boosting techniques – AdaBoost and Gradient Boosting; Grid Search for optimal parameters; Clustering algorithms; Forecasting with Time-Series data : Auto-Regressive Integrated Moving Average Models, Recommender Systems : Association Rule Mining, Collaborative Filtering, Text Analytics – Sentiment Classification using Naïve Bayesian model.			
Course Out Comes	On successful completion of this course the students shall be able to: 1] To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents. (KNOWLEDGE) 2] Produce machine learning models for predictive analytics. (Application) 3] Apply ensemble learning, optimization and hyper parameter tuning techniques for machine learning algorithms. (Application) 4] Demonstrate different types of clustering techniques. (Application) 5] Employ time series forecasting techniques/models for real world problems. (Application)			
Course Content:				
Module 1	**Introduction to Artificial Intelligence and Knowledge based systems**	Assignment	Theory	**6Hours(6L)**
Topics: Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agent, Structure of Intelligent agent and its functions, Agents and Environment; Introduction to Knowledge representation, approaches and issues in knowledge representation, Knowledge-based agent and its Structure, Knowledge-Based Systems; Frame Structures, Conceptual graphs.				
Module 2	**Supervised Machine Learning Algorithms**	Assignment	Programming activity	**16 Hours(8L,8P)**
Topics: Introduction to the Machine Learning (ML) Framework, types of ML, types of variables/features used in ML algorithms, One-hot encoding, Simple Linear Regression, Multiple Linear Regression, Model Evaluation, Validation and Accuracy measures for Regression models. Classification models – Decision Tree algorithms using Entropy and Gini Index as measures of node impurity, model evaluation metrics for classification algorithms, **Cohen's Kappa Statistic, Multi-class classification and Class Imbalance problem. Naïve Bayes Classifiers and Naive Bayes model for sentiment classification – an introduction.**				
Module 3	**Advanced Machine**	Assignment	Programming activity	14Hours(8L ,6P)

	Learning Concepts			

Topics:

Nearest Neighbor techniques, Cost functions and Optimization Technique – introduction to Gradient Descent, its applications on Linear Regression. Ensemble Learning algorithms – Bagging (Random Forest), Boosting(AdaBoost), Hyper parameter Tuning for nearest neighbor learning using Grid Search. Introduction to Regularization with Advanced Regression models- LASSO and Ridge Regression an introduction.

Module 4	**Clustering and Forecasting with Time-Series Data**	Assignment	Programming activity	**10 Hours(6L,4 P)**

Topics:

Partitioned Clustering – K-means and Hierarchical Clustering techniques, cluster validity measures, Components of Time Series data, forecasting using moving average, exponential smoothing, calculating forecast accuracy, decomposing time series data, auto-regressive integrated moving average models(ARIMA). Association Rule Mining, Collaborative Filtering – User based and item based similarity

List of Laboratory Tasks:

Lab sheet -1

Level 1: **A review of Python programming -** Introduction to Python Stack for Data Science, Core Python Libraries for data analysis, Anaconda platform and its installation, Executing programs on Jupyter IDE/ Colab.

Level2: Programming exercises to revise variables, control statements and collections – lists, list comprehension

Lab sheet -2

Level 1 - **Programming exercises on** Tuples

Level 2- **Nested data structures**

Lab sheet -3

Level 1: Introduction to Numpy, Pandas,

Level 2: Scikit-learn and Visualization techniques.

Lab sheet -4

Level 1 - Dictionaries, dictionary comprehension.

Level 2 - Introduction to Data Frames using Pandas and working with frames

Lab sheet -5

Level 1- Regression Models Simple linear regression, outlier detection.

Level 2 - multiple linear regressions – model evaluation, multi-co linearity and handling multi-co linearity, outlier detection**.**

Lab sheet -6

Level 1- **Decision Tree Classifiers** - Decision Tree classifier using Gini Index- measuring test accuracy, displaying the tree, confusion matrix and ROC.

Level 2- Decision Tree Classifier using Entropy.

Lab sheet -7

Level 1 - **Optimization Techniques** Developing a Gradient Descent Algorithm for linear regression – using NumPy and using sklearn.

Level 2 - cohen_kappa_score.

Lab sheet -8

Level 1- Hyper parameter Tuning methods Hyper parameter tuning using Grid Search for Nearest Neighbor Classifiers and

Level 2- Hyper parameter tuning using Grid Search for Decision Tree Classifiers.

Lab sheet -9

Level 1 - Hyper parameter Tuning for Ensemble models Ensemble Learning – Random Forest – Building the model, Grid Search for optimal parameters,

Level 2 - Feature Importance. Ada Boost Classifiers and Gradient Boosting Classifiers

Lab sheet -10

Level 2 - Clustering – Kmeans – cluster centers and interpreting the clusters, finding the optimal number of clusters using Elbow Curve method.

Level 2 - Agglomerative Hierarchical Clustering – Compare the clusters formed by kmeans and Agglomerative Clustering

Lab sheet -1 1

Level 1 – Probability theory(Conditional Probability)

Level 2 - Naïve Bayes Model

Lab sheet -12

Level 1- Models forecasting Applications

Level 2 - Models for Forecasting Time Series data

Lab sheet -1 3

Level 1- Recommender Systems - Association Rule Mining using Apriori for frequent Itemset Generation.

Level 2 - Recommender Systems – user based similarity

Targeted Application & Tools that can be used: Use of PowerPoint software for lecture slides and use of Google's Colab cloud service **https://www.tutorialspoint.com/google_colab/index.html** for executing and sharing of lab exercises.

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

1] Programming: Implementation of given scenario using Python and Colab.
2] **Assignment: Learning courses for 4 Hours from the following link https://learn.datacamp.com/courses?topics=Machine%20Learning**

Text Book

1. Andreas C Muller, Sarah Guido, "Introduction to Machine Learning with Python :A Guide for Data Scientists", Oreilly, First Edition, 2016

2. Stuart J. Russell and Peter Norvig, Artificial intelligence: A Modern Approach, 3rd edition, Upper Saddle River, Prentice Hall.

References

1. Tan P. N., Steinbach M & Kumar V. "*Introduction to Data Mining",* Pearson Education, 2016.
2. Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning", Packt Publishing, 2017.
3. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning Using Python", Wiley, First Edition 2019.

Catalogue prepared by	Dr. Aditya K Saxena and Dr. Sandeep
Recommended by the Board of Studies on	BOS NO: 12th BOS, held on 04/08/2021

Date of Approval by the Academic Council	Academic Council Meeting No. 16, Dated 23/10/2021

Course Code: CSE2067	Course Title: Web Technology Type of Course: Program core Theory & Integrated Laboratory	L- P- C	2	2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The purpose of the course is to provide a comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.				
Course Objective	This course is designed to improve the learners' **EMPLOYABILITY SKILLS** by using **EXPERIENTIAL LEARNING** techniques.				
Course Outcomes	On successful completion of this course the students shall be able to: **CO1:** Implement web-based application using client-side scripting languages. **(Application level)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Application level)** **CO3:** Apply server-side scripting languages to develop a web page linked to a database. **(Application level)**				
Course Content:					

Module 1	Introduction to XHTML	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications	10 Classes

Topics:

Basics: Web, WWW, Web browsers, Web servers, Internet.

