CR24

ENGINEERING CURRICULUM

B.Tech. Regular / Honors

B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year **2024-25** onwards)

&

B.Tech.(Lateral Entry Scheme)

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year **2025 - 26** onwards)

SIR C R REDDY COLLEGE OF ENGINEERING, ELURU

(AUTONOMOUS)

(SPONSORED BY SIR C R R EDUCATIONAL INSTITUTIONS, SOCIETY REGD. NO.: 10/1950)

VATLURU, ELURU-534007, ELURU DISTRICT, ANDHRA PRADESH, INDIA

Approved by AICTE, Accredited By NBA (UG: CSE, IT, ECE, EEE, ME), Affiliated To JNTUK, Kakinada

Estd. 1989

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ENGINEERING CURRICULUM – 2024

Academic Regulations (CR24) for B. Tech (Regular-Full time)

(*Effective for the students admitted into I year from the Academic Year 2024-25 onwards*)

Sir C R Reddy College of Engineering 2024 Regulations (CR24 Regulations) applicable to all programmes given hereunder. These regulations govern the B. Tech. programmes offered by all the departments with effect from the students admitted into the programmes from academic year 2024-25.

Courses of Study

S.No	Programme	Code	AP EAPCET Codes
1	Civil Engineering	01	CIV
2	Electrical & Electronics Engineering	02	EEE
3	Mechanical Engineering	03	MEC
4	Electronics & Communication Engineering	04	ECE
5	Computer Science & Engineering	05	CSE
6	Information Technology	12	INF
7	Computer Science & Engineering (Artificial Intelligence and Machine Learning)	42	CSM
8	Computer Science & Engineering (Artificial Intelligence and Data Science)	45	CAD
9	Computer Science & Engineering (Cyber Security)	46	CSC

1. **Award of the Degree**
   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfills the following:
      (i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
      (ii) Registers for 160 credits and secures all 160 credits.

   (b) Award of B.Tech. degree with Honors if he/she fulfills the following:
      (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.
      (ii) Registering for Honors is optional.
      (iii) Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

3. **Admissions**
   Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. **Program related terms**
   Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

   Credit Definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hrs. Practical (Lab) per week	1 credit

a) Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

b) Choice Based Credit System (CBCS): The CBCS provides a choice for students to select from the prescribed courses.

5. Semester/Credits:

i) A semester comprises 90 working days and an academic year is divided into two semesters.

ii) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.

iii) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

6. Structure of the Undergraduate Programme

All courses offered for the undergraduate program (B.Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total credits	AICTE Recommendation (%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%
6.	Internships & Project work (PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	-

7. Course Classification:

All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly classified as follows:

S.No	Broad Course Classification	Course Category	Description
1.	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline/ department/ branch of Engineering
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4.	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory non - credit courses	Covering subjects of developing desired attitude among the learners

8. Programme Pattern

i. Total duration of the of B. Tech (Regular) Programme is four academic years.
ii. Each academic year of study is divided into two semesters.
iii. Minimum number of instruction days in each semester is 90 days.
iv. There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
v. Health/wellness/yoga/sports and NSS /NCC /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.
vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.

ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.

x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.

xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.

xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.

xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.

xv. Undergraduate degree with Honors is introduced by the University for the students having good academic record.

xvi. Each college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xvii. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career-growth/placements/opportunities for higher studies/GATE/ other competitive exams etc.

xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

9. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.
iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

a) Continuous Internal Evaluation

i) For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.
ii) Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted by the respective institution on the day of subjective paper test.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.

iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.

iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the

units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid: 25
Marks obtained in second mid: 20
Final mid semester Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

Marks obtained in first mid: Absent
Marks obtained in second mid: 25
Final mid semester Marks: (25x0.8) + (0x0.2) =20

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

i) There shall be 6 questions and all questions are compulsory.
ii) Question I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.
iii) There shall be 2 short answer questions from each unit.
a) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical &Electronics Engineering shall have the following pattern:

i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.
iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Practical Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.

c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.
- Procedure: 20 marks
- Experimental work & Results: 30 marks
- Viva voce: 20 marks.

In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

e) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Assessment Method	**Marks**
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing , multiple branches, etc is mentioned along with the syllabus.

f) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-

examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

g) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

10. Skill oriented Courses

i) There shall be five skill-oriented courses offered during III to VII semesters.

ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.

iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

iv) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.

v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the University/ at the beginning of the semester. The principal of the respective college shall forward such proposals to the University for approval.

vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the University.

11. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete one course compulsorily through MOOCs approved by the University. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the university.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

12. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

i) The University shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
iv) The concerned department shall identify the courses permitted for credit transfer.
v) The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
vii) The university/Institution shall ensure no overlap of MOOC exams with that of the End Semester examination schedule. In case of delay in results, the university/Institution will re-issue the marks sheet for such students.

viii) Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

ix) The institution shall submit the following to the examination section of the university:
   a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
   b) Undertaking form filled by the students for credit transfer.

x) The universities shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the University from time to time.

13. Academic Bank of Credits (ABC)

The University has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

i. provide option of mobility for learners across the universities of their choice
ii. provide option to gain the credits through MOOCs from approved digital platforms.
iii. facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
iv. execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

14. Mandatory Internships

Summer Internships : Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall

be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the Institution /University.

Full Semester Internship and Project work: In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the Institution/University and is evaluated for 140 marks.

The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

15. Guidelines for offering a Minor

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

i) The Minor program requires the completion of 12 credits in Minor stream chosen.
i) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.
ii) Electives (minimum of 2 courses) to complete a total of 12 credits.

Note: A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor by opting for the courses offered through various verticals/tracks under Open Electives.

16. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose

additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
ii) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).
iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.
iv) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.
v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
ix) **A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors** degree program**.** No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.
x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline
ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for

Honors.

iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

i) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.
ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.
iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.
iv) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

17. Attendance Requirements:

i) A student shall be eligible to appear for the Semester End examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the Institution.
iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.
viii) For induction programme attendance shall be maintained as per AICTE norms.

18. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16.

i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.

ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) up to in the subjects that have been studied up to III semester.

iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) in the subjects that have been studied up to V semester.
And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

19. Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	**Grade**	**Grade points Assigned**
90 & above	S (Superior)	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7
50 - 59	D (Average)	6
40 - 49	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative GradePoint Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$$

where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \Sigma (C_i \times S_i)/ \Sigma C_i$$

where "S_i" is the SGPA of the i^{th} semester and C_i is the total numberof credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.
Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	$\geq 6.5 < 7.5$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 5.0 < 5.5$

CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10

20. With–holding of Results

If the candidate has any dues not paid to the university/Institution or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

21. Multiple Entry / Exit Option

(a) Exit Policy:

The students can choose to exit the four-year programme at the end of first/second/third year.

i) **UG Certificate in (Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

ii) **UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline)** i.e., **B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

Note: The Universities shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

22. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

23. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section **2** and they will follow the academic regulations into which they are readmitted.

24. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each semester shall be 90 days.

25. Medium of Instruction:

The medium of instruction of the entire B. Tech undergraduate programme in Engineering &Technology (including examinations and project reports) will be in English only.

26. Student Transfers:

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

27. General Instructions:

i. The academic regulations should be read as a whole for purpose of any interpretation.
ii. Malpractices rules-nature and punishments are appended.
iii. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
v. The Universities may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Universities.
vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor / Head of the institution is final.

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ACADEMIC REGULATIONS (CR24)

FOR B.TECH. (LATERAL ENTRY SCHEME)

*(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year **2025-26** onwards)*

1. **Award of the Degree**
   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
      (i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
      (ii) Registers for 120 credits and secures all 120 credits.

   (b) Award of B.Tech. degree with Honors if he/she fulfils the following:
      (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.
      (ii) Registering for Honors is optional.
      (iii) Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. **Minimum Academic Requirements**
   The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.**2**
   i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.

   ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

   And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

i) The entire course of study is three academic years on semester pattern.

ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

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SIR C R REDDY COLLEGE OF ENGINEERING ELURU 534 007

Principal
Sir C R Reddy College of Engineering
ELURU - 534 007

2023

ENGINEERING CURRICULUM

B.Tech. Regular / Honors

JAWAHARLAL NEHRU
TECHNOLOGICAL UNIVERSITY KAKINADA
Kakinada – 533003, Andhra Pradesh, www.jntuk.edu.in

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

(Established by Govt. of A.P., Act No.30 of 2008)

Kakinada – 533003, Andhra Pradesh, India, www.jntuk.edu.in

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B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

&

B.Tech.(Lateral Entry Scheme)

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year **2024 - 25** onwards)

Academic Regulations (R23) for B. Tech (Regular-Full time)

(Effective for the students admitted into I year from
the Academic Year **2023-24** onwards)

1. **Award of the Degree**
   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
      (i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
      (ii) Registers for 160 credits and secures all 160 credits.

   (b) Award of B.Tech. degree with Honors if he/she fulfils the following:
      (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.
      (ii) Registering for Honors is optional.
      (iii) Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

3. **Admissions**
   Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. **Program related terms**
   Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

   Credit Definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hrs. Practical (Lab) per week	1 credit

a) Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

b) Choice Based Credit System (CBCS): The CBCS provides a choice for students to select from the prescribed courses.

5. Semester/Credits:

i) A semester comprises 90 working days and an academic year is divided into two semesters.

ii) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.

iii) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

6. Structure of the Undergraduate Programme

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total credits	AICTE Recommendation (%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%
6.	Internships & Project work (PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	-

7. Course Classification:

All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly classified as follows:

S.No.	Broad Course Classification	Course Category	Description
1.	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline/department/branch of Engineering
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4.	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

8. Programme Pattern

i. Total duration of the of B. Tech (Regular) Programme is four academic years.
ii. Each academic year of study is divided into two semesters.
iii. Minimum number of instruction days in each semester is 90 days.
iv. There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
v. Health/wellness/yoga/sports and NSS /NCC /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.
vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.

ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.

x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.

xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.

xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.

xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.

xv. Undergraduate degree with Honors is introduced by the University for the students having good academic record.

xvi. Each college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xvii. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

9. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship &Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.
iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

a) Continuous Internal Evaluation

i) For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.
ii) Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted by the respective institution on the day of subjective paper test.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.

iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.

iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the

units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid: 25
Marks obtained in second mid: 20
Final mid semester Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

Marks obtained in first mid: Absent
Marks obtained in second mid: 25
Final mid semester Marks: (25x0.8) + (0x0.2) =20

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

i) There shall be 6 questions and all questions are compulsory.
ii) Question I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.
iii) There shall be 2 short answer questions from each unit.
a) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical &Electronics Engineering shall have the following pattern:

i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.
iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Practical Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.

c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.
- Procedure: 20 marks
- Experimental work & Results: 30 marks
- Viva voce: 20 marks.

In a practical subject consisting of two parts (Eg: Basic Electrical &Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

e) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Assessment Method	**Marks**
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing , multiple branches, etc is mentioned along with the syllabus.

f) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-

examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

g) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

10. Skill oriented Courses

i) There shall be five skill-oriented courses offered during III to VII semesters.

ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.

iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

iv) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.

v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the University at the beginning of the semester. The principal of the respective college shall forward such proposals to the University for approval.

vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the University.

11. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete one course compulsorily through MOOCs approved by the University. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the university.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

12. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

i) The University shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
iv) The concerned department shall identify the courses permitted for credit transfer.
v) The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
vii) The university shall ensure no overlap of MOOC exams with that of the university examination schedule. In case of delay in results, the university will re-issue the marks sheet for such students.

viii) Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

ix) The institution shall submit the following to the examination section of the university:
   a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
   b) Undertaking form filled by the students for credit transfer.

x) The universities shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the University from time to time.

13. Academic Bank of Credits (ABC)

The University has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

i. provide option of mobility for learners across the universities of their choice
ii. provide option to gain the credits through MOOCs from approved digital platforms.
iii. facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
iv. execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

14. Mandatory Internships

Summer Internships : Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall

be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

Full Semester Internship and Project work: In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the University and is evaluated for 140 marks.

The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

15. Guidelines for offering a Minor

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

i) The Minor program requires the completion of 12 credits in Minor stream chosen.
i) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.
ii) Electives (minimum of 2 courses) to complete a total of 12 credits.

Note: A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor by opting for the courses offered through various verticals/tracks under Open Electives.

16. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose

additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
ii) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).
iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.
iv) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.
v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
ix) **A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors** degree program**.** No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.
x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline
ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for

Honors.

iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

i) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.
ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.
iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.
iv) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

17. Attendance Requirements:

i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.
iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.
viii) For induction programme attendance shall be maintained as per AICTE norms.

18. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16.

i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.

ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) up to in the subjects that have been studied up to III semester.

iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) in the subjects that have been studied up to V semester.
And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

19. Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	**Grade**	**Grade points Assigned**
90 & above	S (Superior)	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7
50 - 59	D (Average)	6
40 - 49	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative GradePoint Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$$

where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \Sigma (C_i \times S_i)/ \Sigma C_i$$

where "S_i" is the SGPA of the i^{th} semester and C_i is the total numberof credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.
Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 5.0 < 5.5

CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10

20. With–holding of Results

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

21. Multiple Entry / Exit Option

(a) Exit Policy:

The students can choose to exit the four-year programme at the end of first/second/third year.

i) **UG Certificate in (Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

ii) **UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline)** i.e., **B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

Note: The Universities shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

22. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

23. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section **2** and they will follow the academic regulations into which they are readmitted.

24. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each semester shall be 90 days.

25. Medium of Instruction:

The medium of instruction of the entire B. Tech undergraduate programme in Engineering &Technology (including examinations and project reports) will be in English only.

26. Student Transfers:

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

27. General Instructions:

i. The academic regulations should be read as a whole for purpose of any interpretation.
ii. Malpractices rules-nature and punishments are appended.
iii. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
v. The Universities may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Universities.
vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor / Head of the institution is final.

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ACADEMIC REGULATIONS (R23)

FOR B.TECH. (LATERAL ENTRY SCHEME)

*(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year **2024-25** onwards)*

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

(i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).

(ii) Registers for 120 credits and secures all 120 credits.

(b) Award of B.Tech. degree with Honors if he/she fulfils the following:

(i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.

(ii) Registering for Honors is optional.

(iii) Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.**2**

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.

ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

i) The entire course of study is three academic years on semester pattern.

ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

B.TECH. - COURSE STRUCTURE – R23

(Applicable from the academic year 2023-24 onwards)

INDUCTION PROGRAMME

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

Group-A Branches:

CSE, EEE, Chemical Engineering, Food Technology, Petroleum Technology, Pharmaceutical Engineering

Group-B Branches:

Agricultural Engineering, Civil Engineering, Mechanical Engineering, Mining Engineering, Automobile Engineering, Robotics, ECE & ECE-Allied, CSE-Allied & IT

B.Tech. – I Year I Semester (for Group-A Branches)

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Communicative English	2	0	0	2
2	BS&H	Engineering Chemistry/ Chemistry/Fundamental Chemistry	3	0	0	3
3	BS&H	Linear Algebra & Calculus	3	0	0	3
4	Engineering Science	Basic Civil & Mechanical Engineering	3	0	0	3
5	Engineering Science	Introduction to Programming	3	0	0	3
6	BS&H	Communicative English Lab	0	0	2	1
7	BS&H	Engineering Chemistry/ Chemistry/Fundamental Chemistry Lab	0	0	2	1
8	Engineering Science	Engineering Workshop	0	0	3	1.5
9	Engineering Science	Computer Programming Lab	0	0	3	1.5
10	BS&H	Health and wellness, Yoga and Sports	-	-	1	0.5
Total			**14**	**00**	**11**	**19.5**

B.Tech. – I Year I Semester (for Group-B Branches)

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Engineering Physics	3	0	0	3
2	BS&H	Linear Algebra & Calculus	3	0	0	3
3	Engineering Science	Basic Electrical & Electronics Engineering	3	0	0	3
4	Engineering Science	Engineering Graphics	1	0	4	3
5	Engineering Science	Introduction to Programming	3	0	0	3
6	Engineering Science	IT Workshop	0	0	2	1
7	BS&H	Engineering Physics Lab	0	0	2	1
8	Engineering Science	Electrical & Electronics Engineering Workshop	0	0	3	1.5
9	Engineering Science	Computer Programming Lab	0	0	3	1.5
10	BS&H	NSS/NCC/Scouts & Guides/Community Service	-	-	1	0.5
Total			**13**	**00**	**15**	**20.5**

B.Tech. – I Year II Semester (for Group-A Branches)

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Engineering Physics	3	0	0	3
2	BS & H	Differential Equations & Vector Calculus	3	0	0	3
3	Engineering Science	Basic Electrical and Electronics Engineering	3	0	0	3
4	Engineering Science	Engineering Graphics	1	0	4	3
5	Engineering Science	IT Workshop	0	0	2	1
6	Professional Core	Data Structures / Electrical Circuit Analysis – I (Branch specific)	3	0	0	3
7	BS&H	Engineering Physics Lab	0	0	2	1
8	Engineering Science	Electrical and Electronics Engineering Workshop	0	0	3	1.5
9	Professional Core	Data Structures Lab / Electrical Circuits Lab	0	0	3	1.5
10		NSS/NCC/Scouts & Guides/Community Service	-	-	1	0.5
Total			**13**	**00**	**15**	**20.5**

B.Tech. – I Year II Semester (for Group-B Branches)

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Communicative English	2	0	0	2
2	BS & H	Engineering Chemistry / Chemistry / Fundamental Chemistry	3	0	0	3
3	Engineering Science	Differential Equations & Vector Calculus	3	0	0	3
4	Engineering Science	Basic Civil & Mechanical Engineering	3	0	0	3
5	Professional Core	Engineering Mechanics/Network Analysis/ Data structures (Branch specific)	3	0	0	3
6	BS&H	Communicative English Lab	0	0	2	1
7	BS&H	Engineering Chemistry / Chemistry / Fundamental Chemistry Lab	0	0	2	1
8	Engineering Science	Engineering Workshop	0	0	3	1.5
9	Professional Core	Engineering Mechanics & Building Practices Lab Engineering Mechanics Lab / Network Analysis and Simulation Lab / Data structures Lab	0	0	3	1.5
10		Health and wellness, Yoga and Sports	-	-	1	0.5
Total			**14**	**00**	**11**	**19.5**

B.Tech. – II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Engineering Mathematics (Branch specific)	3	0	0	3
2	BS&H	Universal Human Values – Understanding Harmony	2	1	0	3
3	Engineering Science		2	0	0	2
4	Professional Core		3	0	0	3
5	Professional Core		3	0	0	3
6	Engineering Science		0	0	2	1
7	Professional Core		0	0	3	1.5
8	Professional Core		0	0	3	1.5
9	Skill Enhancement course		0	1	2	2
10	Audit Course	Environmental Science	2	0	0	-
Total			**15**	**2**	**10**	**20**

B.Tech. – II Year II Semester

S.No.	**Category**	**Title**	**L**	**T**	**P**	**Credits**
1	Management Course - I		2	0	0	2
2	Engineering Science		3	0	0	3
3	Professional Core		3	0	0	3
4	Professional Core		3	0	0	3
5	Professional Core		3	0	0	3
6	Professional Core		0	0	2	1
7	Professional Core		0	0	3	1.5
8	Professional Core		0	0	3	1.5
9	Skill Enhancement course		0	1	2	2
10	BS&H	Design Thinking & Innovation	1	0	2	2
Total			**15**	**1**	**12**	**22**
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						

B.Tech. – III Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core		3	0	0	3
2	Professional Core		3	0	0	3
3	Professional Elective - I		2	0	0	2
4	Open Elective - I		3	0	0	3
5	Open Elective - II		3	0	0	3
6	Professional Core		0	0	3	1.5
7	Professional Core		0	0	3	1.5
8	Skill Enhancement course		0	1	2	2
9	BS&H	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
Total			**14**	**1**	**10**	**22**

B.Tech. – III Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core		3	0	0	3
2	Professional Core		3	0	0	3
3	Professional Core		3	0	0	3
4	Professional Elective - II		3	0	0	3
5	Professional Elective - III		2	0	0	2
6	Open Elective - III		3	0	0	3
7	Professional Core		0	0	2	1
8	Professional Core		0	0	2	1
9	Skill Enhancement course		0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
Total			**19**	**1**	**06**	**21**
Mandatory Industry Internship of 08 weeks duration during summer vacation						

B.Tech. – IV Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core		3	0	0	3
2	Professional Core		3	0	0	3
3	Management Course - II		2	0	0	2
4	Professional Elective - IV		3	0	0	3
5	Professional Elective - V		3	0	0	3
6	Open Elective - IV		3	0	0	3
7	Professional Core		0	0	2	1
8	Professional Core		0	0	2	1
9	Skill Enhancement Course		0	1	2	2
10	Audit Course	Constitution of India	2	0	0	-
11	Internship	Evaluation of Industry Internship	-	-	-	2
		Total	**19**	**1**	**06**	**23**

B.Tech. – IV Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

FIRST YEAR SYLLABUS

L	T	P	C
2	0	0	2

COMMUNICATIVE ENGLISH

(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, *Communicative English*, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

Course Outcomes:

CO1: Understand the context, topic, and pieces of specific information from social or Transactional dialogues.
CO2: Apply grammatical structures to formulate sentences and correct word forms.
CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions.
CO4: Evaluate reading / listening texts and to write summaries based on global comprehension of these texts.
CO5: Create a coherent paragraph, essay, and resume.

UNIT I

Lesson: HUMAN VALUES: Gift of Magi **(Short Story)**

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.
Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar: Parts of Speech, Basic Sentence Structures-forming questions
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
Vocabulary: Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed
Reading: Readinga text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

UNIT V
Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension.
Writing: Writing structured essays on specific topics.
Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.

4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

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COMMUNICATIVE ENGLISH LAB

(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

Course Outcomes:

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.
CO2: Apply communication skills through various language learning activities.
CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.
CO5: Create effective Course Objectives:

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

- Walden Infotech
- Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed), Kindle, 2013

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

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LINEAR ALGEBRA & CALCULUS

(Common to All Branches of Engineering)

Course Objectives:

- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Develop and use of matrix algebra techniques that are needed by engineers for practical applications.

CO2: Utilize mean value theorems to real life problems.

CO3: Familiarize with functions of several variables which is useful in optimization.

CO4: Learn important tools of calculus in higher dimensions.

CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

UNIT I Matrices

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II Eigenvalues, Eigenvectors and Orthogonal Transformation

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT III Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT IV Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V Multiple Integrals (Multi variable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5th Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th edition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)

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DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(Common to All Branches of Engineering)

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Solve the differential equations related to various engineering fields.
CO2: Identify solution methods for partial differential equations that model physical processes.
CO3: Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO4: Estimate the work done against a field, circulation and flux using vector calculus.

UNIT I Differential equations of first order and first degree

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V Vector integration

LWithoutegral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

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ENGINEERING PHYSICS

(Common for all branches of Engineering)

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes:

CO1: Analyze the intensity variation of light due to polarization, interference and diffraction.
CO2: Familiarize with the basics of crystals and their structures.
CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.
CO4: Summarize various types of polarization of dielectrics and classify the magnetic materials.
CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids.
CO6: Identify the type of semiconductor using Hall effect.

UNIT I Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.
Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT III Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation

polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV Quantum Mechanics and Free electron Theory

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT V Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

Textbooks:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

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ENGINEERING PHYSICS LAB

(Common to All Branches of Engineering)

Course Objectives:

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes: The students will be able to

CO1: Operate optical instruments like travelling microscope and spectrometer.
CO2: Estimate the wavelengths of different colours using diffraction grating.
CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
CO5: Calculate the band gap of a given semiconductor.
CO6: Identify the type of semiconductor using Hall effect.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

References:

- A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

Web Resources

- www.vlab.co.in
- https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

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ENGINEERING CHEMISTRY

(Common to Civil, Chemical, Mechanical Engineering and allied branches)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of ectrochemistry, polymers, surface chemistry, and cement

.

Course Outcomes: At the end of the course, the students will be able to

CO1: Demonstrate the corrosion prevention methods and factors affecting corrosion.

CO2: Explain the preparation, properties, and applications of thermoplastics & thermosetting, elastomers & conducting polymers.

CO3: Explain calorific values, octane number, refining of petroleum and cracking of oils.

CO4: Explain the setting and hardening of cement.

CO5: Summarize the concepts of colloids, micelle and nanomaterials.

UNIT I Water Technology

Soft and hardwater, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen - Boiler troubles –Priming, foaming**,** scale and sludge, Caustic embrittlement, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, Ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

UNIT II Electrochemistry and Applications

Electrodes –electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion**,** cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT III Polymers and Fuel Chemistry

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization.

Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC Nylon 6,6 and Bakelite.

Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol rubbers.

Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number- alternative fuels- propane, methanol, ethanol and bio fuel-bio diesel.

UNIT IV Modern Engineering Materials

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications
Refractories- Classification, Properties, Factors affecting the refractory materials and Applications.
Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications.
Building materials- Portland Cement, constituents, Setting and Hardening of cement.

UNIT V Surface Chemistry and Nanomaterials

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, synthesis of colloids (Braggs Method), chemical and biological methods of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, adsorption isotherm (Freundlich and Longmuir), BET equation (no derivation) applications of colloids and nanomaterials – catalysis, medicine, sensors, etc.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman, 1992.
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

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ENGINEERING CHEMISTRY LAB

(Common to Civil, Chemical, Mechanical Engineering & allied branches)

Course Objectives:

- To verify the fundamental concepts with experiments

Course Outcomes: At the end of the course, the students will be able to

CO1: Determine the cell constant and conductance of solutions.
CO2: Prepare advanced polymer materials.
CO3: Determine the physical properties like surface tension, adsorption and viscosity.
CO4: Estimate the Iron and Calcium in cement.
CO5: Calculate the hardness of water.

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. Estimation of Dissolved Oxygen by Winkler's method
3. Determination of Strength of an acid in Pb-Acid battery
4. Preparation of a polymer (Bakelite)
5. Determination of percentage of Iron in Cement sample by colorimetry
6. Estimation of Calcium in port land Cement
7. Preparation of nanomaterials by precipitation method.
8. Adsorption of acetic acid by charcoal
9. Determination of percentage Moisture content in a coal sample
10. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
11. Determination of Viscosity of lubricating oil by Redwood Viscometer 2
12. Determination of Calorific value of gases by Junker's gas Calorimeter

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

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CHEMISTRY

(Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

Course Outcomes: At the end of the course, the students will be able to:
CO1: Compare the materials of construction for battery and electrochemical sensors.
CO2: Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.
CO3: Explain the principles of spectrometry, slc in separation of solid and liquid mixtures.
CO4: Apply the principle of Band diagrams in the application of conductors and semiconductors.
CO5: Summarize the concepts of Instrumental methods.