XHTML: Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML.

Module 2	Advanced CSS	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages	12 Classes

Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn.
Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks
XML: Basics, demonstration of applications using XML

Module 3	PHP – Application Level	Quizzes and assignments	Application of PHP in web designing	14 Classes

Topics:

PHP: Introduction to server-side Development with PHP, Arrays, and Superglobals, Arrays, $GET and $ POST, Super global Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object, Classes and Objects in PHP, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP.

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

Level 1: Demonstration of various XHTML Tags (Level 1)
Level 2: Design and develop static web pages for an online Book store (Level 2).

Experiment No. 2: Application of CSS in web designing
Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.
Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

Experiment No. 3: Application of PHP in web designing.
Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.
Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.
Build a website for organizing an International Conference. The conference website must be able to collect the author's details and upload a file.

Targeted Application & Tools that can be used:
Xampp web server to be used to demonstrate PHP.

Project work/Assignment:
Assignments are given after completion of each module which the student need to submit within the stipulated deadline.

Textbook(s):

1] Robert. W. Sebesta, "*Programming the World Wide Web"*, Pearson Education, 8th Edition, 2015.
2] *CSS Notes for Professionals*, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)
3] Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.

References

1] Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.

2] Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Topics related to development of "FOUNDATION":   Web, WWW, Web browsers, Web servers, Internet.
Topics related to development of "EMPLOYABILITY": CSS, PHP.
Topics related to development of "HUMAN VALUES AND PROFESSIONAL ETHICS":   Web designing for healthcare.

Catalogue prepared by	Dr. Shankar K. Ghosh, Jobin Thomas.
Recommended by the Board of Studies on	BOS NO: 12th BOS, held on 04/08/2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16, Dated 23/10/2021

Course Code: CSE3014	**Course Title:** Fundamentals of Natural Language Processing **Type of Course:** Discipline Elective in AI & ML Basket Theory Course		**L- P- C**	3	0	3
Version No.	1.0					
Course Pre-requisites	**[1] Problem Solving Using Java (CSE 1001)** **[2] Innovative Project – Raspberry Pi Using Python (CSE 1003)** **[3] Applied Statistics (MAT 1003)**					
Anti-requisites	**NIL**					
Course Description	The purpose of this course is to introduce students to the science of natural language processing (NLP). NLP is the science of extracting information from unstructured text. It is basically how we can teach machines to understand human languages and extract meaning from text. In addition to regular theory, the course also involves: 1. **Programming Assignments** 2. **Regular Quiz Tests (once a week and once after every module)**					
Course Objective	This course is designed to improve the student's EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: (1) **Understand** the fundamental concepts of Natural Language Processing (2) **Read** corpora and **train** models for different NLP tasks. (3) **Create** word embeddings (4) **Understand** sequence to sequence modeling as used in machine translation.					
Course Content:						
Module 1	**Introduction**	Quizzes				7 Classes

Topics:

Introduction. History. Text Analytics. Various tasks in NLP. Sentence boundary Detection. Edit distance. Introduction to word embeddings, PoS tagging, chunking, parsing, machine translation.

Module 2	**Word and Text Representations**	Quizzes	Assignments	**8 Classes**

Topics:

Logistic Regression and Naïve Bayes classification. Vector semantics and embeddings. Neural Networks and Neural Language Models. Text representations and classification. Deep learning architectures for sequence processing (CNN and LSTM). Word Sense Disambiguation and WordNet.

Module 3	**PoS Tagging, NER Tagging, Parsing**	Quizzes	Assignments	**12 Classes**

Topics:

Part-of-Speech Tagging – using NLTK and spacy. Building a PoS Tagger using existing data and Hidden Markov Model. Named Entity Recognition. Relationship between NER tagging and PoS tagging. Constituency Parsing.

Module 4	**NLP Applications**	Quizzes		**9 Classes**

Topics:

Lexical Resource Creation. Sentiment Analysis. Machine Translation. Word Sense Disambiguation and WordNet. Question Answering.

Targeted Application & Tools that can be used:
1. **Python Libraries (Eg. NLTK, Spacy, etc.)**
2. **Java (Stanford CoreNLP)**

Project work/Assignment:
Students will have to do group assignments for Modules 2 & 3. As a part of their assignments, they will have to implement the solution to particular problems.

Textbook(s):
Daniel Jurafsky, and James Martin. "*Speech and Language Processing*" (3rd edition draft, 2021)

References:
Chris Manning and Hinrich Schutze, "*Foundations of Statistical Natural Language Processing*", 1st Edition, MIT Press. 1999.

Topics related to development of "EMPLOYABILITY": Assignment implementations in software, batch wise presentations.

Catalogue prepared by	Dr. Sandeep Albert Mathias
Recommended by the Board of Studies on	BOS NO: SOCSE1. BOS held on 22 / 12 / 2022
Date of Approval by the Academic Council	Academic Council Meeting No.20.3 , Dated 15 /02 /23

Course Code: CSE3014	**Course Title:** Fundamentals of Natural Language Processing **Type of Course:** Discipline Elective in AI & ML Basket Theory Course	**L- P- C**	3	0	3
Version No.	1.0				

Course Pre-requisites	[1] Problem Solving Using Java (CSE 1001)
	[2] Innovative Project – Raspberry Pi Using Python (CSE 1003)
	[3] Applied Statistics (MAT 1003)
Anti-requisites	NIL
Course Description	The purpose of this course is to introduce students to the science of natural language processing (NLP). NLP is the science of extracting information from unstructured text. It is basically how we can teach machines to understand human languages and extract meaning from text. In addition to regular theory, the course also involves: 3. Programming Assignments 4. Regular Quiz Tests (once a week and once after every module)
Course Objective	This course is designed to improve the student's EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques.
Course Outcomes	On successful completion of this course the students shall be able to: (5) Understand the fundamental concepts of Natural Language Processing (6) Read corpora and train models for different NLP tasks. (7) Create word embeddings (8) Understand sequence to sequence modeling as used in machine translation.
Course Content:	

Module 1	Introduction	Quizzes		7 Classes

Topics:
Introduction. History. Text Analytics. Various tasks in NLP. Sentence boundary Detection. Edit distance. Introduction to word embeddings, PoS tagging, chunking, parsing, machine translation.

Module 2	Word and Text Representations	Quizzes	Assignments	8 Classes

Topics:
Logistic Regression and Naïve Bayes classification. Vector semantics and embeddings. Neural Networks and Neural Language Models. Text representations and classification. Deep learning architectures for sequence processing (CNN and LSTM). Word Sense Disambiguation and WordNet.

Module 3	PoS Tagging, NER Tagging, Parsing	Quizzes	Assignments	12 Classes

Topics:
Part-of-Speech Tagging – using NLTK and spacy. Building a PoS Tagger using existing data and Hidden Markov Model. Named Entity Recognition. Relationship between NER tagging and PoS tagging. Constituency Parsing.

Module 4	NLP Applications	Quizzes		9 Classes

Topics:
Lexical Resource Creation. Sentiment Analysis. Machine Translation. Word Sense Disambiguation and WordNet. Question Answering.

Targeted Application & Tools that can be used:
   3. Python Libraries (Eg. NLTK, Spacy, etc.)
   4. Java (Stanford CoreNLP)

Project work/Assignment:	
Students will have to do group assignments for Modules 2 & 3. As a part of their assignments, they will have to implement the solution to particular problems.	
Textbook(s):	
Daniel Jurafsky, and James Martin. "*Speech and Language Processing*" (3rd edition draft, 2021)	
References:	
Chris Manning and Hinrich Schutze, "*Foundations of Statistical Natural Language Processing*", 1st Edition, MIT Press. 1999.	
Topics related to development of "EMPLOYABILITY": Assignment implementations in software, batch wise presentations.	
Catalogue prepared by	Dr. Sandeep Albert Mathias
Recommended by the Board of Studies on	BOS NO: SOCSE1. BOS held on 22 / 12 / 2022
Date of Approval by the Academic Council	Academic Council Meeting No.20.3 , Dated 15 /02 /23

Course Code: CSE3010	**Course Title: Deep Learning Techniques** **Type of Course: Discipline Elective Theory**	**L-P-C**	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE3001-Artificial Intelligence and Machine Learning				
Anti-requisites	NIL				
Course Description	This course introduces students to fundamental concepts of deep neural networks and state of the art approaches in developing deep learning models to solve real world applications for various domains like image recognition, natural language processing etc. Topics include fundamental concepts of deep neural networks, Convolutional Neural Networks, Recurrent Network structures, Deep Unsupervised Learning, General Adversarial Networks and applications in various problem domains.				
Course Objectives	This course is designed to improve the learners "EMPLOYIBILTY SIKLLS" by using EXPERIENTIAL LEARNING techniques. Lectures on the applications of different deep learning models and the group project facilitate this learning process.				
Course Out Comes	On successful completion of the course, the students shall be able to: 6) Comprehend basic concepts of Deep Learning Frameworks 7) Apply various supervised deep learning techniques 8) Illustrate various unsupervised deep learning techniques.				
Course Content:					

Module 1	Introduction to Deep Learning and Neural Networks	Assignment	Programming	No. of Classes:10

Topics: Fundamentals of Deep Learning, Perceptron, Multilayer Perceptron, Activation Functions, Loss Functions, Optimization, Gradient Descent, Feedforward Neural Network, Training Neural Network-Back-propagation, Hyper parameters, Underfitting, Overfitting, Regularization, Dropouts, Batch Normalization

Module 2	Supervised Deep Learning Models	Assignment	Programming	No. of Classes:10

Topics: Supervised Deep Learning Models: Convolutional Neural Network, Recurrent Neural Network, LSTM, GRU, Applications

Module 3	Unsupervised Deep Learning Models	Assignment	Programming	No. of Classes:10

Topics: Unsupervised Deep Learning Models: Kohonen Networks, Autoencoders and their types Boltzman Machine, Restricted Boltzmann Machine, Deep Belief Network

Module 4	Advanced Concepts	Assignment	Programming	No. of Classes:8

Topics: Hopfield Network, Generative Adversarial Networks, Probabilistic Neural Network, Pre trained models for transfer learning and applications

Targeted Application & Tools that can be used:

Targeted employment sector is not restricted to any single domain. Today, ML and DL have been employed for data analysis and improved business intelligence in every sector. Targeted job profiles include Data Analyst, Data Scientist, Data Engineer, Neuroinformatician, Bioinformatician, Image Recognition, Research Analyst, Full Stack Developer for Deep Learning, Natural Language Process Engineer, Business Analyst etc. Few of the top recruiters are Amazon, NVIDIA. Microsoft, IBM, Accenture, Facebook, Intel, Samsung, Lenovo, Adobe etc., among numerous others.

Tools: Google Colab, Tensorflow, Keras, PyTorch, Jupiter Notebook

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

On completion of all Modules, students will be given a Mini Project to build a deep learning model for a given application.
Sample mini projects:

- Music genre classification system
  This is one of the interesting deep learning project ideas. This is an excellent project to nurture and improve one's deep learning skills. The aim is to create a deep learning model that uses neural networks to classify the genre of music automatically. For this project, students will use an FMA (Free Music Archive) dataset. FMA is an interactive library comprising high-quality and legal audio downloads. It is an open-source and easily accessible dataset.
  However, it is noteworthy that before one can use the model to classify audio files by genre, he/she will have to extract the relevant information from the audio samples (like spectrograms, MFCC, etc.)

- Image Caption generator
  This is one of the trending deep learning project ideas. This is a Python-based deep learning project that leverages Convolutional Neural Networks and LTSM (a type of Recurrent Neural Network) to build a deep learning model that can generate captions for an image. An Image caption generator combines

both computer vision and natural language processing techniques to analyze and identify the context of an image and describe them accordingly in natural human languages (for example, English, Spanish, Danish, etc.). This project will strengthen one's knowledge of CNN and LSTM, and one will learn how to implement them in real-world applications as this.

- Visual tracking system
  A visual tracking system is designed to track and locate moving object(s) in a given time frame via a camera. It is a handy tool that has numerous applications such as security and surveillance, medical imaging, augmented reality, traffic control, video editing and communication, and human-computer interaction. This system uses a deep learning algorithm to analyze sequential video frames, after which it tracks the movement of target objects between the frames. The two core components of this visual tracking system are Target representation and localization

- Traffic Signal Classification
  The traffic sign classification project is useful for all autonomous vehicles. Machines are able to identify traffic signs from the image. Students can use the GTSRB dataset that contains 43 different traffic sign classes. This is a good project to understand image classification.

- Driver Drowsiness Detection
  The driver drowsiness detection is a project which can detect whether a person is sleeping or not while driving. We can implement a model for drivers and it can also prevent accidents from happening.

- Auto coloring old Black and white images
  The idea of this project is to make a model that is capable of colorizing old black and white images to colorful images. Digital artists take a few hours to color the image but now with Deep Learning, it is possible to color an image within seconds.

Text Books

3) Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016

References

1. Hands-On Machine Learning with Scikit-Learn, Keras and Tensor Flow: Concepts, Tools and Techniques to Build Intelligent Systems by Aurelian Geron, Shroff/O'Reilly
2. Practical Deep Learning for Cloud, Mobile, and Edge: Real-World AI & Computer-Vision Projects Using Python, Keras & TensorFlow by Anirudh Koul , Siddha Ganju , et al., Shroff/O'Reilly

Topics relevant to development of "Foundation skills": Supervised and unsupervised deep learning models

Topics relevant to development of "Employability": Real time application development using deep learning models.