UNIT I Structure and Bonding Models:

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II Modern Engineering materials

Semiconductors – Introduction, basic concept, application

Super conductors-Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

UNIT III Electrochemistry and Applications

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT V Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

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CHEMISTRY LAB

(Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:

- Verify the fundamental concepts with experiments.

Course Outcomes: At the end of the course, the students will be able to

CO1: Determine the cell constant and conductance of solutions.
CO2: Prepare advanced polymer Bakelite materials.
CO3: Measure the strength of an acid present in secondary batteries.
CO4: Analyse the IR spectra of some organic compounds.
CO5: Calculate strength of acid in Pb-Acid battery.

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

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FUNDAMENTAL CHEMISTRY

(Food Technology & allied branches)

Course Objectives:

- To familiarize engineering chemistry and its applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods, molecular machines and switches.

Course Outcomes: At the end of the course, the students will be able to

CO1: Compare the materials of construction for battery and electrochemical sensors.
CO2: Explain the preparation, properties, and applications of thermoplastics &thermosetting, elastomers & conducting polymers.
CO3: Distinguish the principles of spectrometry, solid liquid chromatography in separationof solids and liquid mixtures.
CO4: Apply the principle of Beer Lambert's Law.
CO5: Illustrate conductometric and pH metric titrations.

UNIT I Structure and Bonding Models

Planck's quantum theory, dual nature of matter, Schrodinger wave equation, significance of Ψ and Ψ^2, applications to hydrogen, Molecular Orbital Theory – bonding in homo- and heteronuclear diatomic molecules – Energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II Electrochemistry and Applications

Electrodes –reference electrodes (Calomel electrode, and glass electrode) electrochemical cell, Nernst equation, numerical problems based on cell potential calculations, pH meter and applications of pH metry (acid-base titrations), conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with example.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium and lithium ion batteries-working principle of the batteries including cell reactions; Fuel cells- hydrogen-oxygen fuel cells – basic principle, working, and applications.

UNIT III Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermo settings, Preparation, properties and applications of – PVC, Bakelite, Nylon-6,6, carbon fibres. Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Bio degradable polymers: Poly β-hydroxybutyrate-co-β-hydroxyvalerate(PHBV), poly hydroxyl butyrate(PHB) and applications.

UNIT IV Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation,IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography: Basic principle-Classification of Chromatography-HPLC-principle, Instrumentation, Thin Layer Chromatography (TLC) and applications

UNIT V Surface Chemistry and Nano Materials

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, synthesis of colloids (Braggs Method), chemical and biological methods of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, adsorption isotherm (Freundlich and Longmuir), BET equation (no derivation) applications of colloids and nanomaterials – catalysis, medicine, sensors, etc.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman, 1992.
3. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008

L	T	P	C
0	0	2	1

FUNDAMENTAL CHEMISTRY LAB

(Food Technology & allied branches)

Course Objectives:

- Verify the fundamental concepts with the following experiments.

Course Outcomes: At the end of the course, the students will be able to

CO1: Determine the cell constant and conductance of solutions.
CO2: Prepare advanced polymer materials.
CO3: Measure the strength of an acid present in secondary batteries.
CO4: Analyze the IR spectra of some organic compounds.
CO5: Compare conductometric and pH metric titrations.

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method
2. pH metric titration of strong acid vs strong base,
3. pH metric titration of weak acid vs strong base
4. Conductometric titration of weak acid vs strong base
5. Determination of cell constant and conductance of solutions
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of Bakelite.
8. Determination of viscosity of polymer solution using viscometer
9. Verify Lambert-Beer's law
10. Separation of Organic Mixtures by Thin Layer Chromatography.
11. Identification of simple organic compounds by IR
12. Preparation of nanomaterials by precipitation method.
13. Adsorption of acetic acid by charcoal

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

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3	0	0	3

BASIC CIVIL AND MECHANICAL ENGINEERING

(Common to All branches of Engineering)

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

Course Outcomes: On completion of the course, the student should be able to:

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.

CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.

CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.

CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

UNIT III

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives: The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes: On completion of the course, the student should be able to

CO1: Understand the different manufacturing processes.

CO2: Explain the basics of thermal engineering and its applications.

CO3: Describe the working of different mechanical power transmission systems and power plants.

CO4: Describe the basics of robotics and its applications.

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants.
Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.
Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject.)

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A text book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

1. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.
2. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
3. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
4. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I

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0	0	3	1.5

ENGINEERING WORKSHOP

(Common to All branches of Engineering)

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting, electrical house wiring skills, and basic repairs of two-wheeler vehicle.

Course Outcomes:

CO1: Identify workshop tools and their operational capabilities.
CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
CO3: Apply fitting operations in various applications.
CO4: Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.
9. **Basic repairs of Two-wheeler vehicle** – Demonstration of working of two-wheeler vehicle and its repairs.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

L	T	P	C
3	0	0	3

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to All branches of Engineering)

Course Objectives

To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes: After the completion of the course students will be able to

CO1. Describe fundamental laws, operating principles of motors/generators, MC/MI instruments (L2)
CO2. Demonstrate the working of electrical machines, measuring instruments and power generation stations. (L2)
CO3. Apply mathematical tools and fundamental concepts to derive various equations related to electrical circuits and machines. (L3)
CO4. Calculate electrical load and electricity bill of residential and commercial buildings. (L4)

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

- To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

UNIT I SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction

Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

End examination pattern:

i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1 mark.
iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

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ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

(Common to All branches of Engineering)

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes:

After competition of this course, the student will be able to

CO1. Measure voltage, current and power in an electrical circuit. (L3)
CO2. Measure of Resistance using Wheat stone bridge (L4)
CO3. Discover critical field resistance and critical speed of DC shunt generators. (L4)
CO4. Investigate the effect of reactive power and power factor in electrical loads. (L5)

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hardware tools and instruments are learned to be used by the students.

2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by the students.

3. Components:
   - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.

   - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

Course Outcomes: At the end of the course, the student will be able to
CO1: Identify & testing of various electronic components.
CO2: Understand the usage of electronic measuring instruments.
CO3: Plot and discuss the characteristics of various electron devices.
CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.

8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

L	T	P	C
0	0	2	1

IT WORKSHOP

(Common to all branches of Engineering)

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes:

CO1: Perform Hardware troubleshooting.
CO2: Understand Hardware components and inter dependencies.
CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation.
CO5: Perform calculations using spreadsheets.

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is

no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

L	T	P	C
1	0	4	3

ENGINEERING GRAPHICS

(Common to All branches of Engineering)

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes:

CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
CO3: Understand and draw projection of solids in various positions in first quadrant.
CO4: Explain principles behind development of surfaces.
CO5: Prepare isometric and perspective sections of simple solids.

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings ofobjects including PCB and Transformations using Auto CAD (*Not for end examination*).

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

L	T	P	C
3	0	0	3

INTRODUCTION TO PROGRAMMING

(Common to All branches of Engineering)

Course Objectives:

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

Course Outcomes: A student after completion of the course will be able to

CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO2: Analyse a problem and develop an algorithm to solve it.
CO3: Implement various algorithms using the C programming language.
CO4: Understand more advanced features of C language.
CO5: Develop problem-solving skills and the ability to debug and optimize the code.

UNIT I Introduction to Programming and Problem Solving

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program-Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II Control Structures

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

UNIT III Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

UNIT IV Pointers & User Defined Data types

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT V Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation**.**

Textbooks:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

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COMPUTER PROGRAMMING LAB

(Common to All branches of Engineering)

Course Objectives:

The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

Course Outcomes:

CO1: Read, understand, and trace the execution of programs written in C language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.
CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

UNIT I

WEEK 1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 1: Converting algorithms/flow charts into C Source code.
Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3
Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:
Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.
i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT II

WEEK 4
Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:
Lab4: Simple computational problems using the operator' precedence and associativity
i) Evaluate the following expressions.
    a. A+B*C+(D*E) + F*G
    b. A/B*C-B+A*D/3
    c. A+++B---A
    d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5
Objective: Explore the full scope of different variants of "if construct" namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 5: Problems involving if-then-else structures.
i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

WEEK 6
Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and

for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT III

WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK 9:
Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array

and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

WEEK 10:
Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK 11:
Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:
Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13:
Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:
Tutorial 13: Call by reference, dangling pointers
Lab 13: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:
Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:
Tutorial 14: File handling
Lab 14: File operations

i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-line arguments.
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

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ENGINEERING MECHANICS

(Common to Civil, Mechanical Engineering & Allied branches)

Course Objectives:

- To get familiarized with different types of force systems.
- To draw accurate free body diagrams representing forces and moments acting on a body to analyze the equilibrium of system of forces.
- To teach the basic principles of center of gravity, centroid and moment of inertia and determine them for different simple and composite bodies.
- To apply the Work-Energy method to particle motion.
- To understand the kinematics and kinetics of translational and rotational motion of rigid bodies.

Course Outcomes: On Completion of the course, the student should be able to

CO1: Understand the fundamental concepts in mechanics and determine the frictional forces for bodies in contact.

CO2: Analyze different force systems such as concurrent, coplanar and spatial systems and calculate their resultant forces and moments.

CO3: Calculate the centroids, center of gravity and moment of inertia of different geometrical shapes.

CO4: Apply the principles of work-energy and impulse-momentum to solve the problems of rectilinear and curvilinear motion of a particle.

CO5: Solve the problems involving the translational and rotational motion of rigid bodies.

UNIT I

Introduction to Engineering Mechanics– Basic Concepts. Scope and Applications

Systems of Forces: Coplanar Concurrent Forces– Components in Space–Resultant–Moment of Force and its Application –Couples and Resultant of Force Systems.

Friction: Introduction**,** limiting friction and impending motion, Coulomb'slaws of dryfriction, coefficient of friction, Cone of Static friction.

UNIT II

Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorm, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

Principle of virtual work with simple examples

UNIT III

Centroid: Centroids of simple figures (from basic principles)–Centroids of Composite Figures.

Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems.

Area Moments of Inertia: Definition– Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.
Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies.

UNIT IV

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics –D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method.

UNIT V

Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method.

Textbooks:

1. Engineering Mechanics, S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., , McGraw Hill Education 2017. 5th Edition.
2. Engineering Mechanics, P.C.Dumir- S.Sengupta and Srinivas V veeravalli , University press. 2020. First Edition.
3. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age international publications 2018. 4th Edition.

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education. 2017. First Edition.
2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., PHI, 2002. 4th Edition.
3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L. G. Kraige., John Wiley, 2008. 6th Edition.
4. Introduction to Statics and Dynamics, Basudev Battachatia, Oxford University Press, 2014. Second Edition
5. Engineering Mechanics: Statics and Dynamics, Hibbeler R.C., Pearson Education, Inc., New Delhi, 2022, 14th Edition

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ENGINEERING MECHANICS & BUILDING PRACTICES LAB

(Civil Engineering & allied branches)

Course Objectives: The students completing the course are expected to

- Verify the Law of Parallelogram of Forces and Lami's theorem.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Understand the layout of a building, concepts of Non-Destructive Testing and different Alternative Materials.

Course Outcomes: On completion of the course, the student should be able to:

CO1: Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.

CO2: Verify Law of Parallelogram of forces and Law of Moment using force polygon and bell crank lever.

CO3: Determine the Centre of gravity different configurations and

CO4: Understand the Quality Testing and Assessment Procedures and principles of Non-Destructive Testing.

CO5: Exposure to safety practices in the construction industry.

Students have to perform any 10 of the following Experiments:

1. To study various types of tools used in construction.
2. Forces in Pin Jointed Trusses
3. Experimental Proof of Lami's Theorem
4. Verification of Law of Parallelogram of Forces.
5. Determination of Center of Gravity of different shaped Plane Lamina.
6. Determination of coefficient of Static and Rolling Friction.
7. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever
8. Study of Alternative Materials like M-sand, Fly ash, Sea Sand etc.
9. Field-Visit to understand the Quality Testing - report.
10. Safety Practices in Construction industry
11. Demonstration of Non-Destructive Testing - using Rebound Hammer & UPV
12. Study of Plumbing in buildings.

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ENGINEERING MECHANICS LAB

(Mechanical Engineering & allied branches)

Course Objectives: The students completing the course are expected to:

- Verify the Law of Parallelogram and Triangle of Forces.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Analyse the system of Pulleys and Moment of Inertia of Compound Pendulum and Flywheel.

Course Outcomes:

CO1: Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.
CO2: Verify Law of Polygon of forces and Law of Moment using force polygon and bell crank lever.
CO3: Determine the Centre of gravity and Moment of Inertia of different configurations.
CO4: Verify the equilibrium conditions of a rigid body under the action of different force systems.

Students have to perform any 10 of the following Experiments:

List of Experiments:

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

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ELECTRICAL CIRCUIT ANALYSIS -I

(EEE & allied branches)

Course Objectives:

To develop an understanding of the fundamental laws, elements of electrical circuits and to apply circuit analysis to DC and AC circuits.

Course Outcomes:

CO1: Remembering the basic electrical elements and different fundamental laws.
CO2: Understand the network reduction techniques, transformations, concept of self-inductance and mutual inductance, phasor diagrams, resonance and network theorems.
CO3: Apply the concepts to obtain various mathematical and graphical representations.
CO4: Analyse nodal and mesh networks, series and parallel circuits, steady state response, different circuit topologies (with R, L and C components).
CO5: Evaluation of Network theorems, electrical, magnetic and single-phase circuits.

UNIT I INTRODUCTION TO ELECTRICAL CIRCUITS

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources, node and mesh analysis.

UNIT II MAGNETIC CIRCUITS

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

UNIT III SINGLE PHASE CIRCUITS

Characteristics of periodic functions, Average value, R.M.S. value, form factor, representation of a sine function, concept of phasor, phasor diagrams, node and mesh analysis. Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit.

UNIT IV RESONANCE AND LOCUS DIAGRAMS

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth; Locus diagram: RL, RC, RLC with R, L and C variables.

UNIT V NETWORK THEOREMS (DC & AC EXCITATIONS)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem

Textbooks:

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

Reference Books:

1. Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition
2. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.
3. Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition.
4. Introductory Circuit Analysis, Robert L Boylestad, Pearson Publications, 2023, Fourteenth Edition.
5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, Seventh Revised Edition.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2. https://nptel.ac.in/courses/108104139
3. https://nptel.ac.in/courses/108106172
4. https://nptel.ac.in/courses/117106108

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ELECTRICAL CIRCUITS LAB

(EEE & allied branches)

Course Objectives:

To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics. It also gives practical exposure to the usage of different circuits with different conditions.

Course Outcomes:

CO1: Understand the concepts of network theorems, node and mesh networks, series and parallel resonance and Locus diagrams.
CO2: Apply various theorems to compare practical results obtained with theoretical calculations.
CO3: Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil.
CO4: Analyse different circuit characteristics with the help of fundamental laws and various configurations.
CO5: Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.

List of Experiments:

1. Verification of Kirchhoff's circuit laws.
2. Verification of node and mesh analysis.
3. Verification of network reduction techniques.
4. Determination of cold and hot resistance of an electric lamp
5. Determination of Parameters of a choke coil.
6. Determination of self, mutual inductances, and coefficient of coupling
7. Series and parallel resonance
8. Locus diagrams of R-L (L Variable) and R-C (C Variable) series circuits
9. Verification of Superposition theorem
10. Verification of Thevenin’s and Norton’s Theorems
11. Verification of Maximum power transfer theorem
12. Verification of Compensation theorem
13. Verification of Reciprocity and Millman’s Theorems

Reference Books:

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

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NETWORK ANALYSIS

(ECE & allied branches)

Course Objectives:

- To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits
- To impart knowledge on applying appropriate theorem for electrical circuit analysis
- To explain transient behavior of circuits in time and frequency domains
- To teach concepts of resonance
- To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1: Understand basic electrical circuits with nodal and mesh analysis.
CO2: Analyse the circuit using network simplification theorems.
CO3: Find Transient response and Steady state response of a network.
CO4: Analyse electrical networks in the Laplace domain.
CO5: Compute the parameters of a two-port network.

UNIT I

Types of circuit components, Types of Sources and Source Transformations, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also. Principal of Duality with examples.

Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens - problem solving using dependent sources also.

UNIT II

Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots.

Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform.

UNIT III

Steady State Analysis of A.C Circuits: Impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also.

UNIT IV

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies.

Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

UNIT V

Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also.

Image and iterative impedances. Image and iterative transfer constants. Insertion loss. Attenuators and pads. Lattice network and its parameters. Impedance matching networks.

Textbooks:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI

Reference Books:

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education.

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NETWORK ANALYSIS AND SIMULATION LABORATORY

(ECE & allied branches)

Course Objectives:

- To gain hands on experience in verifying Kirchoff's laws and network theorems
- To analyze transient behavior of circuits
- To study resonance characteristics
- To determine 2-port network parameters

Course Outcomes:

CO1: Verify Kirchoff's laws and network theorems.
CO2: Measure time constants of RL & RC circuits.
CO3: Analyze behavior of RLC circuit for different cases.
CO4: Design resonant circuit for given specifications.
CO5: Characterize and model the network in terms of all network parameters.

The following experiments need to be performed using both Hardware and simulation Software.

The experiments need to be simulated using software and the same need to be verified using the hardware.

1. Study of components of a circuit and Verification of KCL and KVL.
2. Verification of mesh and nodal analysis for AC circuits
3. Verification of Superposition, Thevenin's & Norton theorems for AC circuits
4. Verification of maximum power transfer theorem for AC circuits
5. Verification of Tellegen's theorem for two networks of the same topology.
6. Study of DC transients in RL, RC and RLC circuits
7. To study frequency response of various 1^{st} order RL & RC networks
8. To study the transient and steady state response of a 2^{nd} order circuit by varying its various parameters and studying their effects on responses
9. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit.
10. Determination of open circuit (Z) and short circuit (Y) parameters
11. Determination of hybrid (H) and transmission (ABCD) parameters
12. To measure two port parameters of a twin-T network and study its frequency response.

Hardware Requirements:

Regulated Power supplies, Analog/Digital Function Generators, Digital Multimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components

Software requirements:

Multisim/ Pspice/Equivalent simulation software tool, Computer Systems with required specifications

References:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.

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DATA STRUCTURES

(Common to CSE, IT & allied branches)

Course Objectives:

- To provide the knowledge of basic data structures and their implementations.
- To understand importance of data structures in context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem solving.

Course Outcomes: At the end of the course, Student will be able to

CO1: Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.

CO2: Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.

CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.

CO4: Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.

CO5: Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.

CO6: Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

UNIT I

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort

UNIT II

Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT III

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

UNIT IV

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

UNIT V

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal

Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

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DATA STRUCTURES LAB

(Common to CSE, IT & allied branches)

Course Objectives:

The course aims to strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures.

Course Outcomes: At the end of the course, Student will be able to

CO1: Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
CO2: Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
CO4: Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues and apply them appropriately to solve data management challenges.
CO5: Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

List of Experiments:

Exercise 1: Array Manipulation

i) Write a program to reverse an array.
ii) C Programs to implement the Searching Techniques – Linear & Binary Search
iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

i) Implement a singly linked list and perform insertion and deletion operations.
ii) Develop a program to reverse a linked list iteratively and recursively.
iii) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

i) Create a program to detect and remove duplicates from a linked list.
ii) Implement a linked list to represent polynomials and perform addition.
iii) Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

i) Implement a doubly linked list and perform various operations to understand its properties and applications.
ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

i) Implement a stack using arrays and linked lists.
ii) Write a program to evaluate a postfix expression using a stack.
iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

i) Implement a queue using arrays and linked lists.
ii) Develop a program to simulate a simple printer queue system.
iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

i) Use a stack to evaluate an infix expression and convert it to postfix.
ii) Create a program to determine whether a given string is a palindrome or not.
iii) Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Search Tree

i) Implementing a BST using Linked List.
ii) Traversing of BST.

Exercise 9: Hashing

i) Implement a hash table with collision resolution techniques.
ii) Write a program to implement a simple cache using hashing.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.

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HEALTH AND WELLNESS, YOGA AND SPORTS

(Common to All branches of Engineering)

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.
CO2: Demonstrate an understanding of health-related fitness components.
CO3: Compare and contrast various activities that help enhance their health.
CO4: Assess current personal fitness levels.
CO5: Develop Positive Personality

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
   Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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0	0	1	0.5

NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

(Common to All branches of Engineering)

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes: After completion of the course the students will be able to

CO1: Understand the importance of discipline, character and service motto.
CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3: Explore human relationships by analyzing social problems.
CO4: Determine to extend their help for the fellow beings and downtrodden people.
CO5: Develop leadership skills and civic responsibilities.

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III Community Service

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.

ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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ACADEMIC REGULATIONS (R20)

COURSE STRUCTURE & DETAILED SYLLABUS

For

B. Tech FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2020-21)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533003, ANDHRA PRADESH, INDIA

ACADEMIC REGULATIONS (R20) FOR B. TECH. (REGULAR)

Applicable for students of B. Tech. (Regular) from Academic Year 2020-21 onwards

Jawaharlal Nehru Technological University Kakinada (JNTUK) 2020 Regulations (R20 Regulations) applicable to all affiliated colleges are given hereunder. These regulations govern the B. Tech programmes offered by all affiliated colleges with effect from the students admitted to the programmes in academic year 2020-21.

1. Courses of study:

The following courses of study are offered at present as specializations for the B. Tech. Courses in the jurisdiction of all affiliated colleges of JNTUK.

S. No	Branch	Short Name	Code
1	Civil Engineering	CE	01
2	Electrical & Electronics Engineering	EEE	02
3	Mechanical Engineering	ME	03
4	Electronics and Communication Engineering	ECE	04
5	Computer Science Engineering	CSE	05
6	Computer Science & Technology	CST	06
7	Electronics and Instrumentation Engineering	EIE	10
8	Information Technology	IT	12
9	Automobile Engineering	AME	24
10	Mining Engineering	MM	26
11	Petroleum Engineering	PE	27
12	Agriculture Engineering	AGE	35
13	Artificial Intelligence and Machine Learning	AIML	42
14	Artificial Intelligence	AI	43
15	Data Science	DS	44
16	Artificial Intelligence and Data Science	AIDS	45
17	Cyber Security	CS	46
18	Internet of things and Cyber security including Block chain Technology	IOTCSBT	47
19	Computer Science and Business System	CSBS	48
20	Internet of Things	IOT	49
21	Electronics & Communication Technology	ECT	50
22	Food Engineering	FE	51

2. **Medium of Instruction:** The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in **English** only.

3. **Admissions:** Admission to the B. Tech Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or on the basis of any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. Programme Pattern:

a) Total duration of the of B. Tech (Regular) Programme is four academic years
b) Each Academic year of study is divided in to **two semesters**.
c) Minimum number of instruction days in each semester is 90.
d) Grade points, based on percentage of marks awarded for each course will form the basis forcalculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
e) The total credits for the Programme are 160.
f) A three-week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.
g) Student is introduced to "Choice Based Credit System (CBCS)".
h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)
i) A student has to register for all courses in a semester.
j) All the registered credits will be considered for the calculation of final CGPA.
k) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.
l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.
m) All students shall be mandatorily registered for NCC/NSS activities.
n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

5. Subject/Course Classification: All subjects/courses offered for the undergraduate programme in E & T (B. Tech degree programmes) are broadly classified as follows.

S.No	Category	Code	APSCHE breakup of Credits	AICTE Credits of breakup
1	Humanities and social science including Management courses	HSMC	10.5	12
2	Basic Science courses	BSC	21	25
3	Engineering courses science	ESC	24	24
4	Professional core Courses	PCC	51	48
5	Open Elective Courses	OEC	12	18
6	Professional Courses Elective	PEC	15	18
7	Internship, seminar, project work	PROJ	16.5	15
8	Skill Oriented Courses	SC	10	-
9	Laboratory Courses	LC	-	-
10	Mandatory courses	MC	Non-credit	Non-credit
Total Credits			160	160

6. Registration for Courses:

i) The college shall invite registration forms from the students at the beginning of the semester for the registration for courses each semester. The registration process shall be closed within one week. If any student wishes to withdraw the registration, he/she shall submit a letter to the principal through the class teacher/instructor and HOD. The principal shall communicate the registration and withdraw details courses of each student in a consolidated form to the college examination section andUniversity without fail.

ii) There are four open electives in each branch. All Open Electives are offered to students of all branches in general. A student shall choose an open elective, by consulting the HOD/advisor, from thelist in such a manner that he/she has not studied the same course in any form during the Programme.

iii) A student shall be permitted to pursue up to a maximum of two elective courses under MOOCs during the programme. Students are advised to register for only for minimum 12 weeks in duration MOOCs courses. Student has to pursue and acquire a certificate for a MOOC course only from the SWAY/NPTE through online with the approval of Head of the Department in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester. The details of the MOOCs courses registered by the students shall be submitted to the University examination center as well as college examination center. The Head of the Department shall appoint a mentor for each of the MOOC subjects registered by the students to monitor the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

iv) Two summer internships each with a minimum of six weeks duration shall be mandatorily done/completed respectively at the end of second and third years (during summer vacations). The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs. After completing the summer internship, the students shall register in the immediate respective oddsemester and it will be evaluated at the end of the semester as per norms of the university. The student has to produce the summer internship satisfactory report and certificate taken from the organization to be considered for evaluation. The College shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat andcomplete the internship.

v) In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester thecandidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

vi) Curricular Framework for Skill oriented courses

   a) There are five (05) skill-oriented courses shall be offered during III to VII semesters and students must register and pass the courses successfully.
   b) For skill oriented/skill advanced course, one theory and 2 practical hours (1-0-2) or two theory hours (2-0-0) may be allotted as per the decision of concerned BOS.
   c) Out of the five skill courses; (i) two shall be skill-oriented courses from the same domain and shall be completed in second year (ii) Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or job-oriented skill courses, which can be of inter disciplinary nature.
   d) Students may register the interdisciplinary job-oriented skill courses based on the prerequisites and eligibility in consultation with HOD of the college.

e) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies. However, the department has to assign mentors in the college to monitor the performance of the students.

f) If a student chooses to take a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, then the department shall mark overall attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatoryattendance requirements upon producing a valid certificate. However, the student is deemed to have fulfilled the attendance requirement of the course, if the external agency issues a certificate with satisfactory condition. If the certificate issued by external agency is marked with unsatisfactory condition, then the student shall repeat the course either in the college or at external agency. The credits will be awarded to the student upon producing the successful Course Completion Certificate from the agency/professional bodies and after passing in the viva-voce examination conducted at college as per university norms at the end of the semester.