Catalogue prepared by	Ms. Napa Lakshmi
Recommended by the Board of Studies on	BOS NO: SOCSE1. BOS held on 22 / 12 / 2022
Date of Approval by the	Academic Council Meeting No.20.3 , Dated 15 /02 /23

Academic Council	

Course Code: CSE2018	Course Title: Theory of Computations				
	Type of Course: Program Core	**L- P- C**	3	0	3
Version No.	1.0				
Course Pre-requisites	[1] Set Theory [2] Discrete mathematics [3] Data Structures				
Anti-requisites	NIL				
Course Description	This is an introductory Course for the study of formal languages and the correspondence between language classes and the automata that recognize them. Formal definitions of grammars and acceptors, Deterministic and Nondeterministic systems, Regular Expression, Grammar ambiguity, normal forms; finite state and push-down automata; Turing machines.				
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe various components of Automata. 2] Construct Finite Automata for the given Language. 3] Distinguish between Regular Grammar and Context Free Grammar 4] Construct Push Down Automata. 5] Construct Turing machine for a Language				
Course Content:					

Module 1	Introduction to Automata Theory	Assignment	Data Collection	**6 Hours**

Topics:
Introduction to Automata Theory, Applications of Automata Theory, Alphabets, Strings, Languages & operations on languages, Representation of automata, Language recognizers, Example for language Recognizers.

Module 2	Finite Automata	Case Study	Simulation	**13 Hours**

Topics:

Basic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition Graphs and Languages and DFA's, Regular Languages, NFA- Definition of a Nondeterministic Accepter, Languages and NFA's Why Non-determinism?, Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.

Module 3	Regular Expressions & Context Free Grammar	Case study	Programming	**12 Hours**

Topics:

Formal Definition of a Regular Expression, Languages Associated with Regular Expressions, Closure Properties of Regular Languages, Pumping Lemma, Context Free Grammars-Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Ambiguity in Grammars and Languages, Chomsky Normal Form, Greibach Normal Form

Module 4	Push Down Automata	Case Study	Simulation	**8 Hours**

Topics:

Definition of a Pushdown Automaton, Language Accepted by a Pushdown Automaton, Pushdown Automata for Context-Free Languages, and Context-Free Grammars for Pushdown Automata, Nondeterministic Pushdown Automata and Deterministic Pushdown Automata.

Module 5	Turing Machine	Case Study	Programming/Simulation	**7 Hours**

Topics:

Definition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to construct Turing machine, Turing Machines as Transducers ,example Transducers

Targeted Application & Tools that can be used:

[1]. JFLAP (Java Formal Language and Automata Package) Software simulation tool. It's interactive educational software written in Java to experiment topics in automata theory.
[2]. Turing machine Online simulators.

Project work/Assignment:

1. Simulate deterministic finite automata / Push down automata / Turing machine for any given language using JFLAP software simulation tool.

   The input to the program will be,

   i.   The number of states
   ii.   The set of alphabets
   iii. The transitions on each state
   iv.   The initial and the final state
   v.   Verification of accepting and rejecting strings for the designed automata.

   The output to the program will be,

   i.   Acceptance/Rejection of the string
   ii.   States traversed by the string for that input string.

2. Design and develop a program to convert non-deterministic finite automata to deterministic finite automata and also simulate NFA to DFA Conversion using JFLAP

Text Book

1. Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 5th Ed, 2011.

References

1. Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 2nd Ed,2001.
2. Michael Sipser, "Theory of Computation", Cengage India 2nd Ed, 2012.

Catalogue prepared by	Dr. Manujakshi B C
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

Course Code: CSE2027	Course Title: Fundamentals of data analytics				
	Type of Course: Program Core & theory only Discipline elective	L- P- C	3	0	3
Version No.	1.0				
Course Pre- requisites	Basic statistics for simple operations.				
Anti-requisites	NIL				
Course Description	This course is designed to provide the core concepts of data analysis . Initially train them with basic functionalities, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analysis in Excel, will help the students to apply their knowledge to a wide range of business applications The topics include, All about data, basic functions and techniques, analysis techniques to datasets, manipulate and prepare datasets, Visualize data through conditional formatting and charts - organize data interactively with tables and pivot tables- implement scenarios with what-if analysis-analyze data with statistical and probabilistic add-in tools - optimize formula results with solver/goal seek add-in. Build presentation ready dashboards ,create own formulas ,turn real world data into business insights , learn to use appropriate charts.				
Course Out Comes	On successful completion of the course the students shall be able to:]). **Apply basic excel functions pertaining to fundamental data analysis** **2). Interpret data using appropriate statistical methods** **3). Demonstrate the collection, processing and analysis of data for any given application.** **4). Illustrate various charts using visualization methods.** **5). Apply scenario based analysis techniques for rational decision making.**				
Course Content:					

Module 1	: Introduction to Data Analysis	Assignment	Data Collection , data analysis task	8 classes

Topics:

     Introducing Data, overview of data analysis, Random number generation, rank and percentile. Building tables for data analysis, manipulate and prepare datasets.

Module 2	Statistical functions	Assignment	Data Collection,Formulation	**9 classes**

Topics: Create your own formulas, troubleshooting formulas, enhancing formulas with functions (R1), Basic functions and related lab works. Sampling Techniques: Fundamental Definitions, Important sampling distributions concept of standard error, Descriptive Statistics, Inferential Statistics (T test, Z test,)

Module 3	Data Collection, Processing and Analysis	Assignment	Data Collection data analysis	**8 classes**

Topics: Collection of Primary Data(Observation Method, Interview Method, Collection of Data through Questionnaires ,Collection of Data through Schedule) Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data ,Difference between Survey and Experiment Processing Operations, correlation, Linear Regression Multiple Regression (t1)

Module 4	Data Visualization and Charting	Assignment	Data Collection, data analysis	**9 classes**

Topics: Types of charts and their significance. Organize data interactively with tables -, visualizing data with charts, analyzing data with pivot tables, Build presentation ready dashboards, and turn real world data into business insights, Tracking trends and making forecasts, Interpretation and report writing.

Module 5	Decision Making	Assignment	Data analysis with optimisation	**6 classes**

Topics:
Introduction to decision making: Implement scenarios with what-if analysis, analyze data with statistical and probabilistic add-in tools, Case studies on Portfolio selection, Optimize formula results with solver/goal seek add-in.

Targeted Application & Tools that can be used:
Application Area is data analytics and business analytics, Statistical modelling.

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

1. Collection of data and applying inferential and descriptive statistics.
2. Collecting the appropriate data for the objective , analyze and interpret and visualize the data.
3.Collect the data and predict the values with linear regression.

Text Book
   1. Data Analysis and business modelling using Microsoft Excel – Hansa Lysander-PHI,2017

References

1. Excel Data Analysis-visual blue print –Paul McFedries –Wiley 4th Edition September 2019

2. Analyzing Business Data with Excel - Gerald Knight - O'Reilly; 1st Edition,13 January 2006

3. https://people.highline.edu/mgirvin/AllClasses/348/348/AllFilesBI348Analytics.htm

Catalogue prepared by	Mrs.MANASA C M
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

Course Code: CSE3092	Course Title: Programming in Python and its applications Type of Course: Program Core Theory & Integrated Laboratory		L- P- C	1	4	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of C-programming language					
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to develop python scripts using its powerful programming features and also to familiarize the Python IDLE and other soft wares. This course aids to advance critical thinking and analytical skills to enhance the programming abilities. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to build real time applications.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 2. Summarize the basic Concepts of python 2. Demonstrate proficiency in using various programming constructs and data structures such as string, lists, tuples, sets and dictionaries. 3. Outline user-defined functions using concepts of file processing with exception handling. 4. Identify the Libraries for Specific Applications.					
Course Content:						

Module 1	Introduction to Python	Assignment	Programming	10 Classes
Topics: Data types, operators and Expressions, Input and Output Statements. Control Structures – Selective and Repetitive structures				

Module 2	Indexed and Associative Data Structures	Simple applications	Programming	20 Classes
Topics: Strings, Lists, Sets, Tuples, Dictionaries				

Module 3	Functions, Files and Exception handling	Case study	Programming	10 Classes
Topics: User defined functions, recursive functions, File processing and exception handling				

Module 4	Working with Python libraries	Project work	Programming	20 Classes

Topics: Data Analysis using Numpy and xlrd; Visualization using Pandas and matplotlib; Data structure concepts - Searching and Sorting algorithms, Recursion, Stack, Queues and Trees.

Mini Project(Level-1):
Build a countdown timer using recursion

Mini Project(Level-2):
Job Scheduler using Binary Search Trees(BST)

List of Laboratory Tasks:

Sl. No.	Experiment Name
1	PROGRAMS ON OPERATORS AND EXPRESSIONS Level - 1 : Basic programs on Operators and Expressions Level - 2 : Develop applications to solve mathematical equations
2	PROGRAMS ON CONTROL STRUCTURES Level - 1 : Basic programs on Control structures Level - 2 : Create applications to solve the real time problems
3	PROGRAMS ON SELECTIVE AND REPETITIVE STRUCTURES Level - 1 : Basic programs on Selective and Repetitive structures Level - 2 : Create applications to solve the real time problems
4	PROGRAMS ON STRINGS Level - 1 : Basic programs on Strings and its manipulation Level - 2 : Develop Real world applications that involves string matching
5	PROGRAMS ON LISTS, TUPLES and SETS Level - 1 : Basic programs on lists, Tuples and Sets Level - 2 : Create applications that involves sequential and Random access of data
6	PROGRAMS ON DICTIONARIES Level - 1 : Basic programs on dictionaries Level - 2 : Create applications that involves structuring of data.
7	PROGRAMS ON FUNCTIONS Level - 1 : Basic programs on Functions Level - 2 : Develop Real world applications using functions
8	PROGRAMS ON FILES AND EXCEPTION HANDLING Level - 1 : Basic programs on File processing Level - 2 : Develop applications that involves exception handling
9	PROGRAMS ON DATA VISUALIZATION Level - 1 : Simple applications to visualize the data in the form of graphs Level - 2 : Create applications to see and understand trends, outliers, and patterns in data
10	PROGRAMS ON SEARCHING AND SORTING TECHNIQUES Level - 1 : Basic programs on searching and sorting techniques Level - 2 : Create applications using searching and sorting algorithms

Targeted Application & Tools that can be used:

- **Application Areas:**
- Web Development
- Game Development
- Scientific and Numeric Applications
- Artificial Intelligence and Machine Learning
- Software Development
- Enterprise-level/Business Applications
- Education programs and training courses
- Language Development
- Operating Systems
- Web Scrapping Applications
- Image Processing and Graphic Design Applications

Professionally Used Software: Python IDLE, Spyder, Jupyter Notebook, Google Colab

Project work/Assignment:

Project Assignment: Developing Real world applications using python

Text Books:
- Charles Dierbach, "Introduction to Computer Science Using Python", Wiley India Edition, 2015.

References:
5. E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", Tata McGraw-Hill, 2016
6. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2017
7. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy and Ipython", O'Reilly, 2 nd Edition, 2012.
8. Python Tutor - Visualize Python, Java, C, C++, JavaScript, TypeScript, and Ruby code execution
9. https://practice.geeksforgeeks.org/courses/Python-Foundation

Topics relevant to development of "FOUNDATIONS SKILLS"- Solve the real time problems by analyzing and visualizing the data.
Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS"- Data collection and its arrangement

Catalogue prepared by	Ms. GANGA V C, Ms. PALLAVI M, Ms. NAPALAKSHMI

REGISTRAR

Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

Course Code: CSE 2017	Course Title: Computer Graphics	L-P-C	2	2	3
Version No.	0.9				
Course Pre-requisites	Basic knowledge of C programming				
Anti-requisites	NIL				
Type of Skill	Skill development				
Course Caters to	NA				
Course Description	The purpose of this introductory course is to discuss the basics of graphics and visualization in computer science, enabling students to appreciate how the computer system displays graphics and visual effects on a display device. This course involves both theoretical and practical elements, and expects basic knowledge of high school geometry and Linear Algebra. The course uses assignments to develop programming and visualization skills of the students. The associated laboratory of this course uses OpenGL library to demonstrate how various aspects of graphics are effectuated. The key topics covered in this course include algorithms for drawing basic primitives, transformations, viewing and clipping for both 2D and 3D objects along with Bezier curves and Surfaces.				
Course Out Comes	On successful completion of the course the students shall be able to: CO 1: Illustrate algorithms for drawing basic primitives like Point, Line and Polygon. [Application] CO 2: Illustrate algorithms for performing 2D Geometric Transformations, viewing and clipping. [Application] CO 3: Illustrate algorithms for performing 3D Geometric Transformations, clipping. [Application] CO 4: Demonstrate plane Bezier curves and Bezier surfaces. [Application]				
Course Content:					

REGISTRAR

Module 1	Overview: Basics of Computer Graphics and OpenGL:	Assignment	practical Experiment	7 Classes

Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Graphics software. , Line drawing algorithms (DDA, Bresenham's), circle generation algorithms (Bresenham's). Basics of 2D and 3D objects.

OpenGL: Introduction to OpenGL, coordinate reference frames in OpenGL, Color and Gray Scale, OpenGL Color function, OpenGL point attributes functions, OpenGL line attributes functions, OpenGL polygon drawing, OpenGL polygon fill area attributes functions. Polygon scan-line area filling algorithm.

Module 2	2D Geometric Transformations, viewing and clipping:	Assignment	practical Experiment	8 Classes

2DGeometric Transformations: Basics of translation, scaling and rotation. Matrix representations and homogeneous coordinates for translation, scaling and rotation. 2D Composite transformations, General pivot point rotation and scaling, OpenGL geometric transformations functions.
Basics of 2D viewing and Clipping: Basics of viewing and Clipping, 2D viewing pipeline, Viewing Transformation systems, Types of clipping: point, Line and polygon clipping, 2D line clipping algorithms: cohen-sutherland line clipping, Liang-Barsky line clipping algorithm, polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm, OpenGL 2D viewing and clipping functions.