7. (a) Award of B. Tech. Degree: A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

i) A student shall be declared eligible for award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years.

ii) After eight academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.

iii) The student shall register for 160 credits and must secure all the 160 credits.

iv) All students shall register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer during second and third semesters. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

v) Courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

vi) Credit Definition:

1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
1 Hour Practical (P) per week	0.5 Credit
2 Hours Practical (Lab) per week	1 Credit

(b) Award of B. Tech. (Honor)/B. Tech. (Minor): B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. The regulations/guidelines are separately provided. Registering for Honors/Minor is optional.

8. Attendance Requirements

a) A student is eligible to write the University examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) may be granted by the College Academic Committee. However, this condonation concession is applicable only to any two semesters during the entire programme.

c) Shortage of Attendance below 65% in aggregate shall not be condoned.

d) A student who is short of attendance in a semester may seek re-admission into that semester when offered within 4 weeks from the date of commencement of class work.

e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

f) A stipulated fee of Rs. 500/- in the concerned semester shall be payable towards condonation of shortage of attendance. Students availing condonation on medical ground shall produce a medical certificate issued by the competitive authority.
g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.
h) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
i) For induction programme attendance shall be maintained as per AICTE norms.
j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

9. Evaluation-Distribution and Weightage of marks

(i) Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the University Examination section from time to time.

(ii) For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

(iii) A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/ project etc by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the sum total of the internal marks and end semester examination marks together.

(iv) Distribution and Weightage of marks:

The assessment of the student's performance in each course will be based on Continuous Internal Evaluation (CIE) and Semester-End Examination (SEE). The performance of a student in each semester shall be evaluated subject–wise with a maximum of 100 marks for theory subject and 50 marks for practical subject. For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Examinations.

S. No	Components	Internal	External	Total
1	Theory	30	70	100
2	Engineering Graphics/Design/Drawing	30	70	100
3	Practical	15	35	50
4	Mini Project/Internship/Industrial Training/ Skill Development programmes/Research Project	–	50	50
5	Project Work	60	140	200

(v) Continuous Internal Theory Evaluation:

(a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (ii) one descriptive examination and (iii) one assignment. The online examination (objective) shall be 10 marks and descriptive examination shall be for 15 marks with a total duration of 1 hour 50 minutes (20 minutes for objective and 90 minutes for descriptive paper).

(b) The first online examination (objective) is set with 20 multiple choice questions for 10 marks (20 questions x ½ marks) from first two and half units (50% of the syllabus) and it is conducted by **University Examination Section.** The descriptive examination is set with 3 full questions for 5 marks each from first two and half units (50% of the syllabus), the student has to answer all questions. In the similar lines, the second online and descriptive examinations shall be conducted on the rest of the syllabus.

(c) The assignment is given by the concerned class teacher for five marks from first two and half units (50% of the syllabus). The second assignment shall be given from rest of the syllabus. The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination.

(d) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The first mid marks (Mid-1) consisting of marks of online objective examination, descriptive examination and assignment shall be submitted to the University examination section within one week after completion of first mid examination.

(e) The mid marks submitted to the University examination section shall be displayed in the concerned college notice boards for the benefit of the students.

(f) If any discrepancy found in the submitted Mid-1 marks, it shall be brought to the notice of university examination section within one week from the submission.

(g) Second mid marks (Mid-2) consisting of marks of online objective examination, descriptive

examination and assignment shall also be submitted to University examination section within one week after completion of second mid examination and it shall be displayed in the notice boards. If any discrepancy found in the submitted mid-2 marks, it shall be brought to the notice of university examination section within one week from the submission.

(h) Internal marks can be calculated with 80% weightage for better of the two mids and 20% Weightage for another mid exam.

Example:

Mid-1 marks = Marks secured in (online examination-1+descriptive examination-1 +one assignment-1)

Mid-2 marks = Marks secured in (online examination-2+descriptive examination-2 +one assignment-2)

Final internal Marks = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

(i) With the above criteria, university examination section will send mid marks of all subjects in consolidated form to all the concerned colleges and same shall be displayed in the concerned college notice boards. If any discrepancy found, it shall be brought to the notice of university examination section through proper channel within one week with all proofs. Discrepancies brought after the given deadline will not be entertained under any circumstances.

(vi) Semester End Theory Examinations Evaluation:

(a) The semester end examinations will be conducted university examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

(b) For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows: day to day work - 5 marks, Record-5 marks and the remaining 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner appointed by controller of examinations, JNTUK.

Note: Laboratory marks and the internal marks awarded by the College are not final. The marks are subject to scrutiny and scaling by the University wherever felt desirable. The internal and laboratory marks awarded by the College will be referred to a Committee. The Committee shall arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding. All the laboratory records and internal test papers shall be preserved in respective departments as per University norms and shall be produced to the Committees of University as and when they ask for.

(c) For the subject having design and / or drawing (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester for 15 marks each and final marks can be calculated with 80% weightage for better of the two tests and 20% weightage for other test and these are to be added to the marks obtained in day-to-day work.

(d) Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. Students shall pursue this internship during summer vacation just before its offeringas per course structure. The minimum duration of this course shall be at least 6 weeks. The student shall register for the internship as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the University. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner appointed by the University; Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages respectively. It shall be evaluated for 50 external marks at the end of

the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

(e) The job-oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the on the list skills learned. If the student completes job-oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external (appointed by the university) and internal examiner (course instructor or mentor). There are no internal marks for the job-oriented skill courses.

(f) Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% ofthe marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.

(g) **Procedure for Conduct and Evaluation of MOOC:** There shall be a Discipline CentricElective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn acertificate by passing the exam. The student will be awarded the credits given in curriculum onlyby submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

(h) *Major Project (*Project - Project work, seminar and internship in industry):

In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior facultyand HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the University and is evaluated for 140 marks.

10. Integrated theory lab:

a. The integrated course is in the ratio of 2:1 (total credit: 3).
b. Attendance shall be counted for both in theory as well as lab (75:25 ratio). Minimum attendance shall be required individually in theory and lab as per university norms
c. Student has to attend the internal examination and external examination conducted by the college and University as per the regulations.
d. Student has to pass individually both the external examinations (Theory for 100 marks and Lab for 50 marks) conducted by the University as per the regulations.
e. If the student fails in either theory or laboratory, the final result is FAIL only.
f. The student has to pass separately both in the external theory examination and external lab examination as per the University regulations.

11. Recounting of Marks in the End Semester Examination: A student can request for recounting of his/her answer book on payment of a prescribed fee as per university norms.

12. Re-evaluation or Revaluation by Challenge of the End Semester Examination: A student can request for Revaluation or Revaluation by Challenge of his/her answer book on payment of a prescribed fee as per university norms.

13. Supplementary Examinations: A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the University.

14. Malpractices in Examinations: Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the University.

15. Promotion Rules

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.8 for promotion to higher classes

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement as per University norm.

b) A student will be promoted from II to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether ornot the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

a) A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

16. Course Pattern

a) The entire course of study is for four academic years; all years are on semester pattern.

b) A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.

c) When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

17. Earning of Credit:

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range A+ to E as given below. Letter grade 'F' in any course implies failure of the student in that course and no credits earned. Absent is also treated as no credits earned. For project same % percentages will be followed for grading.

Marks Range Theory (Max – 100)	Marks Range Lab (Max – 50)	Level	Letter Grade	Grade Point
≥ 90	≥ 45	Outstanding	A+	10
≥80 to <89	≥40 to <44	Excellent	A	9
≥70 to <79	≥35 to <39	Very Good	B	8
≥60 to <69	≥30 to <34	Good	C	7
≥50 to <59	≥25 to <29	Fair	D	6
≥40 to <49	≥20 to <24	Satisfactory	E	5
<40	<20	Fail	F	0
-		Absent	AB	0

18. Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

(i) ***SGPA***(S_k) of k^{th} semester (1 to 8) is ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the total number of credits of all the courses undergone/registered by a student, i.e.,

$$SGPA(S_k) = \frac{\sum_{i=1}^{n}(C_i \times G_i)}{\sum_{i=1}^{n} C_i}$$

Where C_i is the number of credits of the i^{th} course/subject in a semester and G_i is the

grade point scored by the student in the i^{th} course/subject and n is the number of courses/subjects registered in that semester.

CGPA: The CGPA is calculated in the same manner taking into account all the '*m'* courses/subjectsregistered by student over all the semesters of a Programme i.e., in all eight semesters

$$CGPA = \frac{\sum_{i=1}^{m}(C_i \times S_i)}{\sum_{i=1}^{m} C_i}$$

Where S_i is SGPA of the i^{th} semester and C_i is total number of credits in that semester.

(ii) SGPA and CGPA shall be rounded off to 2 decimal points and reported in transcripts.

(iii) While computing the SGPA/CGPA, the subjects in which the student is awarded Zero grade points will also be included.

(iv) *Grade Point:* It is a numerical weight allotted to each letter grade on a 10-point scale.

(v) *Letter Grade:* It is an index of the performance of students in a said course. Grades are denoted by letters A+, A, B, C, D, E, F and AB.

(vi) As per AICTE regulations, conversion of CGPA into equivalent percentage as follows:

Equivalent Percentage = (CGPA – 0.75) x 10

(vii) Illustration of Computation of SGPA and CGPA

Illustration for **SGPA:** Let us assume there are 6 subjects in a semester. The grades obtained as follows:

Course	Credit	Grade Obtained	Grade point	S_i= Credit Point (Credit x Grade)
Subject 1	3	B	8	3 X 8 = 24
Subject 2	4	C	7	4 X 7 = 28
Subject 3	3	D	6	3 X 6 = 18
Subject 4	3	A+	10	3 X 10 = 30
Subject 5	3	E	5	3 X 5 = 15
Subject 6	4	D	6	4 X 6 = 24
	20			139

Thus, **SGPA =139/20 =6.95=6.9 (approx.)**

Illustration for **CGPA:**

Semester 1	**Semester 2**	**Semester 3**	**Semester 4**
Credits: 20 SGPA: 6.9	Credits: 22 SGPA: 7.8	Credits: 25 SGPA: 5.6	Credits: 26 SGPA: 6.0
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
Credits: 26 SGPA: 6.3	Credits: 25 SGPA: 8.0	Credits: 21 SGPA: 6.4	Credits: 23 SGPA: 7.5

Thus,

$$CGPA = \frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0 + 21 \times 6.4 + 23 \times 7.5}{188} = \frac{1276.3}{188} = 6.78$$

19. Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

20. Minimum Instruction Days

The minimum instruction days for each semester shall be 90 working days. There shall be no branch transfers after the completion of the admission process. There shall be no transfer from one college/stream to another within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Kakinada.

21. Withholding of Results

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

22. Transitory Regulations

(a) Discontinued or detained candidates are eligible for re-admission as and when next offered.

(b) The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.

(c) (i) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.

(ii) The students seeking transfer to colleges affiliated to JNTUK from various other Universities / Institutions have to obtain the credits of any equivalent subjects as prescribed by JNTUK. In addition, the transferred candidates have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by JNTUK.

23. Gap - Year

Gap Year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I/II/III yearto pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

24. General

(a) Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

(b) The academic regulation should be read as a whole for the purpose of any interpretation.

(c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

(d) The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

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ACADEMIC REGULATIONS (R20) FOR B. TECH (LATERAL ENTRY SCHEME)

Applicable for students admitted into II B. Tech. from the Academic Year 2020-21 onwards

1 **Award of B. Tech. Degree**

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

a) A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years. After six academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.

b) The candidate shall register for 121 credits and secure all the 121 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech (lateral entry).

3. Promotion Rule

A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. Award of Class

After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 121 Credits from II Year to IV Year
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

5. All the other regulations as applicable to **B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)**.

COMMUNITY SERVICE PROJECT

Introduction

1. Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
2. Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
3. Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the collegestudents for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsibleinstitution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever thereis an exigency when students cannot pursue their summer internships. The specific objectives are;

1. To sensitize the students to the living conditions of the people who are around them,
2. To help students to realize the stark realities of the society.
3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
6. To help students to initiate developmental activities in the community in coordination with public and government authorities.
7. To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

1. Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation.
2. Each class/section should be assigned with a mentor.
3. Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
4. A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
5. The log book has to be countersigned by the concerned mentor/faculty in charge.
6. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
7. The final evaluation to be reflected in the grade memo of the student.
8. The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
9. Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
10. Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

1. A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
2. The Community Service Project is a twofold one –
   a) First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
   b) Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

- Agriculture
- Health
- Marketing and Cooperation
- Animal Husbandry
- Horticulture
- Fisheries
- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

1. Positive impact on students' academic learning
2. Improves students' ability to apply what they have learned in "the real world"
3. Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
4. Improved ability to understand complexity and ambiguity

Personal Outcomes

1. Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
2. Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

1. Reduced stereotypes and greater inter-cultural understanding
2. Improved social responsibility and citizenship skills
3. Greater involvement in community service after graduation

Career Development

1. Connections with professionals and community members for learning and career opportunities

2. Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

1. Stronger relationships with faculty
2. Greater satisfaction with college
3. Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

1. Satisfaction with the quality of student learning
2. New avenues for research and publication via new relationships between faculty and community
3. Providing networking opportunities with engaged faculty in other disciplines or institutions
4. A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

1. Improved institutional commitment
2. Improved student retention
3. Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

1. Satisfaction with student participation
2. Valuable human resources needed to achieve community goals
3. New energy, enthusiasm and perspectives applied to community work
4. Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection

20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilization of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complimenting the community service project, the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are;

Programmes for School Children

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programmes for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharat
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

Programmes for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programmes

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture
    vi. Fisheries
    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
    xiv. Energy

Role of Students:

1. Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
2. For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
3. As and when required the College faculty themselves act as Resource Persons.
4. Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
5. And also, with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
6. An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. **Preliminary Survey (One Week)**
    a) A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
    b) A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
    c) The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.
2. ***Community Awareness Campaigns (Two Weeks)***

Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. ***Community Immersion Programme (Four Weeks)***

Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. ***Community Exit Report (One Week)***

During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall,any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In caseof outsiders, they will be handed over to the police and a policecase is registered against them.

	other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action and impose suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show because notice shall be issued to the college.
   - (ii) Impose a suitable fine on the college.
   - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

* * * * *

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

ABSOLUTELY NO TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

Jawaharlal Nehru Technological University Kakinada
For Constituent Colleges and Affiliated Colleges of JNTUK

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

SIRC.R.REDDYCOLLEGEOFENGINEERINGELURU-534007, WEST GODAVARI DIST, A P.,INDIA

(Approved by AICTE, New Delhi, Accredited by NBA)Phoneno:08812-230840,2300656Fax:08812- 224193

Visitusathttp://www.sircrrengg.ac.in

DEPARTMENTOFCOMPUTER SCIENCENDENGINEERING

R20Series JNTUK CO's

COURSE	CODE	C.O CODE	COURSE OUTCOME DESCRIPTION
Communicative English	HS1101	CO1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
		CO2	Employ knowledge of grammatical structures and vocabulary in speech and writing
		CO3	Apply effective communication skills to enhance professional possibilities.
		CO4	Develop acceptable personality traits suitable for chosen profession.
Mathematics - I (Calculus And Differential Equations)	BS1101	CO1	Examine the convergence of series and apply mean value theorem to real life problem.
		CO2	Solve the Differential Equations of first and higher order related to various engineering applications.
		CO3	Apply the partial differentiation technique to solve physical problem
		CO4	Apply double and triple integrals to find areas and volumes.
Applied Physics	BS1102	CO1	Apply the knowledge of different optical phenomena in daily life.
		CO2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibers.
		CO3	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
		CO4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
		CO5	Understand electrons& holes behavior in semiconductors and extraordinary behavior of materials at various transition temperatures

Programming for Problem Solving using C	ES1101	CO1	Apply the basic concepts of C Programming for problem-solving and different number systems.
		CO2	To use different operators, write programs that use control statements for a given problem.
		CO3	Illustrate the concepts of Homogeneous and heterogeneous data types, pointers and file system for solving mathematical and engineering problems.
		CO4	Decompose a given problem into functions and to develop modular reusable code.
Computer Engineering Workshop	ES1102	CO1	Apply knowledge for Computer Assembling and Software installation
		CO2	Understand and implement Unix commands
		CO3	Ability to effectively use Internet, World Wide Web(WWW) and Web browsers
		CO4	Apply the tools for MS-Word, PowerPoint , Excel and PDF documentation
English Communication Skills Laboratory	HS1102	CO1	Recognize the sounds of English with the help of audio visual aids
		CO2	Build confidence and overcome inhibitions while speaking in English.
		CO3	Demonstrate acquired language skills in performing the designated activity.
Applied Physics Lab	BS1103	CO1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
		CO2	Analyze various electronic circuits and study the temperature dependence of semiconductors.
		CO3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fibre
Programming for Problem Solving using C Lab	ES1103	CO1	Describe the basics of computer and understand the problem-solving aspect.
		CO2	Design and develop C program to evaluate simple expressions and logical operations.
		CO3	Develop & Implement C programs with suitable modules to solve the given problem.
		CO4	Demonstrate the concept of pointer and perform I/O operations in files.
Mathematics – II (Linear Algebra And Numerical Methods)	BS1201	CO1	Solve system of linear algebraic equations and apply Eigen value computation technics to reduce a given quadratic to canonical form
		CO2	Solve algebraic and Transcendental equations by using Numerical methods
		CO3	Apply Newton 's forward and backward interpolation and Lagrange's formula for equal and unequal intervals.
		CO4	Compute numerical solutions of differential equations.

Applied Chemistry	BS1202	CO1	Identify the advantages and limitations of Plastic materials, Elastomers and their use in day to day life.
		CO2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
		CO3	Recognize the need of nano materials, liquid crystals, semiconductors and super conductors.
		CO4	Gain the knowledge of applications of different analytical instruments and generation of electricity from various Non-Conventional energy sources.
		CO5	Obtain the knowledge of computational chemistry and molecular machines.
Computer Organization	ES1201	CO1	Recall the internal organization of computers, CPU,I/O and its main components
		CO2	Relate postulates of Boolean algebra and basic computer organization design
		CO3	Design and analyze combinational and sequential circuits and basics of I/O organization
Python Programming	ES1202	CO1	Understand the need for learning basic concepts of Python programming language
		CO2	Apply various data structures in developing solutions to real time scenarios
		CO3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.
		CO4	Apply the usage of pattern matching, GUI in python programming.
Data Structures	CS1201	CO1	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
		CO2	Apply the different linear data structures like stack and queue to various computing problems
		CO3	Implement different types of trees, heaps and apply them to problem solutions
		CO4	Identify different non linear data structures to analyze the performance of an algorithm.
Applied Chemistry Lab	BS1203	CO1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
		CO2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, KMnO4 and Copper using different indicators.
		CO3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
		CO4	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.
Python Programming Lab	ES1203	CO1	Understand the need for learning basic concepts of Python programming language
		CO2	Apply various data structures in developing solutions to real time scenarios
		CO3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.

		CO4	Design the usage of pattern matching, GUI in python programming.
Data Structures Lab	CS1202	CO1	Implement different sorting and searching algorithms
		CO2	Implement the stack, Queue and their applications
		CO3	Implement various types of linked lists and their applications
		CO4	Perform basic operations on trees and graphs and determine minimum spanning tree
Mathematics III	R2021011	CO1	Apply the concepts of vector calculus to the problems of work done by a force, circulation and flux
		CO2	Apply Laplace Transforms to solve linear differential equations with constant coefficients.
		CO3	Compute Fourier series of the periodic function and apply Fourier transform to a range of non-periodic function.
		CO4	Solve the first and higher order of partial differential equations and apply to various engineering problems
		CO5	
		CO6	
Object Oriented Programming through C++	R2021051	CO1	Apply the basics of programming in the C++ language and differentiate object-oriented programming and procedural programming.
		CO2	Apply C++ features such as composition of objects, operator overloading, dynamic memory allocation and inheritance.
		CO3	Apply virtual and pure virtual function & complex programming situations
		CO4	Apply generic programming and exception handling techniques.
		CO5	Build C++ classes using appropriate encapsulation and design principles.
		CO6	
Operating Systems	R2021052	CO1	Understand the basic principles of operating systems.
		CO2	Analyze the process management policies and its scheduling by CPU.
		CO3	Analyze the memory management and its allocation policies and file systems.
		CO4	Analyze the mechanisms used for process synchronization, deadlock prevention and detection.
		CO5	Understand system security and protection mechanisms in operating systems like UNIX/LINUX and Windows.
		CO6	
Software Engineering	R2021053	CO1	understands the basics concepts of software engineering, evolution of software and process pattern
		CO2	Apply various agile software models and principles
		CO3	Analyze the principles of requirements engineering
		CO4	create architectural designs and components for a given project

		CO5	Apply different testing techniques
		CO6	
Mathematical Foundations of Computer Science	R2021054	CO1	Apply the mathematical logic and different proof methods to validate the arguments.
		CO2	Identify and apply operations on discrete structures such as sets, relations and algebraic structures in different areas of computing.
		CO3	Apply the counting techniques and principles of number theory to solve Combinatorial and problems of computer science.
		CO4	Solve the complex problems using the recurrence relations.
		CO5	Apply concepts of graphs and trees to Design algorithms for real world problems and find Solutions with optimal complexity.
		CO6	
Object Oriented Programming through C++ Lab	R2021055	CO1	Develop programming skills in computer programming concepts in C++ language
		CO2	Solve coding problems in C++ language
		CO3	Solve coding problems related to OOP in C++language
		CO4	
		CO5	
		CO6	
Operating Systems Lab	R2021056	CO1	Make use of Linux environment for Unix Utilities and perform basic shell and file access control.
		CO2	Solve various CPU scheduling and page replacement algorithms.
		CO3	Analyze tasks of multiprogramming and file allocation strategies.
		CO4	Classify Bankers algorithm implementation for deadlock avoidance and prevention.
		CO5	Examine process communication, process synchronization and usage of pthread library.
		CO6	
Software Engineering Lab	R2021057	CO1	Ability to develop Software Architectures
		CO2	To Implement Creational and Structural patterns
		CO3	To Create behavioural patterns in structures.
		CO4	
		CO5	
		CO6	
Python-NumPy Lab	R2021058	CO1	Explain how data is collected, managed and stored for processing
		CO2	Understand the workings of various numerical techniques, different descriptive measures of Statistics, correlation and regression to solve the engineering problems

		CO3	Understand how to apply some linear algebra operations to n-dimensional arrays
		CO4	Use NumPy perform common data wrangling and computational tasks in Python.
		CO5	
		CO6	
Constitution of India	R2021010	CO1	Understand Historical Back Ground of Constitution Making and Its Importance for Building Democratic India.
		CO2	Understand the Functioning of Three Wings of Government.
		CO3	Understand the Value of Fundamental Rights and Duties for becoming good citizen of India
		CO4	Analyze the Decentralization of power between state central and local Government
		CO5	Apply the knowledge in strengthening of constitutional Institutions like Election Commission and UPSC for sustaining Democracy.
		CO6	
Probability and Statistics	R2022051	CO1	Analyse Statistical data using measures of central tendency, dispersion and location.
		CO2	Calculate and interpret the correlation between two variables.
		CO3	Apply various probability distribution for both discrete and continuous random variables
		CO4	Apply the terms of sampling distribution and test the hypothesis for small and large samples.
		CO5	
		CO6	
Database Management Systems	R2022052	CO1	Interpret the fundamentals of DBMS.
		CO2	Apply the concepts of relational model and use of SQL for database management.
		CO3	Understand ER concepts and Develop Queries in RDBMS.
		CO4	Analyze DB design methodology and normalization process.
		CO5	Compare and Contrast various transaction, concurrency management, file organizations and indexing techniques.
		CO6	
Formal Languages and Automata Theory	R2022053	CO1	Students can Able to Design Finite Automata for different language classes and can apply techniques to find the equivalency and minimal forms of a Finite Automata.
		CO2	Students can Able To Design Regular Expressions for different set of Languages and can construct Finite Automaton for the languages. And also can apply pumping lemma to identify non regular languages.
		CO3	Students can Able To Construct context free grammar for various languages and apply Context Free Grammars to solve problems in computer science.
		CO4	Students can Able To solve various problems in computer science by applying normal form techniques and push down automata.
		CO5	Students can Able To design Turing machines and apply them to solve complex problems. Can also able to identify the different computational problems and their associated complexity.

		CO6	
Java Programming	R2022054	CO1	Apply OOPs Concepts and basics of java programming to simplify software development.
		CO2	Solve the inter-disciplinary applications using the concept of inheritance and interfaces.
		CO3	Illustrate error free applications using exception handling mechanisms and multi tasking applications using multithreading concepts.
		CO4	Understand interactive JDBC for standalone and Internet applications.
		CO5	
		CO6	
Managerial Economics and Financial Accountancy	R2022055	CO1	Understand the fundamental concepts of Economics, estimating the Demand and Demand elasticity & Supply for a product.
		CO2	Apply the basic concepts of production, cost & break-even analysis.
		CO3	Have Knowledge on forms of Business organization & conditions of different market structure & pricing policies.
		CO4	Utilize the knowledge on Accounting & Financing Analysis for preparation and interpretation of Financial Statements.
		CO5	Make use of the concepts related to Capital & Capital Budgeting.
		CO6	
Database Management Systems Lab	R2022056	CO1	Able to create database with different types of integrity constraints and use the SQL commands.
		CO2	Able to use database security and authorization in order to access database for the different kinds of the user.
		CO3	Develop an Entity-Relationship Model with the appropriate entireties, attributes, relationships and connectivity.
		CO4	Able to access and manipulate data using PL/SQL blocks
		CO5	Able to connect database to front end using JDBC and ODBC driver.
		CO6	
R Programming Lab	R2022057	CO1	Import, review, manipulate and summarize data by using R programming.
		CO2	Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
		CO3	Perform appropriate statistical tests using R.
		CO4	Create and edit visualizations with R.
		CO5	
		CO6	
Java Programming Lab	R2022058	CO1	Develop programming skills in computer programming concepts in Java programming language.
		CO2	Solve coding problems in Java language.