Module 3	3D Geometric Transformations, clipping.	Assignment	practical Experiment	6 Classes

3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, OpenGL 3D geometric transformations functions.

Basics of 3D Viewing and Clipping: 3D viewing concepts, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, Three dimensional line and polygon clipping.

Module 4	Plane curves and surfaces	Assignment	practical Experiment	8 Classes

Plane Curves: Plane Curves representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Parametric Representation of a Hyperbola, A Procedure for using Conic Sections, The General Conic Equation,

Basics of Surfaces Curve: Representation of Space Curves, Cubic Splines, Bezier Curves, Parametric Cubic Curves, Quadric Surfaces, Bezier Surfaces.

List of Laboratory Tasks:

Lab Sheet 1:
Experiment No1: Programs to implement basic primitives like Point, Line and polygon using C graphics
                [One lab Session]

Level 1: Program to plot vertices of a square and complete the square.
Level 2: Program to draw equilateral triangle of side length entered by user.

Experiment No2: Programs to implement line drawing algorithms using OpenGL. [One lab Session]
Level 1: Program to draw a line using DDA line drawing algorithm.
Level 2: Program to draw a circle using Bresenham's line drawing algorithm.

Experiment No3: Programs to implement polygon drawing using OpenGL.   [One lab Session]
Level 1: Program to draw a triangle having vertices entered by user.
Level 2: Program to create a square and fill the polygon using scan-line area filling algorithm.

Lab Sheet 2:
Experiment No4: Programs to implement 2D Geometric Translation and scaling using OpenGL.
[One lab Session]

Level 1: Program to Create and translate a line to a given translation coordinates.
Level 2: Program to Create a rectangle and scale the rectangle by given scaling factor.

Experiment No5: Programs to implement 2D Geometric rotation using OpenGL. [One lab Session]
Level 1: Program to Create and rotate a line by an angle entered by user.
Level 2: Program to create a house like figure and rotate it about a given fixed point.

Experiment No6: Programs to implement 2D Geometric clipping using OpenGL.[One lab Session]
Level 1: Program to implement Liang-Barsky line clipping algorithm.
Level 2: Program to implement Sutherland-Hodgeman polygon clipping algorithm.

Lab Sheet 3:

Experiment No7: Programs to implement 3D Geometric Translation and scaling using OpenGL.
[One lab Session]
Level 1: Program to draw a color cube and translate the cube to a given translation coordinates.
Level 2: Program to draw a color cuboid and scale the cuboid by given scaling factor.
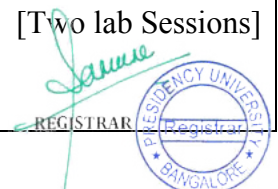

Experiment No8: Programs to implement 3D Geometric rotation using OpenGL.
[One lab Session]
Level 1: Program to create a cylinder by extruding a circle and rotate it about a given fixed point.
Level 2: Program to draw a color cube and spin it using OpenGL transformation matrices.

Lab Sheet 4:

Experiment No9: Programs to implement Bezier curve using OpenGL.
[Two lab Sessions]

Level 1: Program to draw a parabolic (quadratic curve) Bezier curve.
Level 2: Program to create a flag by using Bezier curve concept.

Experiment No10:	Programs to implement Bezier curved surface using OpenGL.

[Two lab Sessions]

Level 1: Program to draw a spherical Bezier surface.
Level 2: Program to draw a wired Tea Pot and solid Tea Pot.

Targeted Application & Tools that can be used:

Application Area: Game design and Animation

Tools/Simulator/Software used: Visual Studio 17.0

Text Book:

1) Donald D. Hearn, M. Pauline Baker and Warren Carither,"Computer Graphics with OpenGL", 4th Edition, Pearson Education, 2021.

2) Edward Angel and Dave shreiner,"Interactive Computer Graphics, A top down approach with shader based OpenGL", 6th Edition, Pearson Education, 2018.

Reference Books:

1) John F Hughes, Andries van Dam, Steven K. Feiner, James D. Foley, Morga, "Computer Graphics: Principles and Practice" Third Edition, Pearson Education India, 2013.
2) John Kessenich, Graham Sellers, Dave Shreiner, "OpenGL Programming guide", Ninth Edition, Addison-Wesley, 2016.

Catalogue prepared by	7. Prof. Uday Kumar Singh 8. Prof. Divya Kulkarni 9. Prof. S. Thiruselvan 10. Prof. Murali P.
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21
Catalog Reviewed Details	4-2-2022

REGISTRAR

Course Code: ECE 2007	Course Title: Digital Design Type of Course: Program Core & Theory & Integrated Laboratory		L- P- C	2	2	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	**NIL**					
Course Description	**The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. This course is analytical in nature and needs a fundamental knowledge on logical computation with Boolean Algebra. The focus of the course will be to discuss the minimization techniques for making canonical and low-cost digital circuit implementations. In this course we emphasize on analysis and design of digital electronic circuits. Additionally, this course will create a foundation for future courses includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc.** The course also enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.					

Course Outcomes	**On successful completion of this course the students shall be able to:**
	   i. **Apply** minimization techniques to simplify Boolean expressions.
	   ii. **Demonstrate** the Combinational circuits for a given logic.
	  iii. **Illustrate** the Sequential logic circuits.
	  iv. **Implement** various combinational logic circuits using gates.
	   v. **Verify** the performance of various sequential logic circuits using gates and memory elements.					

Course Content:						

Module 1	Boolean function simplification	Assignment	Programming and Simulation task	**10 Session**

Topics:
Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. Introduction to HDL.

Module 2	Combinational Logic circuits	Assignment	Programming and Simulation task	**10 Session**

Topics:
Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders, HDL Models of combinational circuits.

Module 3	Sequential and Programmable logic circuits	Assignment	Programming and Simulation task	**10 Session**

Topics:
Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. HDL Models of Sequential circuits.

List of Laboratory Tasks:

Experiment No 1: Verify the Logic Gates truth table
Level 1: Verify basic logic gates on Digital Logic simulator.
Level 2: Construct basic logic gates using universal gates and verify using Digital Logic Simulator

Experiment No. 2: Construct and verify 2-bit and 3-bit adder and subtractor logic circuits
Level 1: By using basic logic and XOR gates on Simulator
Level 2: By using Universal logic gates on Simulator

Experiment No. 3: Construct and verify the Multiplexer and Demultiplexer logic circuits
Level 1: By using basic logic and XOR gates on Simulator
Level 2: By using Universal logic gates on Simulator.

Experiment No. 4: Construct and verify the Encoder and Decoder logic circuits
Level 1: By using basic logic gates on Simulator
Level 2: Design and simulate Priority encoder.