		CO3	Solve coding problems related to OOP in Java language
		CO4	
		CO5	
		CO6	
Python-Pandas Lab	R2022059	CO1	Create and manipulate data structures like Series and Data Frames
		CO2	Create Data Frame structures for cleaning and processing and manipulating files
		CO3	Creates an pandas SQL table from the Pandas Data frame of interest and allow users to query from the SQLite table using SQL.
		CO4	Create different plots for basic exploratory data analysis
		CO5	
		CO6	
Computer Networks	R2031051	CO1	Illustrate OSI and TCP/IP Models and basics of physical layer and their issues.
		CO2	Demonstrate Data Link layer issues and MAC sub layers concepts
		CO3	Demonstrate the basic concepts of Error Detection and LAN & PAN Technologies.
		CO4	Analyze and implement the algorithms of network and transport layers and concerned services
		CO5	Apply and execute the concepts of TCP, UDP and the application layer conceptions
		CO6	
Design and Analysis of Algorithms	R2031052	CO1	Understand fundamentals of algorithms and analyse efficiency of algorithms.
		CO2	Apply Divide & Conquer and Greedy methods to design an algorithm for a problem.
		CO3	Apply Dynamic Programming technique to design an algorithm for a problem.
		CO4	Analyse algorithms for problems using various algorithmic methods such as backtracking.
		CO5	Apply NP completeness theory to design an algorithm for problem.
		CO6	
Data Warehousing and Data Mining	R2031053	CO1	Illustrate the importance of Data Warehousing, Data Mining and its functionalities and Design schema for real time data warehousing applications.
		CO2	Demonstrate on various Data Preprocessing Techniques viz. data cleaning, data integration, data transformation and data reduction and Process raw data to make it suitable for various data mining algorithms
		CO3	Choose appropriate classification technique to perform classification, model building and evaluation.
		CO4	Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent itemsets generation.
		CO5	Identify and apply various clustering algorithm (with open source tools), interpret, evaluate and report the result.

		CO6	
Fundametals of Micro Processors and MIcro Controllers	R203104I	CO1	Explain the Architectural features of 8085 & 8086 Microprocessor
		CO2	Develop the assembly language program for 8086 Microprocessor and 8051 Microcontroller
		CO3	Analyze the concepts of 8086 Microprocessor and 8051 Microcontroller interfacing with peripherals
		CO4	Describe the architectural features of 8051 Microcontroller & its applications
		CO5	
		CO6	
Software Project Management	R203105B	CO1	Knowledge on software development life cycle and improving economics and methodologies are useful in software project development as a software developer.
		CO2	Knowledge on artifacts of the process and different life cycle phases like inception, elaboration, construction, and transition etc. are required for software project development
		CO3	Knowledge on a various embedded firmware design approach, development languages and interrupts is necessary in the design of software project development
		CO4	Knowledge on management perspective and technical perspective architectures, automations, quality indicators are useful in the design of embedded applications
		CO5	
		CO6	
Data Warehousing and Data Mining Lab	R2031054	CO1	Apply data mining concepts for analysis of data
		CO2	To implement the knowledge on Association Rules Mining.
		CO3	Implement and Analyze on knowledge flow application on data sets and Apply the suitable visualization techniques to output analytical results
		CO4	
		CO5	
		CO6	
Computer Networks Lab	R2031055	CO1	Apply the Basics of Phycical layer and Transport layer in Real time applications.
		CO2	Apply Data link layer concepts, design issues and Protocols.
		CO3	Apply Network layer routing protocols and IP Addressing.
		CO4	Analyze the functions of Application layer and Presentation layer paradigms and Protocols.
		CO5	
		CO6	

Continuous Integration and Continuous Delivery using DevOps	R2031057	CO1	Understand thevarious phases of SDLC and agile software development
		CO2	Understand the fundamentals of Devops, adoption in projects, CI/CD and Devops maturity models
		CO3	Implement an automated CICD pipeline using a stack of tools by individual or group
		CO4	
		CO5	
		CO6	
Employability Skills-I	R2031058	CO1	Understand individual skill assessments and different types of Communication.
		CO2	Develop and practice self management skills and corporate etiquette.
		CO3	Apply presentation techniques effectively with appropriate body language
		CO4	Improve their verbal, written and other skills by performing mock sessions.
		CO5	Prepare for different types of interviews and be prepared for HR and technical interviews.
		CO6	
Machine Learning	R2032051	CO1	Demonstrate the fundamental usage of the concept Machine Learning system.
		CO2	Apply various Supervised Learning techniques in problem solving.
		CO3	Analyze the Ensemble Learning Methods.
		CO4	Apply the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
		CO5	understand the Neural Network Models and concepts of Deep Learning.
		CO6	
Compiler Design	R2032052	CO1	Explain different phases of compilation with Design of lexical analyzer for a language.
		CO2	Compare top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input.
		CO3	Apply optimization techniques to intermediate code for statements and generate machine code for high level language program.
		CO4	Design syntax directed translation schemes for a given context free grammar and generate symbol tables for runtime environment
		CO5	
		CO6	
Cryptography and Network Security	R2032053	CO1	Analyze the basic principles of Cryptography.
		CO2	Apply the functionality of Secret and Public Key Cryptography.
		CO3	Analyze various Message Authentication functions and Secure Algorithms.
		CO4	Examine the Layers of various Security Services.

		CO5	
		CO6	
Object Oriented Analysis and Design	R203205C	CO1	Analyze the nature of complex systems and its solutions.
		CO2	Understands the conceptual UML model, classes, and relationships.
		CO3	Understand the modeling of Class and Object Diagram and able to apply for real time applications.
		CO4	Understand basic behavioral modeling and designs Diagrams.
		CO5	Gain the Knowledge on advanced behavioral and architectural modeling and applies the techniques for Diagrams.
		CO6	
MEAN Stack Development	R203205E	CO1	Build static web pages using HTML 5 elements.
		CO2	Apply JavaScript to embed programming interface for web pages and to perform Client-side validations.
		CO3	Build a basic web server using Node.js and recognize the need for Express.js.
		CO4	Develop JavaScript applications using Typescript and work with document database using MongoDB.
		CO5	Design dynamic and responsive single-page web applications using Angular.
		CO6	
Employability skills-II	R2032059	CO1	Demonstrate the fundamental usage of the different methods to solve basic mathematical problems.
		CO2	Apply various strategies in minimizing time consumption in problem solving.
		CO3	Analyze the mathematical problems and utilize these mathematical skills both in their professionals as well as personal life.
		CO4	Illustrate the present information in quantitative forms including table, graphs and formulas.
		CO5	
		CO6	
Machine Learning using Python Lab	R2032054	CO1	Apply the hypothesis concepts on various Learning Models.
		CO2	Construct Machine learning programs for Supervised learning models
		CO3	Construct Machine learning programs for unsupervised learning models
		CO4	Create an Artificial Neural Network by implementing the Back propagation algorithm
		CO5	Analyse the graphical outcomes of learning algorithms with specific datasets
		CO6	
Compiler Design Lab	R2032055	CO1	Design and implement Lexical analyzer using C programs and LEX tools.
		CO2	Design and implement various types of top down and Bottom up parsers.
		CO3	Apply Lex and Yacc Tools.

		CO4	Implementation of Three address code and code generation Algorithms.
		CO5	
		CO6	
Cryptography and Network Security Lab	R2032056	CO1	Use C language to develop simple XOR operation for encryption of data
		CO2	Make use of C/Java to implement Symmetric cryptography
		CO3	Choose C/Java to develop Asymmetric cryptography
		CO4	Implement Diffie-Hellman Key exchange using HTML and Javascript
		CO5	Develop java programs on MD-5 and SHA-1 algorithms
		CO6	
MEAN Stack Technologies-Module I	R2032058	CO1	Develop professional web pages of an application using HTML elements like lists, navigations, tables, various form elements, embedded media which includes images, audio, video, and CSS Styles.
		CO2	Utilize JavaScript for developing interactive HTML web pages and validate form data.
		CO3	Build a basic web server using Node.js and working with Node Package Manager (NPM).
		CO4	Build a web server using Express.js.
		CO5	Make use of Typescript to optimize JavaScript code by using the concept of strict type checking.
		CO6	
Cloud Computing	R204105A	CO1	Understand knowledge of different aspects of Cloud Computing such as: Services, Models, and Challenges.
		CO2	Identify the Infrastructure of Cloud Computing and also Analyze the different Cloud Computing Applications and Paradigms.
		CO3	Analyze the importance of Cloud Resourcing Virtualization and Cloud Resourcing and Scheduling.
		CO4	Understand Cloud based Storage and need of Security in Cloud Computing
		CO5	Understand the Development of Cloud-based applications like Google and Microsoft.
		CO6	
Deep Learning Techniques	R204105E	CO1	Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning.
		CO2	Discuss the Neural Network training, various random models.
		CO3	Develop Keras, TensorFlow, Theano and CNTK based deep learning models for solving problems.
		CO4	Analyze different Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN)
		CO5	Implement Interactive Applications of Deep Learning.
		CO6	

Wireless Network Security	R204105J	CO1	Identify and describe the security threats and vulnerabilities of wireless networks.
		CO2	Understand the purpose and functions of various wireless protocols and cryptography.
		CO3	Implement the security considerations of wireless devices from unauthorized access.
		CO4	Analyse the various wireless data networks.
		CO5	Implement the various Wireless Deployment Strategies
		CO6	
API and Microservices (Job Oriented Course)	R204105M	CO1	Understand fundamentals of Spring Framework.
		CO2	Create and Develop Spring Boot Application.
		CO3	Develop a Spring Data JPA application with Spring Boot.
		CO4	Write RESTful service using Spring REST.
		CO5	Create secure RESTful endpoints using Spring Security Document.
		CO6	
Secure Coding Techniques (Job Oriented Course)	R204105U	CO1	understand the trend,reasons and impact of recent cyber attacks.
		CO2	Understand OWASP design principles while designing a web application.
		CO3	Understand Threat modeling.
		CO4	Importance of security in all phases of SDLC
		CO5	Write secure coding using some of practices in C/C++/JAVA and python programming languages.
		CO6	
Universal Human Values 2: Understanding Harmony	R2041011	CO1	Understand the essentials of human values and skills, self-exploration, happiness and prosperity
		CO2	Apply the role of a human being in ensuring harmony in self and family
		CO3	Interpret the role of a human being in ensuring harmony in society and nature
		CO4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.
		CO5	
		CO6	
Skill Oriented Course - V PYTHON: Deep Learning Lab	R2041052	CO1	Implement deep learning models for image analysis
		CO2	Build a convolutional neural network, and understand its application to build a recurrent neural network.
		CO3	Apply various optimization algorithms to comprehend different activation functions to understand hyper parameter tuning
		CO4	Design auto encoders in real time application.
		CO5	Building a simple Generative Adversarial Network (GAN) using TensorFlow
		CO6	Develop the ability to present and communicate outcomes of deep learning projects

Industrial/Research Internship	R2041055	CO1	
		CO2	
		CO3	
		CO4	
		CO5	
		CO6	
Major Project Work, Seminar Internship	Project	CO1	Identify the complex engineering problems relevant to the society and industry.
		CO2	Apply modern technologies, tools and systems in the field of information technology to analyze the identified problem.
		CO3	Design and implement a viable solution to the problem.
		CO4	Apply communication, report writing skills and Presentation skills.
		CO5	Develop the team work and leadership skills with professional and ethical values.
		CO6	

Head of the Department
Computer Science & Engineering
Sir C.R.R. College of Engineering
ELURU - 534 007

SIR C. R. REDDY COLLEGE OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING

COURSE OUTCOME NUMBER	COURSE OUTCOMES
II - Year Semester – I	
COURSE NAME: PROBABILITY & STATISTICS	
R1621011	Examine, analyze, and compare various Probability distributions for both discrete and continuous random variables.
	Describe and compute confidence intervals for the mean of a population.
	Describe and compute confidence intervals for the proportion and the variance of a population and test the hypothesis concerning mean, proportion and variance and perform ANOVA test.
	Fit a curve to the numerical data.
COURSE NAME: BASIC ELECTRICAL & ELECTRONICS ENGINEERING	
R1621012	Able to analyse the various electrical networks.
	Able to understand the operation of DC generators,3-point starter and conduct the Swinburne's Test.
	Able to analyse the performance of transformer.
	Able to explain the operation of 3-phase alternator and 3-phase induction motors.
	Able to analyse the operation of half wave, full wave rectifiers and OP-AMPs.
	Able to explain the single stage CE amplifier and concept of feedback amplifier.
COURSE NAME: STRENGTH OF MATERIALS-I	
R1621013	The student will be able to understand the basic materials behavior under the influence of different external loading conditions and the support conditions
	The student will be able to draw the diagrams indicating the variation of the key performance features like bending moment and shear forces
	The student will have knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams and deflections due to various loading conditions
	The student will be able to assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure using Lame's equation.

COURSE NAME: BUILDING MATERIALS & CONSTRUCTION	
R1621014	The student should be able to identify different building materials and their importance in building construction.
	The student is expected to differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions.
	The student should have learnt the importance of building components and finishings.
	The student is expected to know the classification of aggregates, sieve analysis and moisture content usually required in building construction.
COURSE NAME: SURVEYING	
R1621015	Illustrate the Principles and classification of Surveying.
	Identify corrections to Linear Measurements & bearings. Appraise the Omitted Measurements in Traversing
	Recognize the concept of leveling and practice the methods of leveling and contours
	Evaluate horizontal and vertical levels by using theodolite, trigonometric leveling and tacheometry
	Design of Curves and define the importance of Total station and GPS
	Appraise the areas of boundaries and volumes of earthwork by various methods.
COURSE NAME: FLUID MECHANICS	
R1621016	Understand the various properties of fluids and their influence on fluid motion and analyse a variety of problems in fluid statics and dynamics.
	Calculate the forces that act on submerged planes and curves.
	Identify and analyse various types of fluid flows.
	Apply the integral forms of the three fundamental laws of fluid mechanics to turbulent and laminar flow through pipes and ducts in order to predict relevant pressures, velocities and forces.
	Draw simple hydraulic and energy gradient lines.
	Measure the quantities of fluid flowing in pipes, tanks and channels.
II - Year Semester – II	
COURSE NAME: BUILDING PLANNING & DRAWING	
R1622011	Student should be able to plan various buildings as per the building by-laws.

	The student should be able to distinguish the relation between the plan, elevation and cross section and identify the form and functions among the buildings.
	The student is expected to learn the skills of drawing building elements and plan the buildings as per requirements.
COURSE NAME: STRENGTH OF MATERIALS - II	
R1622012	After going through this course the student will be able tounderstand the basic concepts of Principal stressesdeveloped in a member when it is subjected to stresses along different axes and designthe sections.
	The student can asses stresses in engineering applications of shafts, springs, columns and struts subjected to different loading conditions
	The student can asses stresses in engineering applications of columns and struts subjected to different loading conditions
	The student will be able tounderstand and analyze the determination of stresses in the case of chimneys, retaining walls and dams
	The student will be able to understand and analyze the concept of unsymmetrical bending in beams
	The student will be able to assess forces in different types of trusses used in construction
COURSE NAME: HYDRAULICS & HYDRAULIC MACHINERY	
R1622013	Solve uniform & non uniform open channel flow problems.
	Apply the principles of dimensional analysis and similitude in hydraulic model testing.
	Calculate the forces exerted by fluid jet on vanes of different shapes either stationary or moving.
	Understand the working principles of various hydraulic machineries.
	Select the suitable pump based on the requirement criteria
	Draw the performance curves for various hydraulic machines.
COURSE NAME: CONCRETE TECHNOLOGY	
R1622014	Understand the basic concepts of concrete.
	Realize the importance of quality of concrete.
	Familiarize the basic ingredients of concrete and their role in the production of concrete and its behaviour in the field.
	Test the fresh concrete properties and the hardened concrete properties.
	Evaluate the ingredients of concrete through lab test results. design the concrete mix by BIS method.

	Familiarize the basic concepts of special concrete and their production and applications. understand the behaviour of concrete in various environments.
COURSE NAME: STRUCTURAL ANALYSIS - I	
R1622015	Distinguish between the determinate and indeterminate structures.
	Identify the behaviour of structures due to the expected loads, including the moving loads, acting on the structure.
	Estimate the bending moment and shear forces in beams for different fixity conditions.
	Analyze the continuous beams using various methods -, three moment method, slope deflection method, energy theorems.
	Draw the influence line diagrams for various types of moving loads on beams/bridges.
	Analyze the loads in Pratt and Warren trusses when loads of different types and spans are passing over the truss.
COURSE NAME: TRANSPORTATION ENGINEERING - I	
R1622016	Plan highway network for a givenarea.
	Determine High`way alignment and design highwaygeometrics
	Design Intersections and prepare traffic managementplans
	Judge suitability of pavement materials
	design flexible and rigidpavements
	Construct and maintainhighways
COURSE NAME: MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS	
R1622019	The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product and the knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
	One is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
	*The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis and to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.
III - Year Semester – I	
COURSE NAME: MANAGEMENT SCIENCE	
R1631011	Describe the concept of management, functions, evolution of management thought and organizational structure

	Applying the concept of work study, statistical quality control and inventory management by using HML, FSN, ABC and SDE analysis
	Put forth the concepts of functional management
	Apply the concepts of PERT & CPM in project management
	knowledge on concepts of strategic management such as SWOT analysis, generic strategy alternatives.
	Understanding modern management practices MIS, TQM, SIX SIGMA, ERP.
COURSE NAME: ENGINEERING GEOLOGY	
R1631012	Identify and classify the geological minerals
	Measure the rock strengths of various rocks
	Classify and measure the earthquake prone areas to practice the hazard zonation
	Classify, monitor and measure the Landslides and subsidence
	Prepares, analyses and interpret the Engineering Geologic maps
	Analyses the ground conditions through geophysical surveys.
	Test the geological material and ground to check the suitability of civil engineering project construction.
	Investigate the project site for mega/mini civil engineering projects. Site selection for mega engineering projects like Dams, Tunnels, disposal sites etc…
COURSE NAME: STRUCTURAL ANALYSIS -II	
R1631013	Can you analyse the three hinged & two hinged arches subjected to various loads.
	How do you rate your knowledge on the analysis of multistory frames.
	Can you analyse the forces on cable and suspension bridges.
	Could you compare the methods of analysis between MDM and kani' s method.
	How do you rate your knowledge on the concepts of MM.
COURSE NAME: DESIGN & DRAWING OF REINFORCED CONCRETE STRUCTURES	
R1631014	Work on different types of design philosophies
	Carryout analysis and design of flexural members and detailing
	Design structures subjected to shear, bond and torsion
	Design different type of compression members and footings
COURSE NAME: TRANSPORTATION ENGINEERING - II	
R1631015	Learn various components and their functions in a railway track.
	Design the geometrics of a railway track.

	Know the techniques for effective movement of trains.
	Design the airport geometrics and air field pavements.
	Know planning, construction and maintenance of Docks & Harbours.
III - Year Semester – II	
COURSE NAME: DESIGN & DRAWING OF STEEL STRUCTURES	
R1632011	Able to apply relevant IS codes provisions to ensure safety of structural steel elements
	Able to design tension & compression members with welded connections
	Able to design the roof trusses, column bases & splices with welded connection
	Able to design plate girder and gantry girder including stiffeners with welded connections.
	Able to produce the drawings pertaining to different components of steel structures
COURSE NAME: GEOTECHNICAL ENGINEERING - I	
R1632012	Explain the definitions of various soil parameters and establish a relation between them.
	Determine the index properties and classify the soils.
	Understand the importance of various Engineering properties of the soil.
	Understand the concepts of stresses within the soil.
	Apply the concepts in day-to-day Civil Engineering problems.
COURSE NAME: ENVIRONMENTAL ENGINEERING -I	
R1632013	Appraise the quantity of water required for a community
	List with types of intakes
	Examine the water characteristics
	Discuss the Primary treatment of raw water
	Identify the Miscellaneous treatments
	Describe the distribution network
COURSE NAME: WATER RESOURCE ENGINEERING -I	
R1632014	Quantify major hydrologic components and apply key concepts to several practical areas of engineering hydrology and related design aspects
	Learn measurement and estimation of the abstractions from the precipitation
	Determination of runoff in various durations through unit hydrograph theory and its analysis.

	Analyzing the flood occurrence and frequency by using statistical technique.
	Determine aquifer parameters and yield of wells.
	Different advanced hydrologic modeling processes.
COURSE NAME: WASTE WATER MANAGEMENT	
R163201D	Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation
	To impart knowledge on selection of treatment methods for industrial wasteswater.
	To Know the operational problems of common effluent treatment plant.
	To acquire knowledge on manufacturing process and treatment methods of industries.
IV - Year Semester – I	
COURSE NAME: ENVIRONMENTAL ENGINEERING - II	
R1641011	Able to plan & design a good sewage system.
	Select suitable appurtenances in sewage system.
	Analysis the characteristics of sewage.
	Suggest & design a suitable treatment system for sewage treatment
	Identify the critical point of pollution in a river for a specific amount of pollutant into the river.
	Suggest a suitable disposal method with respect to effluent standarts.
COURSE NAME: WATER RESOURCE ENGINEERING - II	
R1641012	Recognize water requirements and plan an Irrigation system
	Design an Irrigation Canal and its network
	Design an Irrigation Canal structure
	Plan a diversion head works and Design impervious floor of diversion head works
	Select a suitable type of Dam and Appraise the stability of Gravity Dam
	Examine the stability of earth dams, Design principles of Ogee spillways.
COURSE NAME: GEOTECHNICAL ENGINEERING - II	
R1641013	Analyze the slopes to attain the stability.
	Calculate the earth pressures.
	Calculate the bearing capacity of the soils.
	Adopt the suitable foundation for different soils.

	Understand the concept of Caissions & Well Foundations.
	Understand the need of sub soil exploration.
COURSE NAME: REMOTE SENSING & GIS APPLICATIONS	
R1641014	Acquire the physical principles of remote sensing (scattering, reflection, and absorption of electromagnetic radiation) and Digital image formats (line, pixel, sequential)
	Recognize the visual interpretation processing, enhancement and classification
	Recognize the Spatial data operators, Network for optimal path &Tracing
	Apply RS & GIS tool in the areas of agriculture, forestry, geology, geomorphology and urban land area
	Obtain the concepts & components of GIS and different types of data representation models.
COURSE NAME: AIR POLLUTION & CONTROL	
R164101C	To know the Sourses, sampling analysis of air pollutants
	To know the Applications in the removal of gases
	To acquire the design principles of particulate and gaseous control
	To learn plume Behaviour in different environmental conditions
	To know the Ambient Air Monitoring - Stack Monitoring
COURSE NAME: ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT	
R164101H	Prepare EMP, EIS, and EIA report
	Identify the risks and impacts of a project
	Selection of an appropriate EIA methodology
	Evaluation the EIA report
	Estimate the cost benefit ratio of a project
	Know the role of stakeholder and public hearing in the preparation of EIA
IV - Year Semester – II	
COURSE NAME: ESTIMATION SPECIFICATION & CONTRACTS	
R1642011	Explain the concept of estimating & work out rate analysis for various items of work
	Develop the specifications for different Civil Engineering works
	Prepare contract documents for tenders and valuation of buildings.

	Prepare detailed estimate of different Civil Engineering works.
COURSE NAME: CONSTRUCTION TECHNOLOGY & MANAGEMENT	
R1642012	Value the importance of construction planning by using various network analysis techniques.
	Evaluate PERT, cost analysis, crashing of optimum cost & resources.
	Apply the functioning of various earth moving equipments by their types.
	Classify the functioning of various earth work equipments.
	Examine methods of production of aggregate & conceding equipment.
	Apply the gained knowledge to construction techniques & safety.
COURSE NAME: PRESTRESSED CONCRETE	
R1642013	Understand the different methods of prestressing
	Estimate effective prestress including the short and long term losses
	Analyze and design prestressed concrete beams under flexure and shear
	Understand the relevant IS Codal provisions for prestressed concrete
COURSE NAME: SOLID AND HAZARDOUS WASTE MANAGE	
R164201C	Knowledge about the solid waste generation, composition and factors influencing generation rate.
	Design the collection systems of solid waste of a town
	Design treatment of municipal solid waste and landfill
	Know the criteria for selection of landfill
	Characterize the solid waste and design a composting facility
	Know the Method of treatment and disposal of Hazardous wastes

SIRC.R.REDDYCOLLEGEOFENGINEERINGELURU-534007, WEST GODAVARI DIST, A P.,INDIA

(Approved by AICTE, New Delhi, Accredited by NBA)Phoneno:08812-230840,2300656Fax:08812- 224193

Visitusathttp://www.sircrrengg.ac.in

DEPARTMENTOFCOMPUTER SCIENCENDENGINEERING

R20Series JNTUK CO's

COURSE	CODE	C.O CODE	COURSE OUTCOME DESCRIPTION
Communicative English	HS1101	CO1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
		CO2	Employ knowledge of grammatical structures and vocabulary in speech and writing
		CO3	Apply effective communication skills to enhance professional possibilities.
		CO4	Develop acceptable personality traits suitable for chosen profession.
Mathematics - I (Calculus And Differential Equations)	BS1101	CO1	Examine the convergence of series and apply mean value theorem to real life problem.
		CO2	Solve the Differential Equations of first and higher order related to various engineering applications.
		CO3	Apply the partial differentiation technique to solve physical problem
		CO4	Apply double and triple integrals to find areas and volumes.
Applied Physics	BS1102	CO1	Apply the knowledge of different optical phenomena in daily life.
		CO2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibers.
		CO3	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
		CO4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
		CO5	Understand electrons& holes behavior in semiconductors and extraordinary behavior of materials at various transition temperatures

Programming for Problem Solving using C	ES1101	CO1	Apply the basic concepts of C Programming for problem-solving and different number systems.
		CO2	To use different operators, write programs that use control statements for a given problem.
		CO3	Illustrate the concepts of Homogeneous and heterogeneous data types, pointers and file system for solving mathematical and engineering problems.
		CO4	Decompose a given problem into functions and to develop modular reusable code.
Computer Engineering Workshop	ES1102	CO1	Apply knowledge for Computer Assembling and Software installation
		CO2	Understand and implement Unix commands
		CO3	Ability to effectively use Internet, World Wide Web(WWW) and Web browsers
		CO4	Apply the tools for MS-Word, PowerPoint , Excel and PDF documentation
English Communication Skills Laboratory	HS1102	CO1	Recognize the sounds of English with the help of audio visual aids
		CO2	Build confidence and overcome inhibitions while speaking in English.
		CO3	Demonstrate acquired language skills in performing the designated activity.
Applied Physics Lab	BS1103	CO1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
		CO2	Analyze various electronic circuits and study the temperature dependence of semiconductors.
		CO3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fibre
Programming for Problem Solving using C Lab	ES1103	CO1	Describe the basics of computer and understand the problem-solving aspect.
		CO2	Design and develop C program to evaluate simple expressions and logical operations.
		CO3	Develop & Implement C programs with suitable modules to solve the given problem.
		CO4	Demonstrate the concept of pointer and perform I/O operations in files.
Mathematics – II (Linear Algebra And Numerical Methods)	BS1201	CO1	Solve system of linear algebraic equations and apply Eigen value computation technics to reduce a given quadratic to canonical form
		CO2	Solve algebraic and Transcendental equations by using Numerical methods
		CO3	Apply Newton 's forward and backward interpolation and Lagrange's formula for equal and unequal intervals.
		CO4	Compute numerical solutions of differential equations.

Applied Chemistry	BS1202	CO1	Identify the advantages and limitations of Plastic materials, Elastomers and their use in day to day life.
		CO2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
		CO3	Recognize the need of nano materials, liquid crystals, semiconductors and super conductors.
		CO4	Gain the knowledge of applications of different analytical instruments and generation of electricity from various Non-Conventional energy sources.
		CO5	Obtain the knowledge of computational chemistry and molecular machines.
Computer Organization	ES1201	CO1	Recall the internal organization of computers, CPU,I/O and its main components
		CO2	Relate postulates of Boolean algebra and basic computer organization design
		CO3	Design and analyze combinational and sequential circuits and basics of I/O organization
Python Programming	ES1202	CO1	Understand the need for learning basic concepts of Python programming language
		CO2	Apply various data structures in developing solutions to real time scenarios
		CO3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.
		CO4	Apply the usage of pattern matching, GUI in python programming.
Data Structures	CS1201	CO1	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
		CO2	Apply the different linear data structures like stack and queue to various computing problems
		CO3	Implement different types of trees, heaps and apply them to problem solutions
		CO4	Identify different non linear data structures to analyze the performance of an algorithm.
Applied Chemistry Lab	BS1203	CO1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
		CO2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, KMnO4 and Copper using different indicators.
		CO3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
		CO4	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.
Python Programming Lab	ES1203	CO1	Understand the need for learning basic concepts of Python programming language
		CO2	Apply various data structures in developing solutions to real time scenarios
		CO3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.

		CO4	Design the usage of pattern matching, GUI in python programming.
Data Structures Lab	CS1202	CO1	Implement different sorting and searching algorithms
		CO2	Implement the stack, Queue and their applications
		CO3	Implement various types of linked lists and their applications
		CO4	Perform basic operations on trees and graphs and determine minimum spanning tree
Mathematics III	R2021011	CO1	Apply the concepts of vector calculus to the problems of work done by a force, circulation and flux
		CO2	Apply Laplace Transforms to solve linear differential equations with constant coefficients.
		CO3	Compute Fourier series of the periodic function and apply Fourier transform to a range of non-periodic function.
		CO4	Solve the first and higher order of partial differential equations and apply to various engineering problems
		CO5	
		CO6	
Object Oriented Programming through C++	R2021051	CO1	Apply the basics of programming in the C++ language and differentiate object-oriented programming and procedural programming.
		CO2	Apply C++ features such as composition of objects, operator overloading, dynamic memory allocation and inheritance.
		CO3	Apply virtual and pure virtual function & complex programming situations
		CO4	Apply generic programming and exception handling techniques.
		CO5	Build C++ classes using appropriate encapsulation and design principles.
		CO6	
Operating Systems	R2021052	CO1	Understand the basic principles of operating systems.
		CO2	Analyze the process management policies and its scheduling by CPU.
		CO3	Analyze the memory management and its allocation policies and file systems.
		CO4	Analyze the mechanisms used for process synchronization, deadlock prevention and detection.
		CO5	Understand system security and protection mechanisms in operating systems like UNIX/LINUX and Windows.
		CO6	
Software Engineering	R2021053	CO1	understands the basics concepts of software engineering, evolution of software and process pattern
		CO2	Apply various agile software models and principles
		CO3	Analyze the principles of requirements engineering
		CO4	create architectural designs and components for a given project

		CO5	Apply different testing techniques
		CO6	
Mathematical Foundations of Computer Science	R2021054	CO1	Apply the mathematical logic and different proof methods to validate the arguments.
		CO2	Identify and apply operations on discrete structures such as sets, relations and algebraic structures in different areas of computing.
		CO3	Apply the counting techniques and principles of number theory to solve Combinatorial and problems of computer science.
		CO4	Solve the complex problems using the recurrence relations.
		CO5	Apply concepts of graphs and trees to Design algorithms for real world problems and find Solutions with optimal complexity.
		CO6	
Object Oriented Programming through C++ Lab	R2021055	CO1	Develop programming skills in computer programming concepts in C++ language
		CO2	Solve coding problems in C++ language
		CO3	Solve coding problems related to OOP in C++language
		CO4	
		CO5	
		CO6	
Operating Systems Lab	R2021056	CO1	Make use of Linux environment for Unix Utilities and perform basic shell and file access control.
		CO2	Solve various CPU scheduling and page replacement algorithms.
		CO3	Analyze tasks of multiprogramming and file allocation strategies.
		CO4	Classify Bankers algorithm implementation for deadlock avoidance and prevention.
		CO5	Examine process communication, process synchronization and usage of pthread library.
		CO6	
Software Engineering Lab	R2021057	CO1	Ability to develop Software Architectures
		CO2	To Implement Creational and Structural patterns
		CO3	To Create behavioural patterns in structures.
		CO4	
		CO5	
		CO6	
Python-NumPy Lab	R2021058	CO1	Explain how data is collected, managed and stored for processing
		CO2	Understand the workings of various numerical techniques, different descriptive measures of Statistics, correlation and regression to solve the engineering problems

		CO3	Understand how to apply some linear algebra operations to n-dimensional arrays
		CO4	Use NumPy perform common data wrangling and computational tasks in Python.
		CO5	
		CO6	
Constitution of India	R2021010	CO1	Understand Historical Back Ground of Constitution Making and Its Importance for Building Democratic India.
		CO2	Understand the Functioning of Three Wings of Government.
		CO3	Understand the Value of Fundamental Rights and Duties for becoming good citizen of India
		CO4	Analyze the Decentralization of power between state central and local Government
		CO5	Apply the knowledge in strengthening of constitutional Institutions like Election Commission and UPSC for sustaining Democracy.
		CO6	
Probability and Statistics	R2022051	CO1	Analyse Statistical data using measures of central tendency, dispersion and location.
		CO2	Calculate and interpret the correlation between two variables.
		CO3	Apply various probability distribution for both discrete and continuous random variables
		CO4	Apply the terms of sampling distribution and test the hypothesis for small and large samples.
		CO5	
		CO6	
Database Management Systems	R2022052	CO1	Interpret the fundamentals of DBMS.
		CO2	Apply the concepts of relational model and use of SQL for database management.
		CO3	Understand ER concepts and Develop Queries in RDBMS.
		CO4	Analyze DB design methodology and normalization process.
		CO5	Compare and Contrast various transaction, concurrency management, file organizations and indexing techniques.
		CO6	
Formal Languages and Automata Theory	R2022053	CO1	Students can Able to Design Finite Automata for different language classes and can apply techniques to find the equivalency and minimal forms of a Finite Automata.
		CO2	Students can Able To Design Regular Expressions for different set of Languages and can construct Finite Automaton for the languages. And also can apply pumping lemma to identify non regular languages.
		CO3	Students can Able To Construct context free grammar for various languages and apply Context Free Grammars to solve problems in computer science.
		CO4	Students can Able To solve various problems in computer science by applying normal form techniques and push down automata.
		CO5	Students can Able To design Turing machines and apply them to solve complex problems. Can also able to identify the different computational problems and their associated complexity.

		CO6	
Java Programming	R2022054	CO1	Apply OOPs Concepts and basics of java programming to simplify software development.
		CO2	Solve the inter-disciplinary applications using the concept of inheritance and interfaces.
		CO3	Illustrate error free applications using exception handling mechanisms and multi tasking applications using multithreading concepts.
		CO4	Understand interactive JDBC for standalone and Internet applications.
		CO5	
		CO6	
Managerial Economics and Financial Accountancy	R2022055	CO1	Understand the fundamental concepts of Economics, estimating the Demand and Demand elasticity & Supply for a product.
		CO2	Apply the basic concepts of production, cost & break-even analysis.
		CO3	Have Knowledge on forms of Business organization & conditions of different market structure & pricing policies.
		CO4	Utilize the knowledge on Accounting & Financing Analysis for preparation and interpretation of Financial Statements.
		CO5	Make use of the concepts related to Capital & Capital Budgeting.
		CO6	
Database Management Systems Lab	R2022056	CO1	Able to create database with different types of integrity constraints and use the SQL commands.
		CO2	Able to use database security and authorization in order to access database for the different kinds of the user.
		CO3	Develop an Entity-Relationship Model with the appropriate entireties, attributes, relationships and connectivity.
		CO4	Able to access and manipulate data using PL/SQL blocks
		CO5	Able to connect database to front end using JDBC and ODBC driver.
		CO6	
R Programming Lab	R2022057	CO1	Import, review, manipulate and summarize data by using R programming.
		CO2	Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
		CO3	Perform appropriate statistical tests using R.
		CO4	Create and edit visualizations with R.
		CO5	
		CO6	
Java Programming Lab	R2022058	CO1	Develop programming skills in computer programming concepts in Java programming language.
		CO2	Solve coding problems in Java language.

		CO3	Solve coding problems related to OOP in Java language
		CO4	
		CO5	
		CO6	
Python-Pandas Lab	R2022059	CO1	Create and manipulate data structures like Series and Data Frames
		CO2	Create Data Frame structures for cleaning and processing and manipulating files
		CO3	Creates an pandas SQL table from the Pandas Data frame of interest and allow users to query from the SQLite table using SQL.
		CO4	Create different plots for basic exploratory data analysis
		CO5	
		CO6	
Computer Networks	R2031051	CO1	Illustrate OSI and TCP/IP Models and basics of physical layer and their issues.
		CO2	Demonstrate Data Link layer issues and MAC sub layers concepts
		CO3	Demonstrate the basic concepts of Error Detection and LAN & PAN Technologies.
		CO4	Analyze and implement the algorithms of network and transport layers and concerned services
		CO5	Apply and execute the concepts of TCP, UDP and the application layer conceptions
		CO6	
Design and Analysis of Algorithms	R2031052	CO1	Understand fundamentals of algorithms and analyse efficiency of algorithms.
		CO2	Apply Divide & Conquer and Greedy methods to design an algorithm for a problem.
		CO3	Apply Dynamic Programming technique to design an algorithm for a problem.
		CO4	Analyse algorithms for problems using various algorithmic methods such as backtracking.
		CO5	Apply NP completeness theory to design an algorithm for problem.
		CO6	
Data Warehousing and Data Mining	R2031053	CO1	Illustrate the importance of Data Warehousing, Data Mining and its functionalities and Design schema for real time data warehousing applications.
		CO2	Demonstrate on various Data Preprocessing Techniques viz. data cleaning, data integration, data transformation and data reduction and Process raw data to make it suitable for various data mining algorithms
		CO3	Choose appropriate classification technique to perform classification, model building and evaluation.
		CO4	Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent itemsets generation.
		CO5	Identify and apply various clustering algorithm (with open source tools), interpret, evaluate and report the result.

		CO6	
Fundametals of Micro Processors and MIcro Controllers	R203104I	CO1	Explain the Architectural features of 8085 & 8086 Microprocessor
		CO2	Develop the assembly language program for 8086 Microprocessor and 8051 Microcontroller
		CO3	Analyze the concepts of 8086 Microprocessor and 8051 Microcontroller interfacing with peripherals
		CO4	Describe the architectural features of 8051 Microcontroller & its applications
		CO5	
		CO6	
Software Project Management	R203105B	CO1	Knowledge on software development life cycle and improving economics and methodologies are useful in software project development as a software developer.
		CO2	Knowledge on artifacts of the process and different life cycle phases like inception, elaboration, construction, and transition etc. are required for software project development
		CO3	Knowledge on a various embedded firmware design approach, development languages and interrupts is necessary in the design of software project development
		CO4	Knowledge on management perspective and technical perspective architectures, automations, quality indicators are useful in the design of embedded applications
		CO5	
		CO6	
Data Warehousing and Data Mining Lab	R2031054	CO1	Apply data mining concepts for analysis of data
		CO2	To implement the knowledge on Association Rules Mining.
		CO3	Implement and Analyze on knowledge flow application on data sets and Apply the suitable visualization techniques to output analytical results
		CO4	
		CO5	
		CO6	
Computer Networks Lab	R2031055	CO1	Apply the Basics of Phycical layer and Transport layer in Real time applications.
		CO2	Apply Data link layer concepts, design issues and Protocols.
		CO3	Apply Network layer routing protocols and IP Addressing.
		CO4	Analyze the functions of Application layer and Presentation layer paradigms and Protocols.
		CO5	
		CO6	

Continuous Integration and Continuous Delivery using DevOps	R2031057	CO1	Understand thevarious phases of SDLC and agile software development
		CO2	Understand the fundamentals of Devops, adoption in projects, CI/CD and Devops maturity models
		CO3	Implement an automated CICD pipeline using a stack of tools by individual or group
		CO4	
		CO5	
		CO6	
Employability Skills-I	R2031058	CO1	Understand individual skill assessments and different types of Communication.
		CO2	Develop and practice self management skills and corporate etiquette.
		CO3	Apply presentation techniques effectively with appropriate body language
		CO4	Improve their verbal, written and other skills by performing mock sessions.
		CO5	Prepare for different types of interviews and be prepared for HR and technical interviews.
		CO6	
Machine Learning	R2032051	CO1	Demonstrate the fundamental usage of the concept Machine Learning system.
		CO2	Apply various Supervised Learning techniques in problem solving.
		CO3	Analyze the Ensemble Learning Methods.
		CO4	Apply the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
		CO5	understand the Neural Network Models and concepts of Deep Learning.
		CO6	
Compiler Design	R2032052	CO1	Explain different phases of compilation with Design of lexical analyzer for a language.
		CO2	Compare top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input.
		CO3	Apply optimization techniques to intermediate code for statements and generate machine code for high level language program.
		CO4	Design syntax directed translation schemes for a given context free grammar and generate symbol tables for runtime environment
		CO5	
		CO6	
Cryptography and Network Security	R2032053	CO1	Analyze the basic principles of Cryptography.
		CO2	Apply the functionality of Secret and Public Key Cryptography.
		CO3	Analyze various Message Authentication functions and Secure Algorithms.
		CO4	Examine the Layers of various Security Services.

		CO5	
		CO6	
Object Oriented Analysis and Design	R203205C	CO1	Analyze the nature of complex systems and its solutions.
		CO2	Understands the conceptual UML model, classes, and relationships.
		CO3	Understand the modeling of Class and Object Diagram and able to apply for real time applications.
		CO4	Understand basic behavioral modeling and designs Diagrams.
		CO5	Gain the Knowledge on advanced behavioral and architectural modeling and applies the techniques for Diagrams.
		CO6	
MEAN Stack Development	R203205E	CO1	Build static web pages using HTML 5 elements.
		CO2	Apply JavaScript to embed programming interface for web pages and to perform Client-side validations.
		CO3	Build a basic web server using Node.js and recognize the need for Express.js.
		CO4	Develop JavaScript applications using Typescript and work with document database using MongoDB.
		CO5	Design dynamic and responsive single-page web applications using Angular.
		CO6	
Employability skills-II	R2032059	CO1	Demonstrate the fundamental usage of the different methods to solve basic mathematical problems.
		CO2	Apply various strategies in minimizing time consumption in problem solving.
		CO3	Analyze the mathematical problems and utilize these mathematical skills both in their professionals as well as personal life.
		CO4	Illustrate the present information in quantitative forms including table, graphs and formulas.
		CO5	
		CO6	
Machine Learning using Python Lab	R2032054	CO1	Apply the hypothesis concepts on various Learning Models.
		CO2	Construct Machine learning programs for Supervised learning models
		CO3	Construct Machine learning programs for unsupervised learning models
		CO4	Create an Artificial Neural Network by implementing the Back propagation algorithm
		CO5	Analyse the graphical outcomes of learning algorithms with specific datasets
		CO6	
Compiler Design Lab	R2032055	CO1	Design and implement Lexical analyzer using C programs and LEX tools.
		CO2	Design and implement various types of top down and Bottom up parsers.
		CO3	Apply Lex and Yacc Tools.

		CO4	Implementation of Three address code and code generation Algorithms.
		CO5	
		CO6	
Cryptography and Network Security Lab	R2032056	CO1	Use C language to develop simple XOR operation for encryption of data
		CO2	Make use of C/Java to implement Symmetric cryptography
		CO3	Choose C/Java to develop Asymmetric cryptography
		CO4	Implement Diffie-Hellman Key exchange using HTML and Javascript
		CO5	Develop java programs on MD-5 and SHA-1 algorithms
		CO6	
MEAN Stack Technologies-Module I	R2032058	CO1	Develop professional web pages of an application using HTML elements like lists, navigations, tables, various form elements, embedded media which includes images, audio, video, and CSS Styles.
		CO2	Utilize JavaScript for developing interactive HTML web pages and validate form data.
		CO3	Build a basic web server using Node.js and working with Node Package Manager (NPM).
		CO4	Build a web server using Express.js.
		CO5	Make use of Typescript to optimize JavaScript code by using the concept of strict type checking.
		CO6	
Cloud Computing	R204105A	CO1	Understand knowledge of different aspects of Cloud Computing such as: Services, Models, and Challenges.
		CO2	Identify the Infrastructure of Cloud Computing and also Analyze the different Cloud Computing Applications and Paradigms.
		CO3	Analyze the importance of Cloud Resourcing Virtualization and Cloud Resourcing and Scheduling.
		CO4	Understand Cloud based Storage and need of Security in Cloud Computing
		CO5	Understand the Development of Cloud-based applications like Google and Microsoft.
		CO6	
Deep Learning Techniques	R204105E	CO1	Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning.
		CO2	Discuss the Neural Network training, various random models.
		CO3	Develop Keras, TensorFlow, Theano and CNTK based deep learning models for solving problems.
		CO4	Analyze different Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN)
		CO5	Implement Interactive Applications of Deep Learning.
		CO6	

Wireless Network Security	R204105J	CO1	Identify and describe the security threats and vulnerabilities of wireless networks.
		CO2	Understand the purpose and functions of various wireless protocols and cryptography.
		CO3	Implement the security considerations of wireless devices from unauthorized access.
		CO4	Analyse the various wireless data networks.
		CO5	Implement the various Wireless Deployment Strategies
		CO6	
API and Microservices (Job Oriented Course)	R204105M	CO1	Understand fundamentals of Spring Framework.
		CO2	Create and Develop Spring Boot Application.
		CO3	Develop a Spring Data JPA application with Spring Boot.
		CO4	Write RESTful service using Spring REST.
		CO5	Create secure RESTful endpoints using Spring Security Document.
		CO6	
Secure Coding Techniques (Job Oriented Course)	R204105U	CO1	understand the trend,reasons and impact of recent cyber attacks.
		CO2	Understand OWASP design principles while designing a web application.
		CO3	Understand Threat modeling.
		CO4	Importance of security in all phases of SDLC
		CO5	Write secure coding using some of practices in C/C++/JAVA and python programming languages.
		CO6	
Universal Human Values 2: Understanding Harmony	R2041011	CO1	Understand the essentials of human values and skills, self-exploration, happiness and prosperity
		CO2	Apply the role of a human being in ensuring harmony in self and family
		CO3	Interpret the role of a human being in ensuring harmony in society and nature
		CO4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.
		CO5	
		CO6	
Skill Oriented Course - V PYTHON: Deep Learning Lab	R2041052	CO1	Implement deep learning models for image analysis
		CO2	Build a convolutional neural network, and understand its application to build a recurrent neural network.
		CO3	Apply various optimization algorithms to comprehend different activation functions to understand hyper parameter tuning
		CO4	Design auto encoders in real time application.
		CO5	Building a simple Generative Adversarial Network (GAN) using TensorFlow
		CO6	Develop the ability to present and communicate outcomes of deep learning projects

Industrial/Research Internship	R2041055	CO1	
		CO2	
		CO3	
		CO4	
		CO5	
		CO6	
Major Project Work, Seminar Internship	Project	CO1	Identify the complex engineering problems relevant to the society and industry.
		CO2	Apply modern technologies, tools and systems in the field of information technology to analyze the identified problem.
		CO3	Design and implement a viable solution to the problem.
		CO4	Apply communication, report writing skills and Presentation skills.
		CO5	Develop the team work and leadership skills with professional and ethical values.
		CO6	

Head of the Department
Computer Science & Engineering
Sir C.R.R. College of Engineering
ELURU - 534 007

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ELURU-534007, WEST GODAVARI DIST, ANDHRA PRADESH, INDIA

(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)

Phone no: 08812-230840, Visit us at http://www.sircrrengg.ac.in, eeehod@sircrrengg.ac.in

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

R20 COURSE OUTCOMES

I Year – I SEMESTER

S.No	Course Code	Subjects	Co. No	Course Outcomes
1	R201102	Communicative English	R201102.1	Apply The Four Languages Learning Skills-Listening, Speaking, Reading, Writing (Lsrw) For Professional Success.
			R201102.2	Employ Knowledge Of Grammatical Structures And Vocabulary In Speech And Writing
			R201102.3	Apply Effective Communication Skills To Enhance Professional Possibilities.
			R201102.4	Develop Acceptable Personality Traits Suitable For Chosen Profession.
2	R201101	Mathematics -I	R201101.1	Examine the convergence of series and apply mean value theorem to real life problem.
			R201101.2	Solve the Differential Equations of first and higher order related to various engineering applications.
			R201101.3	Apply the partial differentiation technique to solve physical problem
			R201101.4	Apply double and triple integrals to find areas and volumes.
3	R201109	Mathematics-II	R201109.1	Solve system of linear algebraic equations and apply Eigen value computation techniques to reduce a given quadratic to canonical form
			R201109.2	Solve algebraic and Transcendental equations by using Numerical methods
			R201109.3	Apply Newton's forward and backward interpolation and Lagrange's formula for equal and unequal intervals.
			R201109.4	Computer numerical solutions of differential equations.
4	R201110	Programming for Problem Solving Using C	R201110.1	Able to understand the fundamental concepts of computers and C language constructs
			R201110.2	Able to apply the concepts of C constructs Homogeneous and heterogeneous data types and pointers for solving the given problems
			R201110.3	Able to divide a given problem into modules using C constructs and functions to develop modular reusable code.
			R201110.4	Able to analyze the problem, choose appropriate C constructs and use the file system to solve mathematical and engineering problems accordingly.
5	R201111	Engineering Design	R201111.1	Construct polygons, scales and draw curves used in engineering applications
			R201111.2	Apply concept of orthographic projection to project points and lines inclined to both reference planes.

			R201111.3	Apply concept of orthographic projections of planes inclined to both the reference planes.
			R201111.4	Apply concept of orthographic projections of solids inclined to both the reference planes.
			R201111.5	Draw isometric view of objects from orthographic views and vice versa
6	R201106	English Communications Skill Laboratory	R201106.1	Recognize the sounds of English with the help of audio visual aids
			R201106.2	Build confidence and overcome inhibitions while speaking in English.
			R201106.3	Demonstrate acquired language skills in performing the designated activity.
7	R201112	Electrical Engineering Workshop	R201112.1	To understand the limitations, tolerances, safety aspects of electrical systems and wiring.
			R201112.2	Ability to Select wires/cables and other accessories used in different types of wiring.
			R201112.3	To understand the basic concepts of electrical circuits and able to measure current, voltage and power in a circuit
8	R201113	Programming for Problem Solving Using C LAB	R201113.1	Able to understand the concepts of C language
			R201113.2	Able to apply the C language constructions for simple problems
			R201113.3	Able to apply C constructs like homogeneous, heterogeneous data for a given mathematical problem
			R201113.4	Able to analysis a given scenario using functions & file concepts

I Year – II SEMESTER

S.No	Course Code	Subjects	Co. No	Course outcomes
1	R201206	Mathematics-III	R201206.1	Apply the concepts of vector calculus to the problems of work done by a force, circulation and flux
			R201206.2	Apply Laplace Transforms to solve the ordinary differential equations
			R201206.3	Compute Fourier series of the periodic function and Apply Fourier transform to a range of non-periodic function.
			R201206.4	Solve the first and higher order partial differential equations and apply to various physical problems
2	R201207	Applied Physics	R201207.1	Apply the knowledge of different optical phenomena in daily life.
			R201207.2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibers.
			R201207.3	Explain fundamental concepts of quantum mechanics and analyze the behaviour of electron in metals according to various theories
			R201207.4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
			R201207.5	Understand electrons & holes behaviour in semiconductors and extraordinary behaviour of materials at various transition temperatures
3	R201208	Data Structure Through C	R201208.1	Describe how arrays, records, linked structures, stacks, queues, trees and graphs are represented in memory and used by algorithm
			R201208.2	Discuss the computational efficiency of the principal algorithms for sorting ,searching and hashing
			R201208.3	Demonstrate different methods for traversing trees and graphs
			R201208.4	Solve various algorithm design techniques for developing algorithms
4	R201209	Electrical Circuit Analysis-1	R201209.1	able to solve problems on nodal ,mesh analysis and other network reduction techniques
			R201209.2	Able to differentiate between electric and magnetic circuits
			R201209.3	Able to understand power factor and its significance
			R201209.4	Able to solve problems on resonance and network theorems
5	R201227	Basic Civil And Mechanical Engineering	R201227.1	Familiarize about Shear force diagram & Bending moment diagrams for various beams.
			R201227.2	Apply concepts of Rosette analysis for strain measurements.
			R201227.3	Analyze the characteristics of common building materials
			R201227.4	Explain the working characteristics of Internal Combustion engines.
			R201227.5	Distinguish the differences between boiler mountings and

S.No	Course Code	Subjects	Co. No	Course outcomes
				accessories.
6	R201233	Applied Physics Lab	R201233.1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
			R201233.2	Analyze various electronic circuits and study the temperature dependence of semiconductors.
			R201233.3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fibre
7	R201251	Basic Civil and mechanical engineering lab	R201251.2	Solve to arrive at finding constant speed and variable speed on IC engines and interpret their performance
			R201251.2	Estimate energy distribution by conducting heat balance test on IC engines
			R201251.3	Determine flow discharge measuring device used in pipes channels and tanks
			R201251.4	Test for performance of pumps and turbines by using concepts of fluid mechanics
8	R201234	Data Structure Through C lab	R201234.1	To develop skills to design and analyze simple linear and non linear data structures
			R201234.2	To Strengthen the ability to identify and apply the suitable data structure for the given real world problem
			R201234.3	To Gain knowledge in practical applications of data structures

II Year – I SEMESTER

S.No	Course Code	Subjects	Co. No	Course outcomes
1	R2021021	Mathematics IV	R2021021.1	Apply the concepts of analytic functions, sequences and series of the complex functions
			R2021021.2	Apply various probability distributions for both descrete and continuous random variable
			R2021021.3	Apply the terms of the sampling distribution and test the hypothesis for small samples
			R2021021.4	Apply the terms of the sampling distribution and test the hypothesis for large samples
2	R2021022	Electronic Devices and Circuits	R2021022.1	Able to demonstrate the basic concept of diodes and transistors.
			R2021022.2	Able to summarize the operation of rectifiers with and without filters.
			R2021022.3	Ability to analyze various characteristics of different configurations of transistors.
			R2021022.4	Able to analyze oscillators and amplifiers.
			R2021022.5	Able to illustrate the concepts of MOSFET, IGBT, FET etc
3	R2021023	Electrical Circuit Analysis -II	R2021023.1	Classify different forms of electrical circuits based on components, supply and structures.
			R2021023.2	Determine the response of different electrical circuits.
			R2021023.3	Analyze the response of Electrical circuits with different excitations using Laplace Transforms.
			R2021023.4	Evaluate electrical equivalent network for the given transfer function & network parameters.
4	R2021024	DC Machines and Transformers	R2021024.1	Summarize the basics and principle of operation of DC machines and Transformer
			R2021024.2	Distinguishing the fundamental parts of DC machines and Transformer
			R2021024.3	Explain the Performance of DC machines and Transformer
			R2021024.4	Identify possible applications of different DC machines and Transformers for a given requirement
5	R2021025	Electro Magnetic Fields	R2021025.1	Demonstrate knowledge on basic laws in electro statics, magneto statics fields.
			R2021025.2	Determine the electric field and magnetic field quantities for different charge/Current configurations.
			R2021025.3	Differentiate and analyze the forces, torques, energy stored in electro static fields and Magneto static fields.
			R2021025.4	Illustrate Electrostatics and Magneto static boundary conditions and develop the concepts of capacitances and inductances.
			R2021025.5	Determine the energy of electromagnetic wave and learn the concepts on Time varying fields.