Experiment No. 5: Construct and verify the combinational logic circuit for given specifications.
Level 1: Specifications given in the form of Truth table. Implement using basic gates.
Level 2: Specification should be extracted from the given scenario. Implement using universal gates only.

Experiment No. 6: To write the HDL coding for given combinational circuit
Level 1: Implementation using Gate level model
Level 2: Implementation using Behavioral level model

Experiment No. 7: Study of Flip flops
Level 1: Verify the operation of Flip-Flops on Digital Logic Simulator
Level 2: Conversion of one FF to other and verify on Digital Logic Simulator.

Experiment No. 8: Construct and verify the synchronous counter circuit.
Level 1: 3-Bit up counter using JK excitation table.
Level 2: Specification should be extracted from the given scenario and design.

Experiment No. 9: Construct and verify the Asynchronous counter circuit.
Level 1: 3-Bit up counter.

**Experiment No. 10:** To write the HDL coding for given sequential circuit
Level 1: Implementation using Gate level model
Level 2: Implementation using Behavioral level model

Targeted Application & Tools that can be used:
Application Area includes all modern electronic devices (cellular phones, MP3 players, laptop computers, digital cameras, high definition televisions, Home Automation, Communication systems). The students will be able to join a profession which involves basics to high level of digital circuit design and analysis.

Professionally Used Software: HDL (VHDL/ Verilog HDL)/ C++
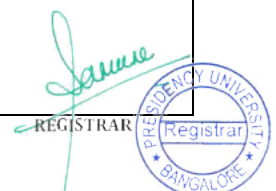
Besides these software tools Digital IC Trainer kit and Integrated Circuits (ICs) can be used to perform circuit testing and analysis.	

Project work/Assignment:

1.Case Studies: At the end of the course students will be given a real-world scenario for any application like security system/digital clock/ 7segment disply. Students will be submitting a report which will include Truth table, Design, Circuit Diagrams, implementation and Results.

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 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.

Text Book(s):
1. Thomas L Flyod, *"Digital Fundamentals"*, Eleventh Edition, Pearson Education. ISBN-10: 132737965. (2014)
   eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
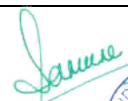
Reference(s):
Reference Book(s):
1. Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
   { [PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download (studymaterialz.in)
2. Jain, R. P., *"Modern Digital Electronics"*, McGraw Hill Education (India).
3. Roth, Charles H., Jr and Kinney Larry L., *"Fundamentals of logic Design"*, Cengage Learning.

Online Resources (e-books, notes, ppts, video lectures etc.):
1. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
2. Digital Logic Design PPT Slide 1 (iare.ac.in)
3. Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video
   CircuitVerse - Digital Circuit Simulator online
   Learn Logisim : Beginners Tutorial | Easy Explanation! - Bing video
   Digital Design 5: LOGISIM Tutorial & Demo

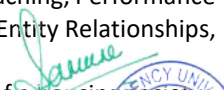|	
Topics related to development of "FOUNDATION SKILLS": Adders, Multiplexers, Decoders / Encoders; Flip-Flops, Counters and Registers.	
Catalogue prepared by	Dr. G. Muthupandi Dr.Bhanurekha Dr.Punneth Mrs. Samreen Fiza
Recommended by the Board of Studies on	BOS NO: 11 th. BOS held on 23/4/21
Date of Approval by the Academic Council	Academic Council Meeting No. 14, Dated 21/5/21

PU/AC-20.3/SOCSE01/CAI/2020-2024   Page **124** of **130**

Course Code: CSE3150	Course Title: Front-end Full Stack Development	L- P- C	2	2	3

Version No.	1.0
Course Pre-requisites	Nil
Anti-requisites	NIL
Course Description	This intermediate course enables students to perform front-end full stack development, with emphasis on employability skills. The course covers key technologies and architectures that enables the student to design and implement front-end. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Outcomes	On successful completion of the course the students shall be able to: 1] Describe the fundamentals of DevOps and Front-end full stack development. [Comprehension] 2] Illustrate development of a responsive web. [Application] 3] Apply concepts of Angular.js to develop a web front-end. [Application] 4] Apply concepts of Angular.js to develop a web front-end. [Application]
Course Content:	

Module 1	Fundamentals of DevOps and Web Development	Project	Programming	04 Sessions

Topics:
Introduction to Agile Methodology; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals; DevOps – Architecture, Lifecycle, Workflow & Principles; DevOps Tools Overview – Jenkins, Docker, Kubernetes.
Review of GIT source control. HTML5 – Syntax, Attributes, Events, Web Forms 2.0, Web Storage, Canvas, Web Sockets; CSS3 – Colors, Gradients, Text, Transform
Assignment: Develop a website for managing HR policies of a department.

Module 2	Responsive web design	Project	Programming	03 Sessions

Topics:
BootStrap for Responsive Web Design; JavaScript – Core syntax, HTML DOM, objects, classes, Async; Ajax and jQuery Introduction
Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society.

Module 3	Fundamentals of Angular.js	Project	Programming	08 Sessions

Topics:
Setting up Development & Build Environment: Node.js and NPM; Introduction to TypeScript; Working with OOP concepts with TypeScript; Angular Fundamentals; Angular CLI; Introduction to TypeScript; Debugging Angular applications; Components & Databinding in Depth; Angular Directives; Using Services & Dependency Injection; Angular Routing; Observables; Handling Forms in Angular Apps; Output transformation using Pipes; Making Http Requests; Authentication & Route Protection; Dynamic Components; Angular Modules & Optimizing Angular Apps; Deploying an Angular App; Angular Animations; Adding Offline Capabilities with Service Workers; Unit Testing in Angular Apps (Jasmine, Karma).

Assignment: Develop a software tool to do inventory management in a warehouse.				
Module 4	Fundamentals of React.js	Project	Programming	**15 Sessions**

Topics:
Overview of React.js.; Reactive Programming; React Components; Render Method; Virtual DOM and Bandwidth Salvation; Two Distinct Ways of Initializing a React Class; States & Life Cycles; Component Mounting; Node.js & NPM; JSX Walkthrough; React Testing.

Assignment: Develop a web-based application to book movies/events (like bookmyshow).

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: GCC compiler.