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S.No	Course Code	Subjects	Co. No	Course outcomes
6	R2021026	Electrical Circuits Laboratory	R2021026.1	Apply and Verify the Principals of various theorems.
			R2021026.2	Solve Self & Mutual inductance ,Various Parameter for Electrical Network
			R2021026.3	Analyze the characteristics of resonant circuits
7	R2021027	DC Machines and Transformers lab	R2021027.1	Examine the characteristics of different dc machines transformers and predict specific applications of those machines accordingly.
			R2021027.2	Compare the speed control method of different types of DC motors
			R2021027.3	Estimating the parameters of equivalent circuit of transformers
			R2021027.4	Identify various losses in dc machines and transformers by conducting suitable tests.
8	R2021028	EDC Lab	R2021028.1	Analyze the operation of devices like diodes, transistors, BJT, UJT and FETs practically.
			R2021028.2	Design electronic circuits using basic devices
			R2021028.3	Illustrate the construction and working of CRO
9	R2021029	Skill Oriented Course –I Design of Electrical Circuits using Engineering Software Tools	R2021029.1	Develop the Matlab programs to analyze the electrical circuit problems
			R2021029.2	Construct various electrical circuits using simulation tool.
			R2021029.3	Compare resonant parameters for RLC series and parallel resonance circuits.
10	R202101A	Community service Project	R202101A.1	Ability to develop a solution to the technological problems of society.
			R202101A.2	Able to make use of technological change which suits current need of society
			R202101A.3	Able to explain new technologies available for problems of the society

II Year – II SEMESTER

S.No	Course Code	Subjects	CO. No	Course outcomes
1	R2022021	Python Programming	R2022021.1	Summarize the fundamental concepts of python programming
			R2022021.2	Solve coding tasks related conditional execution, loops and functions
			R2022021.3	Apply various data structures in developing solutions to real time scenarios.
			R2022021.4	Analyze files, object oriented concepts in python, Outline Exception handling concepts and GUI applications in Python.
2	R2022022	Digital Electronics	R2022022.1	Classify different number systems and apply to generate various codes.
			R2022022.2	Apply the concept of Boolean algebra in minimization of functions
			R2022022.3	Design different types of combinational logic circuits.
			R2022022.4	Apply knowledge of flip-flops in designing of registers and counters.
			R2022022.5	Analyse the operation and design methodology for sequential circuits
3	R2022023	Power System-I	R2022023.1	Explain the construction and principle of operation of different power generating stations
			R2022023.2	Ability to explain the function of various sections of different power stations
			R2022023.3	Ability to design and estimate different power substations
			R2022023.4	Illustrate different economic aspects and tariff
4	R2022024	Induction and Synchronous Machines	R2022024.1	Annotating the construction and principle of operation of different kinds of rotating AC machines
			R2022024.2	Ability to experimenting on Ac Machines to find the performance characteristics.
			R2022024.3	Appraise the purpose for parallel operation of generators and learn the conditions to be satisfied.
			R2022024.4	Illustrate the construction, operation and characteristics of commonly used special purpose machines.
5	R2022015	MEFA	R2022015.1	Able to determine the objectives and able to know the nature and scope of Managerial Economics, Predict the demand of products and services by using different methods
			R2022015.2	Examine Optimum Production, economies of scale, production, production functions, optimum size of the firm, cost, cost behavior and Break Even Point.
			R2022015.3	Identify the price and market structure, behavior of consumer and producer under competitive market situations
			R2022015.4	Discuss the process & principles of accounting and prepare Journal, Ledger, Trial Balance, Manufacturing A/c, Trading A/c., Profit & Loss A/c. and Balance Sheet of an enterprise

S.No	Course Code	Subjects	CO. No	Course outcomes
			R2022015.5	Outline the steps, methods & sources of raising capital by business undertaking
6	R2022025	Python Programming Lab	R2022025.1	Summarize the basic concepts of Python programming language
			R2022025.2	Apply various data structures in developing solutions to real time scenarios
			R2022025.3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.
			R2022025.4	Design the usage of pattern matching, GUI in python programming.
7	R2022026	Induction and Synchronous Machines lab	R2022026.1	choosing methods for testing of different electrical machines to identify their performance
			R2022026.2	estimating equivalent circuit parameters of three phase Induction motor
			R2022026.3	Experimenting the process of 'synchronization' of a generator to the live bus bar and method of starting a synchronous motor.
			R2022026.4	distinguish the operational features of synchronous machines and induction machines.
8	R2022027	Digital Electronics Laboratory	R2022027.1	Summarize the basic gates and verify their functionalities.
			R2022027.2	Apply Boolean laws to simplify the digital circuits.
			R2022027.3	Apply the design procedures to design basic combinational circuits.
			R2022027.4	Apply the design procedures to design basic sequential circuits.
9	R2022028	Skill Oriented Course -II Internet OF Things Applications to Electrical Engineering	R2022028.1	Analyze various technologies of Internet of Things to real time applications.
			R2022028.2	Experiment with various communication technologies used in the Internet of Things.
			R2022028.3	Analyze the IoT environment which Connect the devices using web and internet.
			R2022028.4	Develop the Smart Home, Smart city using IoT concepts.

III Year – I SEMESTER

S.No	Course Code	Subjects	Co. No	Course outcomes
1	R2031021	Power Systems-II	R2031021.1	Student is able to determine the parameters of transmission lines for various configurations.
			R2031021.2	Student is able to Evaluate the performance of short, medium and long transmission lines.
			R2031021.3	Student is be able to Analyze the transients in power transmission systems.
			R2031021.4	Student is able to Assess the effect of various factors on the performance of transmission lines.
			R2031021.5	Student is able to Design power transmission towers and insulators for different voltage levels & climatic conditions.
2	R2031022	Power Electronics	R2031022.1	Able to Explain characteristics of various power electronic elements and able to build simple power electronic circuits
			R2031022.2	Able to Analyze the operation and waveforms for phase-controlled converters.
			R2031022.3	Able to Analyze the operation and waveforms choppers and inverters
			R2031022.4	Able to Illustrate AC voltage regulators and cyclo converters operation
			R2031022.5	Able to Apply knowledge of modulation techniques for inverters in real time projects.
3	R2031023	Control Systems	R2031023.1	Classify different types of Control Systems
			R2031023.2	Illustrate Transfer function model and state space model of linear Control systems
			R2031023.3	Determination of Time and frequency response specifications of Linear Control Systems
			R2031023.4	Analyses absolute and relative stability of LTI and MIMO systems
			R2031023.5	Design Compensators to improve System Response
4	R2031024	Control Systems Laboratory	R2031024.1	Illustrate to find time response of given control system model
			R2031024.2	Design of Lead, Lag compensators in control systems
			R2031024.3	Analyze Root Locus, Bode plots and nyquist plot for given control system using matlab
			R2031024.4	Examine the basic knowledge on practical control system applications like AC & DC servo motor, synchro and magnetic amplifier
			R2031024.5	Evaluate system performance using PID controllers for given control system using simulation tool
5	R2031025	Power	R2032025.1	Able to Explain the basic operation of various power

S.No	Course Code	Subjects	Co. No	Course outcomes
		Electronics Laboratory		semiconductor devices
			R2032025.2	Able to analyze the performance of different AC-DC power electronic circuits for different loads
			R2032025.3	Able to analyze the performance of different DC-DC power electronic circuits for different loads
			R2032025.4	Able to distinguish the working of Buck and Boost Converters, Cycloconverters and AC voltage controller for different Loads
			R2032025.5	Able to distinguish the working of Square wave Inverter and Pwm Inverter
6	R2031026	Soft Skill Course Employability Skills	R2031026.1	Students are able to solve problems by following strategies in minimizing time consumption in problem solving and shortcut methods.
			R2031026.2	Students are able to solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.
			R2031026.3	Students are able to analyze, summarize and present information in quantitative forms including table, graphs and formulas
			R2031026.4	Students are able to classify the core competencies to succeed in professional and personal life
7	R2031028	Summer Internship	R2031028.1	Gained a better make use of the engineering applications at workplace
			R2031028.2	Developed and demonstrated workplace competencies necessary for professional and academic success
			R2031028.3	Choose your career preferences and professional goals
			R2031028.4	Identify your competitiveness for full-time engineering employment
			R2031028.5	Ability to analyze real life challenges by making effective decisions at the organizations
8	R203102B	Utilization of Electrical Energy	R203102B.1	Explain the efficient illuminating sources and also able to design different lightning systems.
			R203102B.2	Demonstrate different methods of heating and welding systems in industries.
			R203102B.3	Identify appropriate and desirable motors for electric drives in industrial applications.
			R203102B.4	Explain Speed-Time characteristics and to estimate energy consumption of different types of traction motors.
			R203102B.5	Illustrate Various Energy Storage Systems.
9a	R203103G	Sustainable Energy Technologies	R203103G.1	Explain the importance of solar energy collection and storage
			R203103G.2	Apply the principles of wind energy and biomass energy
			R203103G.3	Analyze knowledge on geothermal and ocean energy.

S.No	Course Code	Subjects	Co. No	Course outcomes
			R203103G.4	Justify the knowledge about energy efficient systems.
			R203103G.5	Discuss the concepts of green manufacturing systems.
9b	R20304M	IC Applications	R20304M.1	Outline the linear and non-linear applications of operational amplifiers.
			R20304M.2	Discover the applications of op-amp:555timer,PLL
			R20304M.3	Compare differ types of analog to digital & digital to analog converters
			R20304M.4	Design the digital applications using digital ICs.

III Year – II SEMESTER

S.No	Course Code	Subjects	Co. No	Course outcomes
1	R2032021	Microprocessors & Microcontrollers	R2032021.1	Compare the architectural features of programming concepts of 8086, 80286, 80386, 80486 and PENTIUM microprocessors.
			R2032021.2	Develop the assembly language program for 8086 microprocessors.
			R2032021.3	Analyze the concepts of 8086 microprocessor interfacing with memory and peripherals.
			R2032021.4	Compare the architectural programming concepts of 8051, and PIC controllers.
2	R2032022	Electrical Measurements and Instrumentation	R2032022.1	Summarize the operating principle and working of different types of instruments for measuring of electrical quantities
			R2032022.2	To analyze the working principle for different types of instruments Wattmeter, power factor meters, potentiometers.
			R2032022.3	To analyse the principle and operation of various types of bridges to measure resistance, inductance, capacitance and frequency
			R2032022.4	Explain the operating principle and working of transducers
			R2032022.5	Illustrate the operating principle and working of Digital meters
3	R2032023	Power System Analysis	R2032023.1	Analyze Per Unit representation of Power System
			R2032023.2	Develop the network Matrix and apply the load flow Studies.
			R2032023.3	Determine the Symmetrical Components and Unsymmetrical Components of Power system.
			R2032023.4	Explain the various types of faults on an unloaded alternator.
			R2032023.5	Apply the concepts of Power System Stability swing equation, critical clearing angle calculation elementary real world applications.
4	R2032024	Electrical Measurements and Instrumentation Lab	R2032024.1	Ability to select right type of instrument for measurement of voltage, power, current, energy for A.C&D.C.
			R2032024.2	Ability to test meters and select suitable bridge for measurement of electrical parameters.
			R2032024.3	Ability to design bridges for measurement of resistance, inductance and capacitance.
			R2032024.4	Ability to do experiment with trainer kit for measurement of displacement, strain and dielectric strength of oil
5	R2032025	Microprocessors & Microcontrollers Lab	R2032025.1	Ability to develop assembly language program using 8086 microprocessor
			R2032025.2	Ability to interpret 8086 with I/O and other devices.
			R2032025.3	Ability to develop assembly language program using 8051 microcontroller.

S.No	Course Code	Subjects	Co. No	Course outcomes
6	R2032026	PSS LAB	R2032026.1	Ability to apply iterative techniques for power flow analysis
			R2032026.2	Ability to model and design stability and dynamics of single and two area bus system in power system
			R2032026.3	Ability to acquire knowledge on Fault analysis.
			R2032026.4	Solve the economic dispatch problems
7	R2032027	Skill Advanced Course: Machine Learning with Python	R2032027.1	Illustrate and comprehend the basics of Machine Learning with Python
			R2032027.2	Demonstrate the algorithms of Supervised Learning and be able to differentiate linear and logistic regressions
			R2032027.3	Demonstrate the algorithms of Unsupervised Learning and be able to understand the clustering algorithms
			R2032027.4	Evaluate the concepts of binning, pipeline Interfaces with examples
			R2032027.5	Apply the sentiment analysis for various case studies
8	R203202D	Switchgear & Protection	R203202D.1	Illustrate principle, construction, and working of various types of high-voltage circuit breakers.
			R203202D.2	Illustrate, principle, construction, and working of various types of electromagnetic protective relays, and basics of static relays.
			R203202D.3	Apply electromagnetic relays to protect generator and transformers for different fault conditions.
			R203202D.4	Apply electromagnetic relays to protect feeder and busbars for different fault conditions.
			R203202D.5	Explain over voltage protective schemes and types of neutral grounding
9	R203204G	Principles of Signal Processing	R203204G.1	Use FFT algorithm for solving DFT of a given signal
			R203204G.2	Design a Digital Filter (FIR &IIR) from the given Specifications
			R203204G.3	Realize the FIR and IIR Structures from the designed Digital filters.
			R203204G.4	Applications of Multirate Processing
			R203204G.5	Apply the Adaptive Signal Processing concepts to various signal Processing applications

IV Year – I SEMESTER

S.No	Course Code	Subjects	Co. No	Course outcomes
1	R2041011	Universal Human Values-2	R2041011.1	Recall once again to have a clear perspective of human values and this is conducive for more aware of themselves and also their surroundings like family, society and nature.
			R2041011.2	Demonstrate their efficiency and responsiveness in dealing with the new situations and problems in real life with good and better solutions.
			R2041011.3	Apply the acquired knowledge on the subject, the students might have better ability and critical assessment on their new situations, problems and happenings cropping up from time to time
			R2041011.4	Test their sensitiveness and commitment towards what they understood about human values, human relationships and human society.
			R2041011.5	Adapt what they have learnt about human values in their real life and hope a small beginning may be made in this value-centric direction.
2	R204102C	Flexible Alternating Current Transmission Systems	R204102C.1	Analyze the basics of Power flow control in Transmission lines using FACTS Controllers
			R204102C.2	Relate the performance and applications of VSI & CSI.
			R204102C.3	Analyze the role of shunt and series type FACTS controllers in improving the power system dynamics
			R204102C.4	Analyze the use of control schemes of UPFC and IPFC in improving the power quality
3	R204102G	High Voltage Engineering	R204102G.1	Demonstrate the dielectric properties of gaseous materials used in HV equipment
			R204102G.2	Explains the breakdown phenomenon in liquid and solid dielectric materials
			R204102G.3	Identify the techniques of generation of high AC and DC voltages
			R204102G.4	Identify the techniques of generation of high impulse voltages and currents
			R204102G.5	Select suitable methods for measurement of high AC – DC – Impulse voltages and currents.
4	R204102I	Power System Operation &Control	R2041021.1	Determine optimal scheduling of thermal & Hydro-thermal power plants using Lagrange optimization technique
			R2041021.2	Solve optimal unit commitment problem in power plants using Priority ordering & Dynamic Programming techniques
			R2041021.3	Design an automatic active power/frequency controller (AGC/ALFC) for single area & two area power systems and analyze its performance
			R2041021.4	Evaluate how reactive power compensation improves the performance of transmission line
5	R204104Q	IOT & Applications	R204104Q.1	Illustrate Fundamentals, architecture and various technologies of Internet of Things

S.No	Course Code	Subjects	Co. No	Course outcomes
			R204104Q.2	Analyze various Communication technologies used in IOT
			R204104Q.3	Applying the connectivity of Devices using Bluetooth and internet in the IOT environment
			R204104Q.4	Explain the various data acquisition methods, data handling using cloud for IOT
			R204104Q.5	Experiment with IOT in several case studies like smart home, smart city etc.
6	R204104U	Basic Electronics	R204104U.1	Able to Analyze types of Diodes
			R204104U.2	Able to Analyze applications of diodes
			R204104U.3	Able to explain concept of transistors
			R204104U.4	Able to Apply transistor for different types of applications
			R204104U.5	Able to Analyze the applications of JFET and MOSFET
			R204104U.6	Able to Illustrate the various concepts of modern power electronic devices to society
7	R204102Q	Skill Advanced Course Machine Learning with Python Lab	R204102Q.1	Apply a procedures for the machine learning algorithms
			R204102Q.2	Design and Develop Python programs for various Learning algorithms
			R204102Q.3	Apply appropriate data sets to the Machine Learning algorithms
			R204102Q.4	Develop Machine Learning algorithms to solve real world problems
8	R204102R	Industrial Training	R204102R.1	Students can identify and analyze the real time system problems
			R204102R.2	Students can make use of the latest technology and current trends in the field of respective areas
			R204102R.3	Students can analyze the documents and present technical reports
			R204102R.4	Students can analyze discussions for assessment of knowledge
			R204102R.5	Students can apply professional ethics

IV Year – II SEMESTER

S.No	Course Code	Subjects	Co. No	Course outcomes
1	R204201	Project	R204201.1	Apply the Electrical Knowledge to solve practical problems
			R204201.2	Designing the circuit to implement the projects
			R204201.3	Build the Electrical and Electronics models by Simulation/Emulation.
			R204201.4	Design and Implement Engineering Solutions for real time application

HOD, EEE

Head of the Dept.
Electrical and Electronics Engineering
Sir C.R. Reddy College of Engineering
ELURU-534007, AP

ELECTRICAL AND ELECTORINICS ENGINEERING

COURSE	C.O CODE	COURSE OUTCOME DESCRIPTION
COMMUNICATIVE ENGLISH	R201102.1	Apply The Four Languages Learning Skills-Listening, Speaking, Reading, Writing (Lsrw) For Professional Success.
	R201102.2	Employ Knowledge Of Grammatical Structures And Vocabulary In Speech And Writing
	R201102.3	Apply Effective Communication Skills To Enhance Professional Possibilities.
	R201102.4	Develop Acceptable Personality Traits Suitable For Chosen Profession.
MATHEMATICS -I	R201101.1	Examine the convergence of series and apply mean value theorem to real life problem.
	R201101.2	Solve the Differential Equations of first and higher order related to various engineering applications.
	R201101.3	Apply the partial differentiation technique to solve physical problem
	R201101.4	Apply double and triple integrals to find areas and volumes.
Mathematics-II	R201109.1	Solve system of linear algebraic equations and apply Eigen value computation techniques to reduce a given quadratic to canonical form
	R201109.2	Solve algebraic and Transcendental equations by using Numerical methods
	R201109.3	Apply Newton's forward and backward interpolation and Lagrange's formula for equal and unequal intervals.
	R201109.4	Computer numerical solutions of differential equations.
PPSUC	R201110.1	Able to understand the fundamental concepts of computers and C language constructs
	R201110.2	Able to apply the concepts of C constructs Homogeneous and heterogeneous data types and pointers for solving the given problems
	R201110.3	Able to divide a given problem into modules using C constructs and functions to develop modular reusable code.
	R201110.4	Able to analyze the problem, choose appropriate C constructs and use the file system to solve mathematical and engineering problems accordingly.
ED	R201111.1	Construct polygons, scales and draw curves used in engineering applications
	R201111.2	Apply concept of orthographic projection to project points and lines inclined to both reference planes.
	R201111.3	Apply concept of orthographic projections of planes inclined to both the reference planes.
	R201111.4	Apply concept of orthographic projections of solids inclined to both the reference planes.
	R201111.5	Draw isometric view of objects from orthographic views and vice versa
English Lab	R201106.1	Recognize the sounds of English with the help of audio visual aids
	R201106.2	Build confidence and overcome inhibitions while speaking in English.
	R201106.3	Demonstrate acquired language skills in performing the designated activity.
EEW	R201112.1	To understand the limitations, tolerances, safety aspects of electrical systems and wiring.
	R201112.2	Ability to Select wires/cables and other accessories used in different types of wiring.
	R201112.3	To understand the basic concepts of electrical circuits and able to measure current, voltage and POWER IN A CIRCUIT
	R201113.1	Able to understand the concepts of C language
	R201113.2	Able to apply the C language constructions for simple problems

PPSUC LAB	R201113.3	Able to apply C constructs like homogeneous, heterogeneous data for a given mathematical problem
	R201113.4	Able to analysis a given scenario using functions & file concepts
COURSE	C.O CODE	COURSE OUTCOME DESCRIPTION
Mathematics-III	R201206.1	Apply the concepts of vector calculus to the problems of work done by a force, circulation and flux
	R201206.2	Apply Laplace Transforms to solve the ordinary differential equations
	R201206.3	Compute Fourier series of the periodic function and Apply Fourier transform to a range of non-periodic function.
	R201206.4	Solve the first and higher order partial differential equations and apply to various physical problems
APPLIED PHYSICS	R201207.1	Apply the knowledge of different optical phenomena in daily life.
	R201207.2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibers.
	R201207.3	Explain fundamental concepts of quantum mechanics and analyze the behaviour of electron in metals according to various theories
	R201207.4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	R201207.5	Understand electrons & holes behaviour in semiconductors and extraordinary behaviour of materials at various transition temperatures
DATA STRUCTURE THROUGH C	R201208.1	Describe how arrays, records, linked structures, stacks, queues, trees and graphs are represented in memory and used by algorithm
	R201208.2	Discuss the computational efficiency of the principal algorithms for sorting ,searching and hashing
	R201208.3	Demonstrate different methods for traversing trees and graphs
	R201208.4	Solve various algorithm design techniques for developing algorithms
ELECTRICAL CIRCUIT ANALYSIS	R201209.1	able to solve problems on nodal ,mesh analysis and other network reduction techniques
	R201209.2	Able to differentiate between electric and magnetic circuits
	R201209.3	Able to understand power factor and its significance
	R201209.4	Able to solve problems on resonance and network theorems
BASIC CIVIL AND MECHANICAL ENGG	R201227.1	Familiarize about Shear force diagram & Bending moment diagrams for various beams.
	R201227.2	Apply concepts of Rosette analysis for strain measurements.
	R201227.3	Analyze the characteristics of common building materials
	R201227.4	Explain the working characteristics of Internal Combustion engines.
	R201227.5	Distinguish the differences between boiler mountings and accessories.
APPLIED PHYSICS LAB	R201233.1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	R201233.2	Analyze various electronic circuits and study the temperature dependence of semiconductors.

	R201233.3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fibre
DATA STRUCTURE THROUGH C	R201234.1	To develop skills to design and analyze simple linear and non linear data structures
	R201234.2	To Strengthen the ability to identify and apply the suitable data structure for the given real world problem
	R201234.3	To Gain knowledge in practical applications of data structures
BASIC CIVIL AND MECHANICAL ENGG LAB	R201251.2	Solve to arrive at finding constant speed and variable speed on IC engines and interpret their performance
	R201251.2	Estimate energy distribution by conducting heat balance test on IC engines
	R201251.3	Determine flow discharge measuring device used in pipes channels and tanks
	R201251.4	Test for performance of pumps and turbines by using concepts of fluid mechanics

	C.O CODE	**COURSE OUTCOME DESCRIPTION**
Computer Programming andNum. Methods Lab	C1208.2	Prepare Algorithm And Flowchart To Solve Simple Engineering Problems
	C1208.3	Write C Program To Solve Simple Engineering Programs Using Control Statements, Arrays And Functions
	C1208.4	Write C Program To Solve Simple Engineering Programs Using Pointers, Function Call By Value And Function Call By Reference
	C1208.5	Write C Program To Solve Simple Engineering Programs Using Structures And Files
	C1208.6	Explain About Sources Of Errors In Numerical Methods
	C1208.7	Identify Sources Of Errors In Numerical Methods
	C1208.8	Students Will Have A Fundamental Idea To Solve Partial Differential Equations.
English Language Lab	C1206.1	Recognize the sounds of English with the help of audio visual aids
	C1206.2	Build confidence and overcome inhibitions while speaking in English.
	C1206.3	Demonstrate acquired language skills in performing the designated activity.