Project work/Assignment:

1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using Java.**

Text Book:
T1. Fender, Young, "*Front-end Fundamentals*", Leanpub, 2015
T2. Northwood, Chris, "*The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer*", APress, 2018

References:
R1. Flanagan D S, *"Javascript : The Definitive Guide"* 7th Edition. 7th ed. O'Reilly Media; 2020.
R2. Alex Libby, Gaurav Gupta, and Asoj Talesra. *"Responsive Web Design with HTML5 and CSS3 Essentials",* Packt Publishing, 2016
R3. Duckett J Ruppert G Moore J. *"Javascript & Jquery : Interactive Front-End Web Development.";* Wiley; 2014.
R4. Greg Sidelnikov, *"React.js Book_ Learning React JavaScript Library"*, 1 edition, Scratch-River Tigris LLC 2016
R5. Web Reference:
https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2

Catalogue prepared by	Dr. Jayakumar V, Dr. M Chandrashekhar, Dr. Murali Parameswaran
Recommended by the Board of Studies on	(BOS NO: SOCSE1. BOS held on 22 / 12 / 2022)
Date of Approval by the Academic Council	(Academic Council Meeting No.20.3 , Dated 15 /02 /23)

Course Code: CSE3151	Course Title: Java Full Stack Development			L- P- C	2	2	3

Version No.	1.0
Course Pre-requisites	**Nil**
Anti-requisites	**CSE3152 .NET Full Stack Development**
Course Description	This advanced level course enables students to perform full stack development using Java, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using Java, and the related technologies/tools like Java EE, Java Persistence, Hibernate, Maven, Spring Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Outcomes	**On successful completion of the course the students shall be able to:** **1] Practice the use of Java for full stack development [Application]** **2] Show web applications using Java EE. [Application]** **3] Solve simple applications using Java Persistence and Hibernate [Application]** **4] Apply concepts of Spring to develop a Full Stack application. [Application]** **5] Employ automation tools like Maven, Selenium for Full Stack development. [Application]**
Course Content:	

Module 1	Introduction	Project	Programming	03 Sessions

Topics:
Review of Java; Advanced concepts of Java; Java generics; Java IO; New Features of Java. Unit Testing tools.

Module 2	Java EE Web Applications	Project	Programming	05 Sessions

Topics:
Introduction to Eclipse & Tomcat; JSP Fundamentals; Reading HTML form Data with JSP; State Management with JSP; JSP Standard Tag Library - Core & Function Tags; Servlet API Fundamentals; ServletContext, Session, Cookies; Request Redirection Techniques; Building MVC App with Servlets & JSP; Complete App - Integrating JDBC with MVC App
Assignment: Develop an application for managing HR policies of a department.

Module 3	Java Persistence using JPA and Hibernate	Project	Programming	06 Sessions

Topics:
Fundamentals of Java Persistence with Hibernate; JPA for Object/Relational Mapping, Querying, Caching, Performance and Concurrency; First & Second Level Caching, Batch Fetching, Optimistic Locking & Versioning; Entity Relationships, Inheritance Mapping & Polymorphic Queries; Querying database using JPQL and Criteria API (JPA)
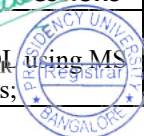**Assignment:** Design and develop a website that can actively keep track of entry-exit information of a housing society.

Module 4	Spring Core	Project	Programming	10 Sessions

Topics:
Spring Core, Spring MVC, Spring Boot REST API; Understanding Spring Framework; Using Spring MVC; Building a Database Web App with Spring and Hibernate o Spring AOP (Aspect Oriented Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development
Assignment: Develop a software tool to do inventory management in a warehouse.

Module 5	Automation tools	Project	Programming	06 Sessions

Topics:
Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup - Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands
Assignment: Illustrate the use of automation tools in the development of a small software project.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.

Project work/Assignment:
1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using Java.**

Text Book:
 T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015

References
 R1. Soni, Ravi Kant. *"Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful."* , Apress, 2017.
 R2. Mardan, Azat. *"Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB."*, Apress, 2015

Catalogue prepared by	Mr. Sunil Sahoo, Dr. M Chandrashekhar, Dr. Murali Parameswaran
Recommended by the Board of Studies on	(BOS NO: SOCSE1. BOS held on 22 / 12 / 2022)
Date of Approval by the Academic Council	(Academic Council Meeting No.20.3 , Dated 15 /02 /23)

Course Code: CSE3152	Course Title: .NET Full Stack Development		L- P- C	2	2	3

Version No.	1.0
Course Pre-requisites	**Nil**
Anti-requisites	**CSE3151 Java Full Stack Development**
Course Description	This advanced level course enables students to perform full stack development using .NET, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using .NET and the related technologies/tools like C#, ASP.NET, Entity Framework Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Outcomes	**On successful completion of the course the students shall be able to:** **1] Practice the use of C# for developing a small application [Application]** **2] Show web applications using Entity Framework. [Application]** **3]Solve simple web applications that use SQL and ASP.NET [Application]** **4] Apply concepts of ASP.NET to develop a Full Stack application. [Application]**
Course Content:	

Module 1	C# Programming for Full Stack Development	Project	Programming	**10 Sessions**

Topics:
.NET Framework Fundamentals, Visual Studio IDE Fundamentals, C# Language Features, Working with arrays and collections, Working with variables, operators, and expressions, Decision and iteration statements, Managing program flow and events, Working with classes and methods, OOP concepts, Properties, Auto Implemented, Delegates, Anonymous Methods and Anonymous Types, Extension methods, Sealed Classes/Methods, Partial Classes/Methods, Asynchronous programming and threading, Data validation and working with data collections including LINQ, Handling errors and exceptions, Working with Files, Unit Testing – Nunit framework
Assignment: Develop a small application for managing library using C#.

Module 2	Entity Framework Core 2.0	Project	Programming	**06 Sessions**

Topics:
Entity Framework Core 2.0 Code First Approach; Introduction To Entity Framework and EDM; Querying the EDM; Working With Stored Procedures; Advanced Entity Framework - DbContext [EF6]; Advanced Operations; Performance Optimization; Data Access with ADO.NET
Assignment: Develop an application for managing HR policies of a department.

Module 3	ASP.NET	Project	Programming	**06 Sessions**

Topics:
ASP.NET Core, ASP.Net Core 3.1 MVC, ASP.NET Core Middleware and Request pipeline, Review of SQL using MS SQL, Working With Data In Asp.Net, Razor View Engine, State Management In Asp. Net MVC & Layouts;

Assignment: Develop a web application to mark entry/exit of guests in a building.				
Module 4	ASP.NET	Project	Programming	**08 Sessions**

Topics:
Introduction To Models, Validations In Asp.Net MVC, Authentication and Authorization In Asp.Net MVC, Advanced Asp. Net MVC - Ajax Action Link In MVC, Advanced Asp.Net MVC - Ajax Forms In MVC, Microsoft Testing Framework – Unit Testing the .NET Application
Assignment: Develop a software tool to do inventory management in a warehouse.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Visual Studio

Project work/Assignment:
1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using .NET.**

Text Book:
- T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015
- T2. Valerio De Sanctis, *"ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11",* 4th Edition, Packt, 2021.

References
- R1. Benjamin Perkins, Jon D. Reid, *"Beginning C# and .NET",* Wiley, 2021 Reid, 2021.
- R2. Piotr Gankiewicz, *"Full Stack .NET Web Development",* Packt Publishing, 2017.
- R3. Tamir Dresher, Amir Zuker, Shay Friedman, *"Hands-On Full-Stack Web Development with ASP.NET Core",* Packt Publishing, 2018.
- R4. Dustin Metzgar, *"Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core"*, Manning, 2017.

Catalogue prepared by	Dr. Komalavalli C, Dr. Jayakumar V, Dr. Murali Parameswaran
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