MECHANICAL ENGINEERING

COURSE	C.OCODE	COURSEOUTCOMEDESCRIPTION
C&DE M-1	R201101.1	Examine the convergence of series and apply mean value theorem to real life problem.
	R201101.2	Solve the Differential Equations of first and higher order related to various engineering applications.
	R201101.3	Apply the partial differentiation technique to solve physical problem
	R201101.4	Apply double and triple integrals to find areas and volumes.
ENGLISH	R201102.1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
	R201102.2	Employ knowledge of grammatical structures and vocabulary in speech and writing
	R201102.3	Apply effective communication skills to enhance professional possibilities.
	R201102.4	Develop acceptable personality traits suitable for chosen profession.
ENGG PHYSICS	R201103.1	Apply the knowledge of different phenomena of light in daily life.
	R201103.2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibres.
	R201103.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	R201103.4	Improve the acoustic quality of concert halls and apply Ultrasonic waves concept in Non Destructive Testing.
	R201103.5	Study the structures and properties of solid state materials, apply this knowledge to estimate the structure of the materials
ENGG DRAWING	R201103.1	Construct polygons, scales and draw curves used in engineering applications
	R201103.2	Apply concept of orthographic projection to project Points, St. lines inclined to one and both reference planes.
	R201103.3	Produce orthographic projections of planes inclined to both the reference planes.
	R201103.4	Produce orthographic projections of regular solids inclined to both the reference planes.
	R201103.5	Construct isometric view from orthographic views and vice versa.
	R201103.6	Drawing practice on AUTO-CAD
PPSUC	R201110.1	Apply the basic concepts of C Programming for problem-solving and different number systems.
	R201110.2	To use different operators, write programs that use control statements for a given problem.
	R201110.3	Illustrate the concepts of Homogeneous and heterogeneous data types, pointers and file system for solving mathematical and engineering problems.
	R201110.4	Decompose a given problem into functions and to develop modular reusable code.
ENGLISH LAB	R201106.1	Recognize the sounds of English with the help of audio visual aids
	R201106.2	Build confidence and overcome inhibitions while speaking in English.
	R201106.3	Demonstrate acquired language skills in performing the designated activity.
ENGG PHYSICS LAB	R201107.1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	R201107.2	Analyze various electronic circuits and its components and verify the laws of stretched string.
	R201107.3	Apply the knowledge of phenomena like LASER diffraction and resonance in sound waves

PPSUC LAB	R201113.1	Describe the basics of computer and understand the problem-solving aspect.
	R201113.2	Design and develop C program to evaluate simple expressions and logical operations.
	R201113.3	Develop & Implement C programs with suitable modules to solve the given problem.
	R201113.4	Demonstrate the concept of pointer and perform I/O operations in files.
COURSE	**C.OCODE**	**COURSEOUTCOMEDESCRIPTION**
M-2	R201201.1	Solve system of linear algebraic equations and apply Eigen value computation techniques to reduce a given quadratic to canonical form
	R201201.2	Solve algebraic and Transcendental equations by using Numerical methods
	R201201.3	Apply Newton's forward and backward interpolation and Lagrange's formula for equal and unequal intervals.
	R201201.4	Compute numerical solutions of differential equations.
ENGG CHEMISTRY	R201202.1	Identify the advantages and limitations of plastic materials, elastomers and their use in day to day life.
	R201202.2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
	R201202.3	Recognize the need of nano materials, *liquid* crystals, semiconductors and super conductors.
	R201202.4	Obtain the knowledge of computational chemistry and molecular machines
	R201202.5	Obtain the knowledge of generation of electricity from various Non-Conventional energy sources.
ENGG MECHANICS	R201204.1	Analyze the system of forces acting on rigid bodies by FBD's
	R201204.2	Apply laws of friction to find friction forces acting on the rigid bodies
	R201204.3	Find Moment of Inertia of plane laminas by locating its Centroid and Analyze the frames and trusses to find internal forces in rigid members
	R201204.4	Analyze motion parameters of bodies both in translation and rotation(D Alembert's Principle)
	R201204.5	Apply work- Energy and Impulse-momentum methods to find motion parameters of a moving bodies
BEEE	R201211.1	Analyze various electrical networks.
	R201211.2	Understand the operation of DC & AC Machines, machine testing procedures for evolution of performance.
	R201211.3	Analyze operation of half wave, full wave bridge rectifiers and OP-AMPs.
	R201211.4	Understanding operations of CE amplifier and basic concept of feedback amplifier
THERMO DYNAMICS	R201254.1	Explain the basic concepts of thermodynamic systems in the energy perspective; distinguish the point function and the path function with respect to energy, work and heat.
	R201254.2	Apply the knowledge of thermodynamic systems while learning the first law of thermodynamics and apply the steady flow steady state energy equation on several mechanical devices also understand the concept of equality of temperature, temperature measuring devices.
	R201254.3	Apply second law statements of thermodynamics on heat engines and heat pumps and analyze the concept of Carnot cycle, entropy, availability and irreversibility and understand the use of Maxwell's relations and thermodynamic functions.
	R201254.4	Demonstrate the process of steam formation and related properties and related steam utilizing mechanical devices with the help of appropriate property relations, steam tables and charts.

ENGG CHEMISTRY LAB	R201231.1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
	R201231.2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, KMnO4 and Copper using different indicators.
	R201231.3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
	R201231.4	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.
WORKSHOP PRACTICE LAB	C.OCODE	COURSEOUTCOMEDESCRIPTION
	R201235.1	Apply working knowledge in making simple wood joints and fitting joints and simple sheet metal works
	R201235.2	Apply electrical working knowledge in making simple wirings
	R201235.3	Apply knowledge for computer assembling and software installation and how to solve the trouble shooting problems.
	R201235.4	Apply the tools for preparation of PPT, Documentation and budget sheet etc.
BEEE LAB	R201236.1	Estimate the performance of the different machines by the computation of efficiency and regulation.
	R201236.2	Examining the performance characteristics of DC &AC machines.
	R201236.3	Measuring various losses in DC machines & Transformers by conducting suitable tests.
	R201236.4	Summarize the characteristics & applications of different electronics devices.

ELECOTRONICS AND COMMUNICATION ENGINEERING

COURSE	C.OCODE	COURSEOUTCOMEDESCRIPTION
Mathematics-I	C1101.1	Examine the convergence of series and apply mean value theorem to real life problem.
	C1101.2	Solve the Differential Equations of first and higher order related to various engineering applications.
	C1101.3	Apply the partial differentiation technique to solve physical problem
	C1101.4	Apply double and triple integrals to find areas and volumes.
Communicative English	C1102.1	Apply the four language learning skills-listening, speaking, reading, writing (LSRW)
	C1102.2	Employ knowledge of grammatical structures and vocabulary in speech and writing
	C1102.3	Apply effective communication skills for professional possibilities.
	C1102.4	Develop acceptable personality traits suitable for chosen profession.
Engineering Drawing	C1104.1	Construct polygons, scales and draw curves used in engineering applications
	C1104.2	Apply concept of orthographic projection to project points and lines inclined to both reference planes.
	C1104.3	Apply concept of orthographic projections of planes inclined to both the reference planes.
	C1104.4	Apply concept of orthographic projections of solids inclined to both the reference planes.
	C1104.5	Draw isometric view of objects from orthographic views and vice versa
English Communication Skills Lab	C1106.1	Recognize the sounds of English with the help of audio visual aids
	C1106.2	Build confidence and overcome inhibitions while speaking in English.
	C1106.3	Demonstrate acquired language skills in performing the designated activity.
PPSUC	C1110.1	Apply the basic concepts of C Programming for problem-solving and different number systems.
	C1110.2	To use different operators, write programs that use control statements for a given problem.
	C1110.3	Illustrate the concepts of Homogeneous and heterogeneous data types, pointers and file system for solving mathematical and engineering problems.
	C1110.4	Decompose a given problem into functions and to develop modular reusable code.
PPSUC LAB	C1113.1	Describe the basics of computer and understand the problem-solving aspect.
	C1113.2	Design and develop C program to evaluate simple expressions and logical operations.
	C1113.3	Develop & Implement C programs with suitable modules to solve the given problem.
	C1113.4	Demonstrate the concept of pointer and perform I/O operations in files.
Applied Chemistry	C1115.1	Identify the advantages and limitations of Plastic materials, Elastomers and their use in day to day life.
	C1115.2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
	C1115.3	Recognize the need of nano materials, *liquid* crystals, semiconductors and super conductors.
	C1115.4	Gain the knowledge of applications of different analytical instruments and generation of electricity from various Non-Conventional energy sources.

	C1115.5	Obtain the knowledge of computational chemistry and molecular machines.
Applied Chemistry Lab	C1116.1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
	C1116.2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, $KMnO_4$ and Copper using different indicators.
	C1116.3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
	C1116.4	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.
COURSE	C.OCODE	COURSEOUTCOMEDESCRIPTION
Mathematics-II	C1201.1	Solve system of linear algebraic equations and apply eigen value computation technics to reduce a given quadratic to canonical form
	C1201.2	Solvealgebraic and Transcendental equations by using Numerical methods
	C1201.3	Apply Newton ‘s forward and backward interpolation and Lagrange’s formula for equal and unequal intervals.
	C1201.4	Compute numerical solutions of differential equations.
Applied Physics	C1207.1	Apply the knowledge of different optical phenomena in daily life.
	C1207.2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibres.
	C1207.3	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
	C1207.4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1207.5	Understand electrons & holes behavior in semiconductors and extraordinary behavior of materials at various transition temperatures
OOPS	C1212.1	Show competence in the use of the Java Programming language in the development of small to mediumsized application programs that demonstrate professionally acceptable coding and performed standard
	C1212.2	Illustrate the basic principles of the object-oriented programming
	C1212.3	Develop exception handling and Multithreading with applications
	C1212.4	Design and Event handling in Gui applications and develop Networking applications
Network Analysis	C1213.1	To Define basic Electrical Quantities and associated units and relationship between charge, current, voltage and power.
	C1213.2	Discuss about what is active elements, passive elements and identification of mesh, node,path,loop.
	C1213.3	Analyze the dc excitations for RL,RC,RLC circuits
	C1213.4	To Analyze the concepts of network theorems for DC and AC and its application in practically
	C1213.5	Calculate the two port network parameters (Z, Y, ABCD, h & g).
BEE	C1214.1	Able to explain the operation of DC generator and analyze the characteristics of DC generator.

	C1214.2	Able to explain the principle of operation of DC motor and analyze their characteristics. Acquire the skills to analyze the starting and speed control methods of DC motors.
	C1214.3	Ability to analyze the performance and speed – torque characteristics of a3-phase induction motor and understand starting methods of 3-phaseinduction motor.
	C1214.4	Able to explain the operation of Synchronous Machines
	C1214.5	Capability to understand the operation of various special machines.
Applied Physics Lab	C1233.1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C1233.2	Analyze various electronic circuits and study the temperature dependence of semiconductors.
	C1233.3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fibre
Electronic Workshop	C1237.1	Examine characteristics and performance of AC and DC components
	C1237.2	Analyze the behavior of various measuring instruments.
	C1237.3	Describe the working of soldering and PCB layout
BEE Lab	C1238.1	Analyze characteristics & performance of dc shunt and series machines
	C1238.2	Analysing behaviour of 1-phase transformer at various loads and power factor conditions
	C1238.3	Analyze performance of 3- Φ induction motor and alternator

COMPUTER SCINCE AND ENGINEERING

COURSE	C.O CODE	COURSE OUTCOME DESCRIPTION
Mathematics-I English	C1101.1	Examine the convergence of series and apply mean value theorem to real life problem.
	C1101.2	Solve the Differential Equations of first and higher order related to various engineering applications.
	C1101.3	Apply the partial differentiation technique to solve physical problem
	C1101.4	Apply double and triple integrals to find areas and volumes.
English	C1102.1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
	C1102.2	Employ knowledge of grammatical structures and vocabulary in speech and writing
	C1102.3	Apply effective communication skills to enhance professional possibilities.
	C1102.4	Develop acceptable personality traits suitable for chosen profession.
Applied Physics	C1117.1	Apply the knowledge of different optical phenomena in daily life.
	C1117.2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibers.
	C1117.3	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
	C1117.4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1117.5	Understand electrons& holes behavior in semiconductors and extraordinary behavior of materials at various transition temperatures
Programming for Problem Solving Using C	C1110.1	Apply the basic concepts of C Programming for problem-solving and different number systems.
	C1110.2	To use different operators, write programs that use control statements for a given problem.
	C1110.3	Illustrate the concepts of Homogeneous and heterogeneous data types, pointers and file system for solving mathematical and engineering problems.
	C1110.4	Decompose a given problem into functions and to develop modular reusable code.
Computer Engineering workshop	C1118.1	Apply knowledge for Computer Assembling and Software installation
	C1118.2	Understand and implement Unix commands
	C1118.3	Ability to effectively use Internet, World Wide Web(WWW) and Web browsers
	C1118.4	Apply the tools for MS-Word, PowerPoint , Excel and PDF documentation
English Language lab	C1106.1	Recognize the sounds of English with the help of audio visual aids
	C1106.2	Build confidence and overcome inhibitions while speaking in English.
	C1106.3	Demonstrate acquired language skills in performing the designated activity.
Applied Physics Lab	C1119.1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C1119.2	Analyze various electronic circuits and study the temperature dependence of semiconductors.
	C1119.3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fibre
Programming for Problem Solving	C1113.1	Describe the basics of computer and understand the problem-solving aspect.

Using C lab	C1113.2	Design and develop C program to evaluate simple expressions and logical operations.
	C1113.3	Develop & Implement C programs with suitable modules to solve the given problem.
	C1113.4	Demonstrate the concept of pointer and perform I/O operations in files.
Mathematics-II	C1201.1	Solve system of linear algebraic equations and apply Eigen value computation technics to reduce a given quadratic to canonical form
	C1201.2	Solve algebraic and Transcendental equations by using Numerical methods
	C1201.3	Apply Newton ‘s forward and backward interpolation and Lagrange’s formula for equal and unequal intervals.
	C1201.4	Compute numerical solutions of differential equations.
Applied Chemistry	C1215.1	Identify the advantages and limitations of Plastic materials, Elastomers and their use in day to day life.
	C1215.2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
	C1215.3	Recognize the need of nano materials, liquid crystals, semiconductors and super conductors.
	C1215.4	Gain the knowledge of applications of different analytical instruments and generation of electricity from various Non-Conventional energy sources.
	C1215.5	Obtain the knowledge of computational chemistry and molecular machines.
Computer Organization	C1216.1	Recall the internal organization of computers, CPU,I/O and its main components
	C1216.2	Relate postulates of Boolean algebra and basic computer organization design
	C1216.3	Design and analyze combinational and sequential circuits and basics of I/O organization
Python Programming	C1217.1	Understand the need for learning basic concepts of Python programming language
	C1217.2	Apply various data structures in developing solutions to real time scenarios
	C1217.3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.
	C1217.4	Apply the usage of pattern matching, GUI in python programming.
Data Structures	C1218.1	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
	C1218.2	Apply the different linear data structures like stack and queue to various computing problems
	C1218.3	Implement different types of trees, heaps and apply them to problem solutions
	C1218.4	Identify different non linear data structures to analyze the performance of an algorithm.
Applied chemistry Lab	C1239.1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
	C1239.2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, KMnO4 and Copper using different indicators.
	C1239.3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
	C1239.4	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.

Python Programming lab	C1250.1	Understand the need for learning basic concepts of Python programming language
	C1250.2	Apply various data structures in developing solutions to real time scenarios
	C1250.3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.
	C1250.4	Design the usage of pattern matching, GUI in python programming.
Data Structures lab	C1241.1	Implement different sorting and searching algorithms
	C1241.2	Implement the stack, Queue and their applications
	C1241.3	Implement various types of linked lists and their applications
	C1241.4	Perform basic operations on trees and graphs and determine minimum spanning tree

INFORMETION TECNOLOGY

COURSE	C.O CODE	COURSE OUTCOME DESCRIPTION
Mathematics-I	C1101.1	Examine the convergence of series and apply mean value theorem to real life problem.
	C1101.2	Solve the Differential Equations of first and higher order related to various engineering applications.
	C1101.3	Apply the partial differentiation technique to solve physical problem
	C1101.4	Apply double and triple integrals to find areas and volumes.
English	C1102.1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
	C1102.2	Employ knowledge of grammatical structures and vocabulary in speech and writing
	C1102.3	Apply effective communication skills to enhance professional possibilities.
	C1102.4	Develop acceptable personality traits suitable for chosen profession.
Applied Physics	C1117.1	Apply the knowledge of different optical phenomena in daily life.
	C1117.2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibres.
	C1117.3	Explain fundamental concepts of quantum mechanics and analyze the behaviour of electron in metals according to various theories
	C1117.4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1117.5	Understand electrons& holes behaviour in semiconductors and extraordinary behaviour of materials at various transition temperatures
Programming for Problem Solving Using C	C1110.1	Able to undestand the fundamental concepts of computers and C language constructs
	C1110.2	able to apply the concepts of C constructs Homongeneous and heterogeneous data types and pointers for solving the given problems
	C1110.3	able to divide a given problem into modules using c constructs and functions to develop modular reusable code.
	C1110.4	able to analyse the problem, choose appropriate C constructs and use the file system to solve mathematical and engineering problems accordingely.
Computer Engineering workshop	C1118.1	Students are able to understand the basic fundamentals of computer peripherals, storage, networking devices and Internet of Things.
	C1118.2	To impact the knowledge and usage of various productivity tools such as Power Point, Word, Excel and Latex.
	C1118.3	Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spreadsheets, HTML & Latex.
	C1118.4	Build applications using productivity tools, HTML & LATEX
English Language lab	C1106.1	Recognize the sounds of English with the help of audio visual aids
	C1106.2	Build confidence and overcome inhibitions while speaking in English.
	C1106.3	Demonstrate acquired language skills in performing the designated activity.
	C1119.1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C1119.2	Analyze various electronic circuits and study the temperature dependence of semiconductors.

Applied Physics Lab	C1119.3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fiber
Programming for Problem Solving Using C lab	C1113.1	Able to understand the concepts of C language
	C1113.2	Able to apply the C language constructions for simple problems
	C1113.3	Able to applyC constructs like homozeneous, hetrogeneous data for a given mathematical problem
	C1113.4	Able to analysis a given scenario using functions & file concepts
Mathematics-II	C1201.1	Solve system of linear algebraic equations and apply Eigen value computation techniques to reduce a given quadratic to canonical form
	C1201.2	Solve algebraic and Transcendental equations by using Numerical methods
	C1201.3	Apply Newton ‘s forward and backward interpolation and Lagrange’s formula for equal and unequal intervals.
	C1201.4	Compute numerical solutions of differential equations.
Applied Chemistry	C1215.1	Identify the advantages and limitations of Plastic materials, Elastomers and their use in day to day life.
	C1215.2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
	C1215.3	Recognize the need of Nano materials, liquid crystals, semiconductors and super conductors.
	C1215.4	Gain the knowledge of applications of different analytical instruments and generation of electricity from various Non-Conventional energy sources.
	C1215.5	Obtain the knowledge of computational chemistry and molecular machines.
Computer Organization	C1216.1	Able to understand the logical design and functional architecture of computing systems.
	C1216.2	Able to identify, compare and assess issues related to bus, memory, Control and I/O functions.
	C1216.3	Able to correlate and analyze the operations carried out in Processing Unit .
	C1216.4	Able to design solutions in the area of computer architecture and logic designing.
Python Programming	C1217.1	Understand the fundamental concept and syntax of python programming language.
	C1217.2	Apply the basics of programming in the Python language.
	C1217.3	Analyze the coding tasks related conditional statements, functions, sequences, file handling, Exception handling.
	C1217.4	Create the python programs using object-oriented concept and GUI
Data Structures	C1218.1	Understand basic concepts of sorting, searching, linear and non-linear data Structures and algorithms.
	C1218.2	Apply the different linear and non-linear data structures, sorting and searching algorithms to various computing problems.
	C1218.3	Analyze the performance of various data structures, sorting and searching algorithms.
	C1218.4	Evaluate the linear and no linear data structures in a given application
Applied chemistry Lab	C1239.1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
	C1239.2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, KMnO4 and Copper using different indicators.
	C1239.3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.

	C1239.4	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.
Python Programming lab	C1250.1	Understand the need for learning basic concepts of Python programming language
	C1250.2	Apply various data structures in developing solutions to real time scenarios
	C1250.3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.
	C1250.4	Design the usage of pattern matching, GUI in python programming.
Data Structures lab	C1241.1	Understand basic data structures such as arrays, linked lists stacks and queues.
	C1241.2	Implement and know the application of algorithms for sorting and pattern matching.
	C1241.3	Design programs using a variety of data structures such as stacks, queues, linked lists, binary trees, search trees, heaps and graphs.
	C1241.4	Implement ADTs such as lists, graphs, and search trees in C to solve problems.

SIR C.R.REDDY COLLEGE OF ENGINEERING
ELURU-534007, WEST GODAVARI DIST, A P., INDIA
(Approved by AICTE. New Delhi)
Phone no: 08812-230840, 2300656 Fax: 08812-224193
Visit us at http://www.sircrrengg.ac.in
DEPARTMENT OF INFORMATION TECHNOLOGY

R20 COURSE OUTCOMES

Upon the completion of the course the students will be able to

COURSES	CO CODE	COURSE OUTCOME DESCRIPTION
Communicative English	C111.1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
	C111.2	Employ knowledge of grammatical structures and vocabulary in speech and writing.
	C111.3	Apply effective communication skills to enhance professional possibilities.
	C111.4	Develop acceptable personality traits suitable for chosen profession.
Mathematics-I (Calculus and Differential Equations)	C112.1	Examine the convergence of series and apply mean value theorem to real life problem.
	C112.2	Solve the Differential Equations of first and higher order related to various engineering applications.
	C112.3	Apply the partial differentiation technique to solve physical problem.
	C112.4	Apply double and triple integrals to find areas and volumes.
Applied Physics	C113.1	Apply the knowledge of different optical phenomena in daily life.
	C113.2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibres.
	C113.3	Explain fundamental concepts of quantum mechanics and analyse the behaviour of electron in metals according to various theories.
	C113.4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C113.5	Understand electrons& holes behaviour in semiconductors and extraordinary behaviour of materials at various transition temperatures.

Programming for Problem Solving using C	**C114.1**	Understand the fundamental concepts of computers and C language constructs.
	C114.2	Apply the concepts of C constructs Homogeneous and heterogeneous data types and pointers for solving the given problems.
	C114.3	Able to divide a given problem into modules using c constructs and functions to develop modular reusable code.
	C114.4	Analyse the problem, choose appropriate C constructs and use the file system to solve mathematical and engineering problems.
Computer Engineering Workshop	**C115.1**	Understand the basic fundamentals of computer peripherals, storage, networking devices and Internet of Things.
	C115.2	To impact the knowledge and usage of various productivity tools such as Power Point, Word, Excel and Latex.
	C115.3	Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spread sheets, HTML & Latex.
	C115.4	Build applications using productivity tools, HTML & LATEX.
English Communication Skills Laboratory	**C116.1**	Recognize the sounds of English with the help of audio visual aids.
	C116.2	Build confidence and overcome inhibitions while speaking in English.
	C116.3	Demonstrate acquired language skills in performing the designated activity.
Applied Physics Lab	**C117.1**	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C117.2	Analyse various electronic circuits and study the temperature dependence of semiconductors.
	C117.3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fiber.
Programming for Problem Solving using C Lab	**C118.1**	Understand the concepts of C language.
	C118.2	Apply the C language constructions for simple problems.
	C118.3	Apply C constructs like homogenous, heterogeneous data for a given mathematical problem.
	C118.4	Analysis a given scenario using functions & file concepts.
Mathematics – II (Linear Algebra And Numerical Methods)	**C121.1**	Solve system of linear algebraic equations and apply Eigen value computation techniques to reduce a given quadratic to canonical form.
	C121.2	Solve algebraic and Transcendental equations by using Numerical methods.
	C121.3	Apply Newton's forward and backward interpolation and Lagrange's formula for equal and unequal intervals.
	C121.4	Compute numerical solutions of differential equations.
Applied Chemistry	**C122.1**	Identify the advantages and limitations of Plastic materials, Elastomers and their use in day to day life.
	C122.2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
	C122.3	Recognize the need of Nano materials, liquid crystals, semiconductors and super conductors.

	C122.4	Gain the knowledge of applications of different analytical instruments and generation of electricity from various Non-Conventional energy sources.
Computer Organization	C123.1	Understand the logical design and functional architecture of computing systems.
	C123.2	Understand the logical design and functional architecture of computing systems.
	C123.3	Identify, compare and assess issues related to bus, memory, Control and I/O functions.
	C123.4	Design solutions in the area of computer architecture and logic designing.
Python Programming	C124.1	Understand the fundamental concept and syntax of python programming language.
	C124.2	Apply the basics of programming in the Python language.
	C124.3	Analyze the coding tasks related conditional statements, functions, sequences, file handling, Exception handling.
	C124.4	Create the python programs using object-oriented concept and GUI.
Data Structures	C125.1	Understand basic concepts of sorting, searching, linear and non-linear data Structures and algorithms.
	C125.2	Apply the different linear and non-linear data structures, sorting and searching algorithms to various computing problems.
	C125.3	Analyze the performance of various data structures, sorting and searching algorithms.
	C125.4	Evaluate the linear and no linear data structures in a given application
Applied Chemistry Lab	C126.1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
	C126.2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, KMnO4 and Copper using different indicators.
	C126.3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
Python Programming Lab	C127.1	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.
	C127.2	Understand the need for learning basic concepts of Python programming language.
	C127.3	Apply various data structures in developing solutions to real time scenarios.
	C127.4	Analyze various concepts of functions; make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.
Data Structures Lab	C128.1	Design the usage of pattern matching, GUI in python programming.
	C128.2	Understand basic data structures such as arrays, linked lists stacks and queues.
	C128.3	Design programs using a variety of data structures such as stacks, queues, linked lists, binary trees, search trees, heaps and graphs.
	C128.4	Implement ADTs such as lists, graphs, and search trees in C to solve problems.
Mathematics –	C211.1	Apply the concepts of vector calculus to the problems of work done by a force, circulation and flux.

III	C211.2	Apply Laplace transforms to solve linear differential equations with constant coefficients.
	C211.3	Compute Fourier series of the periodic functions and apply Fourier transform to a range of non-periodic functions.
	C211.4	Solve the first and higher order Partial differential equations and apply to various engineering problems.
Object Oriented Programming through C++	C212.1	Understand the concepts of object-oriented programming and basic structure of C++ programming.
	C212.2	Apply the concepts of OOP.
	C212.3	Apply C++ programs with reusability concept.
	C212.4	Apply the concepts of Exceptions Handling, templates & amp; STL.
Operating Systems	C213.1	Understand OS evaluation, its structure and services, process concepts, deadlocks concepts, virtual memory, memory management strategies, process synchronization, threads, file systems, system protection & security.
	C213.2	Apply process scheduling policies, mechanisms, process synchronization, inter process communications, threads scheduling, disk scheduling, file concepts, deadlocks concepts, page replacement algorithms, paging and segmentation techniques in memory management.
	C213.3	Analyze various CPU scheduling, disk scheduling, dead lock, memory allocation, replacement algorithms, IPC Communications, file concepts, threads concepts.
	C213.4	Evaluate process scheduling, replacement algorithms; file system and implementation issues, disk scheduling, UNIX/LINUX/WINDOWS OS platforms and other process subsystem related concepts.
Database Management Systems	C214.1	Understand the basic concepts of Data Base, Relational Model, Transaction Management and Concurrency Control, Crash Recovery, Filing and Indexing Techniques.
	C214.2	Apply ER Model for designing Conceptual Data Base and Relational Model for designing Logical Data Base.
	C214.3	Analyze the concepts of Relational Model, Schema Refinement and Normalization.
	C214.4	Design Data Base applications using SQL Queries.
Discrete Mathematics and Graph Theory	C215.1	Understand the fundamentals and various algorithms, theorems, Graphs of DM&GT.
	C215.2	Apply various algorithms, theorems, Graphs to solve problems in DM&GT.
	C215.3	Analyze various problems using different discrete mathematical concepts.
	C215.4	Evaluate various conditions/Statements/problems using the concepts in DM&GT
Object Oriented Programming through C++ Lab	C216.1	Understand the object oriented concepts with language environment.
	C216.2	Implement Object Oriented Programming Concepts in C++.
	C216.3	Implement Object Oriented Programs using templates and exceptional handling concepts.
	C216.4	Analyze the given problem and use appropriate STL algorithm to solve given problem.
Operating Systems Lab	C217.1	Understand the fundamentals of UNIX commands and System calls.
	C217.2	Apply the synchronization concepts using shared memory, semaphores for the given problem.

	C217.3	Apply deadlock avoidance and detection algorithms and various concepts of file systems.
	C217.4	Analyze various thread concepts, CPU scheduling algorithms, and memory management concepts.
Database Management Systems Lab	C218.1	Utilize SQL to execute queries for creating database and performing data manipulation operations.
	C218.2	Examine integrity constraints to build efficient databases.
	C218.3	Apply Queries using Advanced Concepts of SQL.
	C218.4	Build PL/SQL programs including stored procedures, functions, cursors and triggers.
Skill oriented Course-I Distributed Technologies-No SQL	C219.1	Understand about SQLite3, its features and environment setting.
	C219.2	Apply SQLite fundamental commands for various queries.
	C219.3	Apply SQL commands in SQLite environment for data definition and manipulation.
	C219.4	Analyze the complex database functions like Aggregate, Core functions, JOINS and Triggers.
Statistics with R	C221.1	Understand the R programming concepts required for statistics.
	C221.2	Apply basic Math and statistics in R programming.
	C221.3	Analyze the R programming constructs/models required to perform certain statistics.
	C221.4	Apply visualizations/graphics in R Programming.
Principles of Software Engineering	C222.1	Understand basic concepts of software engineering, phases of software development in common process models, unified and agile process models.
	C222.2	Apply various engineering practices such as requirements analysis and specification, modelling, code analysis, testing, and quality assurance strategies for developing software.
	C222.3	Analyze the gathered requirements for creating various requirement models.
	C222.4	Prepare the architectural design, components level design, interface design and acquire skills to design and implement test cases at the Unit and Integration level.
Automata Theory and Compiler Design	C223.1	Understand the language processors, finite Automata and compiler design phases.
	C223.2	Apply various finite Automata techniques and compiler design techniques for a given problem.
	C223.3	Analyse various compiler design techniques for given grammar.
	C223.4	Evaluate various compiler phases for the given grammars.
Java Programming	C224.1	Understand the java programming constructs, control Structures, classes, objects, methods, arrays, inheritance, interfaces, packages, exception handling, string handling, multi-threaded programming and data base connectivity.
	C224.2	Apply the java programming constructs, control structures, classes, objects, methods, arrays, inheritance, interfaces, packages, exception handling, string handling, multi-threaded programming and data base connectivity for a given scenario.
	C224.3	Analyse the java programming constructs, control structures, arrays, inheritance, interfaces, exception handling, string handling and multi-threaded programming.
	C224.4	Recommend the best suitable java construct/concept for a given application/problem.

Managerial Economics and Financial Accountancy	**C225.1**	Understand the fundamental concepts of managerial economics, production & cost analysis, markets & pricing strategies, accounting & financing analysis and capital budgeting.
	C225.2	Apply production cost analysis, capital budgeting, financial analysis techniques in evaluating various investment opportunities.
	C225.3	Analyse the various aspects of managerial economics, production & cost analysis, markets & pricing strategies, accounting & financing analysis and capital budgeting.
	C225.4	Evaluate the performance evaluation of production cost analysis, financial statements and investment project proposals with the help of accounting tools and capital budgeting techniques.
UML Lab	**C226.1**	Understand the modelling tools like IBM Rational Rose/Star UML.
	C226.2	Analyze the requirements and create use case scenarios of an application.
	C226.3	Develop use case, class, activity, sequence, state, component and deployment Diagrams.
	C226.4	Design simple applications and models.
FOSS Lab	**C227.1**	Understand UNIX commands for file handling and System calls.
	C227.2	Apply Regular expressions for pattern matching to various filters for a specific task.
	C227.3	Apply shell script to solve complex problems.
	C227.4	Analyse a given problem in order to devise a shell script to solve.
Java Programming Lab	**C228.1**	Evaluate default value of all primitive data type, Operations, Expressions, Control flow, Strings
	C228.2	Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism.
	C228.3	Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism.
	C228.4	Construct Threads, Event Handling, implement packages, developing applets.
Skill oriented Course - II Distributed Technologies-MongoDB	**C229.1**	Install, configure and setup the drivers to use MongoDB.
	C229.2	Gain an in-depth understanding of main features of MongoDB and their use cases.
	C229.3	Retrieve data in the database using MongoDB querying.
	C229.4	Apply the advanced MongoDB Querying to retrieve the data from the collection.
Computer Networks	**C311.1**	Understand the concepts and functionalities of various layers of OSI reference, TCP/IP Models, Internet working, different transmission media and switching network.
	C311.2	Apply the concepts of Data link Layer, Network layer and application layer.
	C311.3	Analyze the concepts of various layers of OSI, TCP/IP Models, internet working, functions and protocols like HDLC, and PPP.
	C311.4	Compare and classify medium access control protocols like ALOHA,CSMA,CSMA/CD,CSMA/CA, polling, token passing, FDMA,TDMA,CDMA PROTOCOLS.

Design and Analysis of Algorithms	**C312.1**	Understand various algorithms approaches to solve engineering problems, asymptotic notation for denoting time complexities of recursive and non-recursive algorithms and theory of NP-completeness.
	C312.2	Apply various techniques like divide and conquer, greedy technique to solve in common engineering design situations.
	C312.3	Apply various algorithm design paradigms like dynamic programming, backtracking to solve problems
	C312.4	Analyze the performance of given algorithm and determine its space and time complexity.
Data Mining Techniques	**C313.1**	Describe the concepts and functionalities of Data Warehousing and various Data Mining Techniques.
	C313.2	Apply appropriate techniques to convert raw data into suitable format for practical data mining tasks.
	C313.3	Analyze and compare various classification algorithms and apply in appropriate domain.
	C313.4	Identify the kinds of frequent patterns that can be discovered for association rule mining in databases using different techniques.
	C313.5	Cluster the data for better organization and discover the knowledge imbibed in the high dimensional system.
Open Elective – I : DevOps (Job Oriented course)	**C314.1**	Understand the various phases of SDLC and agile software development.
	C314.2	Understand the fundamentals of DevOps ,adoption in projects ,CI/CD and DevOps maturity models.
	C314.3	Use the DevOps Tool stack in software development process.
	C314.4	Analyse various aspects in DevOps like DevOps adoption, CI/CD practices and DevOps Maturity models.
Professional Elective – I : Artificial Intelligence	**C315.1**	Understand Fundamental concepts of Artificial Intelligence.
	C315.2	Apply various logic concepts and search strategies in representing knowledge for various problems.
	C315.3	Analyze the applications of search strategies and problem reductions.
	C315.4	Evaluate the knowledge representations in Artificial Intelligence and fuzzy logic systems.
Data Mining Techniques with R Lab	**C316.1**	Understand the functionality of R by using add-on packages.
	C316.2	Apply various statistical functions and examine data from files and other sources and perform various data manipulation tasks on them.
	C316.3	Apply preprocessing techniques and mining methods to extract knowledge using R Graphics and Tables to visualize the results.
	C316.4	Analyze the data for real life applications.
Computer Networks Lab	**C317.1**	Study the Network devices, physical layer, data link layer and network layer algorithms.
	C317.2	Implement the various computer networks algorithms in any programming language.
	C317.3	Implement the packet capture, captured traffic and perform analysis using Wireshark.
	C317.4	Study and detect the operating system using Nmap.
	C317.5	Find the number of packets dropped in various scenarios using NS2/NS3 Simulator.
Skill Oriented	**C318.1**	Understand various tools of digital 2-D animation.

Course – III : Animation course : Animation Design	**C318.2**	Apply different styles and treatment of content in 2D animation .
	C318.3	Apply tools to create effective 3D modeling texturing and lighting.
	C318.4	Analyze video processing in applications.
Summer Internship	**C319.1**	Understand various interest groups, disciplines, professionals, managers, technicians etc.
	C319.2	Apply the knowledge in day-to-day operations, trouble-shooting and minor-modifications.
	C319.3	Build relations between University and Industry that will help mutual cooperation over long-term.
	C319.4	Develop/strengthen the basic skills of interviewing, analysis, report writing, communication, decision-making, and problem solving
Machine Learning	**C321.1**	Understand the fundamental usage of the Machine Learning System concepts.
	C321.2	Demonstrate on various Regression Techniques.
	C321.3	Analyze the Ensemble Learning Methods.
	C321.4	Apply Supervised Learning Techniques, Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
	C321.5	Discuss the Neural Network Models and Fundamentals concepts of Deep Learning.
Big Data Analytics	**C322.1**	Understand various Big Data techniques in the real world.
	C322.2	Apply various Big Data Analytics techniques for mining stream, Hadoop concepts, pig, Hive and predictive analysis.
	C322.3	Analyze Big Data Analytics techniques for given Scenario.
	C322.4	Choose appropriate various Big Data Analytics techniques for given problem.
Cryptography and Network Security	**C323.1**	Understand various cryptographic techniques and network security algorithms.
	C323.2	Apply various cryptographic techniques and network security algorithms for given scenario.
	C323.3	Analyze various cryptographic techniques and network security algorithms for a given network applications.
	C323.4	Evaluate various cryptographic techniques and network security algorithms for a given network applications.
Professional Elective-II : MEAN Stack Development	**C324.1**	Build static web pages using basic and advanced concepts of HTML 5.
	C324.2	Construct Dynamic web application using the Java script programming concepts such as variables, arrays, conditionals, and loops to solve practical web design problems.
	C324.3	Build a basic web server using Node.js and work with Node Package Manager (NPM) and recognize the need for Express.js.
	C324.4	Develop JavaScript applications using typescript and work with document database using MongoDB .
	C324.5	Develop dynamic and responsive web pages with Angular JS.
Open Elective –II	**C325.1**	Understand various microprocessors, their architectures, families, assembly language programming concepts, interfacing

: FMMC		with other peripheral interfacing chips.
	C325.2	Understand various microcontrollers, memory organization, their architectures, families, programming concepts, interfacing, control algorithms.
	C325.3	Demonstrate various programming techniques of microprocessors and microcontrollers and interface programming with peripherals.
	C325.4	Analyze the performance of microprocessors, microcontrollers, interfacing techniques in designing processor/controller based systems.
Big Data Analytics Lab	C326.1	Understand the basics of data structures like Linked list, stack, queue, set, map in Java and installation of Hadoop, Pig, Hive.
	C326.2	Demonstrate the knowledge of big data analytics in different file management task in Hadoop.
	C326.3	Implement Map Reduce programs in variety applications.
	C326.4	Apply different operations on relations and databases using Hive.
	C326.5	Analyze and perform different operations on data using Pig Latin scripts.
Machine Learning using Python Lab	C327.1	Implement procedures for the machine learning algorithms.
	C327.2	Design and Develop Python programs for various Learning algorithms.
	C327.3	Apply appropriate data sets to the Machine Learning algorithms.
	C327.4	Develop Machine Learning algorithms to solve real world problems.
Cryptography and Network Security Lab	C328.1	Understand the various cryptographic techniques like symmetric key, asymmetric key and hash functions.
	C328.2	Applying the various cryptographic techniques like symmetric key, asymmetric key and hash functions.
	C328.3	Analyze the various cryptographic techniques like symmetric key and asymmetric key algorithms.
	C328.4	Analyze the various hash functions and digital signatures.
Skill Oriented Course-IV:Video Analytics	C329.1	Discuss the principles and techniques of digital image and the fundamentals of digital video processing
	C329.2	Apply the image recognition and motion recognition in videos.
	C329.3	Apply the motion estimation, segmentation and modeling concepts in video applications.
	C329.4	Analyze video processing in applications.
Cloud Computing	C411.1	Understand fundamental aspects of Cloud Computing such as: Cloud Models, Services Challenges, Clustering and Virtualization.
	C411.2	Annotate the importance of virtualization of Clusters and Data Centers, Cloud architectures, Applications& Paradigms, Resource management and Scheduling in Cloud Computing, Storage file system and their security mechanisms.
	C411.3	Employ programming skills in various real time clouds like Microsoft Azure, Amazon AWS etc, virtualization tools and mechanisms in cloud automation, various algorithms of resource management and scheduling, Storage models and Parallel file systems.
	C411.4	Identify issues pertaining to performance, storage, virtualization, resource management, scheduling, security risks in cloud

		computing implementation and corresponding solutions.
Deep Learning Techniques	**C412.1**	Demonstrate the fundamental concepts, learning techniques of Artificial Intelligence, Machine Learning & Deep Learning
	C412.2	Illustrate the Neural Network training, various random models, techniques of Keras, Tenserflow, Theano & CNTK
	C412.3	Implement interactive applications of Deep Learning
	C412.4	Classify the concepts of CNN & RNN
Ethical Hacking	**C413.1**	Understand the concepts of Ethical hacking like Footprinting, System Hacking, Sniffing, and packet Analysis & Session Hijacking and cryptography.
	C413.2	Demonstrate the concepts of Ethical hacking like Footprinting, System Hacking, Sniffing, and packet Analysis & Session Hijacking cryptography.
	C413.3	Analyze the concepts of Ethical hacking like Footprinting, System Hacking, Sniffing, and packet Analysis & Session Hijacking cryptography.
	C413.4	Evaluate the concepts of Ethical hacking like Footprinting, System Hacking ,Sniffing, Packet Analysis & Session Hijacking cryptography for given scenario.
Concepts of Internet of Things	**C414.1**	Summarize Internet of Things (IoT)
	C414.2	Demonstrate various business models relevant to IoT.
	C414.3	Construct designs for web connectivity
	C414.4	Organize sources of data acquisition related to IoT, integrate to enterprise systems and cloud technologies.
Soft Computing Techniques	**C415.1**	Develop intelligent systems leveraging the paradigm of soft Computing techniques.
	C415.2	Implement, evaluate and compare solutions by various soft Computing approaches for finding the optimal solutions.
	C415.3	Recognize the feasibility of applying a soft Computing methodology for a particular problem.
	C415.4	Design the methodology to solve optimization problems using fuzzy logic, genetic algorithms and neural networks.
	C415.5	Design hybrid system to revise the principles of soft Computing in various application.
Universal Human Values	**C416.1**	Understand the essentials of human values and skills, self-exploration, happiness and prosperity
	C416.2	Apply the role of a human being in ensuring harmony in self and family
	C416.3	Interpret the role of a human being in ensuring harmony in society and nature
	C416.4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work
PYTHON: Deep Learning Lab	**C417.1**	Demonstrate the basic concepts fundamental learning techniques and layers
	C417.2	Discuss the neural network training, various random models
	C417.3	Apply various optimization algorithms to comprehend different activation functions to understand hyper parameter tuning.
	C417.4	Build a convolution neural network, and understand its applications to build a recurrent neural network ,and understand its usage to comprehend auto encoders to briefly explain transfer learning.

Industrial/Research Internship	**C418.1**	Explain the concept, meaning and features of entrepreneursh
	C418.2	Infer the entrepreneual environment & Policies of central and state government
	C418.3	Interpret the business plan preparation from sources to evaluation
	C418.4	Analyze the entrepreneurship as a career option
	C418.5	Discuss the management of small business in all aspects.
Project	**C421.1**	Understand software engineering process models to solve complex problems.
	C421.2	Gather and document the requirements of the real world problems.
	C421.3	Design architecture of the application and develop the data store layout by utilising modern tools.
	C421.4	Develop solutions using programming languages.
	C421.5	Develop the team work and leadership skills with professional and ethical values.

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R20 COURSE OUTCOMES

COURSE CODE	COURSE		COURSE OUTCOME DESCRIPTION
111	Mathematics-I	1	Examine the convergence of series and apply mean value theorem to real life problem.
111		2	Solve the Differential Equations of first and higher order related to various engineering applications.
111		3	Apply the partial differentiation technique to solve physical problem
111		4	Apply double and triple integrals to find areas and volumes.
112	Engineering Physics	1	Apply the knowledge of different phenomena of light in daily life.
112		2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibres.
112		3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
112		4	Improve the acoustic quality of concert halls and apply Ultrasonic waves concept in Non Destructive Testing.
112		5	Study the structures and properties of solid state materials, apply this knowledge to estimate the structure of the materials
113	Programming for Problem Solving Using C	1	Apply the basic concepts of C Programming for problem-solving and different number systems.
113		2	To use different operators, write programs that use control statements for a given problem.
113		3	Illustrate the concepts of Homogeneous and heterogeneous data types, pointers and file system for solving mathematical and engineering problems.
113		4	Decompose a given problem into functions and to develop modular reusable code.
114	ENGLISH	1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
114		2	Employ knowledge of grammatical structures and vocabulary in speech and writing.
114		3	Apply effective communication skills to enhance professional possibilities.
114		4	Develop acceptable personality traits suitable for chosen profession.
115	Engineering Drawing	1	Construct polygons, scales and draw curves used in engineering applications
115		2	Apply concept of orthographic projection to project Points, St. lines inclined to one and both reference planes.

115		3	Produce orthographic projections of planes inclined to both the reference planes.
115		4	Produce orthographic projections of regular solids inclined to both the reference planes.
115		5	Construct isometric view from orthographic views and vice versa.
115		6	Drawing practice on AUTO-CAD
116	Engineering Physics Lab	1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
116		2	Analyze various electronic circuits and its components and verify the laws of stretched string.
116		3	Apply the knowledge of phenomena like LASER diffraction and resonance in sound waves
117	Programming for Problem Solving Using C Lab	1	Describe the basics of computer and understand the problem-solving aspect.
117		2	Design and develop C program to evaluate simple expressions and logical operations.
117		3	Develop & Implement C programs with suitable modules to solve the given problem.
117		4	Demonstrate the concept of pointer and perform I/O operations in files.
118	English - Communication Skills Lab	1	Recognize the sounds of English with the help of audio visual aids
118		2	Build confidence and overcome inhibitions while speaking in English.
118		3	Demonstrate acquired language skills in performing the designated activity.
119	ENVIRONMENTAL SCIENCE	1	Overall understanding of the natural resources.
119		2	Basic understanding of the ecosystem and its diversity.
119		3	Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
119		4	An understanding of the environmental impact of developmental activities.
119		5	Awareness on the social issues, environmental legislation and global treaties.
121	M-II	1	Solve system of linear algebraic equations and apply Eigen value computation techniques to reduce a given quadratic to canonical form
121		2	Solve algebraic and Transcendental equations by using Numerical methods
121		3	Apply Newton‘s forward and backward interpolation and Lagrange’s formula for equal and unequal intervals.
121		4	Compute numerical solutions of differential equations.
122	Engineering Chemistry	1	Identify the advantages and limitations of plastic materials, elastomers and their use in day to day life.
122		2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.

122		3	Recognize the need of nano materials, liquid crystals, semiconductors and super conductors.
122		4	Obtain the knowledge of computational chemistry and molecular machines
122		5	Obtain the knowledge of generation of electricity from various Non-Conventional energy sources.
123	Engineering Mechanics	1	Analyze the system of forces acting on rigid bodies by FBD's
123		2	Apply laws of friction to find friction forces acting on the rigid bodies
123		3	Find Moment of Inertia of plane laminas by locating its Centroid and Analyze the frames and trusses to find internal forces in rigid members
123		4	Analyze motion parameters of bodies both in translation and rotation(D Alembert's Principle)
123		5	Apply work- Energy and Impulse-momentum methods to find motion parameters of a moving bodies
124	Basic Electrical and Electronics Engineering	1	Analyze various electrical networks.
124		2	Understand the operation of DC & AC Machines, machine testing procedures for evolution of performance.
124		3	Analyze operation of half wave, full wave bridge rectifiers and OP-AMPs.
124		4	Understanding operations of CE amplifier and basic concept of feedback amplifier
125	Thermodynamics	1	Explain the basic concepts of thermodynamic systems in the energy perspective; distinguish the point function and the path function with respect to energy, work and heat.
125		2	Apply the knowledge of thermodynamic systems while learning the first law of thermodynamics and apply the steady flow steady state energy equation on several mechanical devices also understand the concept of equality of temperature, temperature measuring devices.
125		3	Apply second law statements of thermodynamics on heat engines and heat pumps and analyze the concept of Carnot cycle, entropy, availability and irreversibility and understand the use of Maxwell's relations and thermodynamic functions.
125		4	Demonstrate the process of steam formation and related properties and related steam utilizing mechanical devices with the help of appropriate property relations, steam tables and charts.
126	Workshop Practice Lab	1	Apply working knowledge in making simple wood joints and fitting joints and simple sheet metal works
126		2	Apply electrical working knowledge in making simple wirings
126		3	Apply knowledge for computer assembling and software installation and how to solve the trouble

			shooting problems.
127	Engineering Chemistry Laboratory	1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
127		2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, KMnO4 and Copper using different indicators.
127		3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
127		4	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.
128	Basic Electrical and Electronics Engineering Lab	1	Estimate the performance of the different machines by the computation of efficiency and regulation.
128		2	Examining the performance characteristics of DC &AC machines.
128		3	Measuring various losses in DC machines & Transformers by conducting suitable tests.
128		4	Summarize the characteristics & applications of different electronics devices.
129	Constitution of India	1	Know the role of Election Commission apply knowledge
129		2	Contrast and compare the role of Chief Election commissioner and Commissionerate
129		3	Analyze role of state election commission
129		4	Evaluate various commissions of viz SC/ST/OBC and women
211	Vector Calculus & Fourier Transforms and PDE	1	Apply the concepts of vector calculus to the problems of work done by a force, circulation and flux
211		2	Apply Laplace Transforms to solve the ordinary differential equations
211		3	Compute Fourier series of the periodic function and Apply Fourier transform to a range of non-periodic function.
211		4	Solve the first and higher order partial differential equations and apply to various physical problems
212	Mechanics of Solids	1	Solve problems on simple stresses and strains including thermal concept and relate elastic constants.
212		2	Analyze shear force and bending moment diagram for beams with different loading conditions.
212		3	Calculate bending and shear stresses in beams of different cross sections.
212		4	Calculate slope and deflections in beams using Macaulay's and moment area methods and Analyze members subjected to torsion.

212		5	Design thin, thick cylindrical vessels and spherical vessels and solve columns and struts.
213	Fluid Mechanics & Hydraulic Machines	1	Familiarize the concepts of continuum, properties of fluid, pressure variation and measurement, pressure on submerged bodies.
213		2	Understand various flow lines, types of flows, fluid kinematics, equations of functions.
213		3	Apply conservation laws to fluid flow problems in engineering applications.
213		4	Calculate and solve flow problems.
213		5	Design the working proportions of hydraulic machines.
214	Production Technology	1	Discuss basic manufacturing concepts like product cycle, types of production and casting process.
214		2	Explain the importance and principle of metal forming fabrication Processes.
214		3	Explain the principle of sheet metal operations.
214		4	Explain welding processes, soldering & brazing and analyze their defects.
215	Kinematics of Machinery	1	Understand various Mechanisms, Inversion mechanisms and mobility of mechanisms
215		2	Analyze the velocity, accelerations of various mechanisms.
215		3	Design the cam profiles for different follower motions.
		4	Design various power transmission devises like Belt, Chain and Gear drives
216	Computer Aided Engineering Drawing Practice	1	Exposed on working of sheet metal with help of development of surfaces
216		2	Understands how to know the hidden details of machine components with the help of sections and interpenetrations of solids.
216		3	Exposed to modeling commands for generating 2D and 3D objects using computer aided drafting tools which are useful to create machine elements for computer aided analysis.
217	Fluid Mechanics & Hydraulic Machines Lab	1	Apply the basic concepts of continuum, properties of fluid, pressure measurement, hydrostatic forces on the surfaces, buoyancy & floatation in fluid flow problems
217		2	Solve problems on kinematics & dynamics of fluid flow in engineering applications with the help of Euler and Bernoulli's equations.
217		3	Analyze the boundary layer theory, apply flow through pipes and flow on free surface concepts in solving real life flow problems
217		4	Solve the problems of hydraulic machines like turbines, pumps and other fluid machines.
218	Production Technology	1	Prepare sand moulds in foundry using appropriate foundry shop hand tools.

218	Lab	2	Produce different welding joints at variable voltage sources.
218		3	Find moulding sand properties
218		4	Prepare patterns, produce mould cavities for manufacturing castings.
219	Drafting and Modeling Lab	1	Explain the graphic devices, geometric modeling and drafting devices.
219		2	Analyze the design procedure & CAD packages
219		3	Determine the Finite Element problems
219		4	Explain basics of ANSYS, NASTRAN, NISA-II, Artificial Intelligence
2110	Essence of Indian Traditional Knowledge	1	Understand the concept of Traditional knowledge and its importance.
2110		2	Know the need and importance of protecting traditional knowledge.
2110		3	Know the various enactments related to the protection of traditional knowledge.
2110		4	Understand the concepts of Intellectual property to protect the traditional knowledge.
221	Material Science & Metallurgy	1	Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
221		2	Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains.
221		3	Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
221		4	Grasp the methods of making of metal powders and applications of powder metallurgy.
221		5	Comprehend the properties and applications of ceramic, composites and other advanced materials.
222	Complex Variables & Statistical Methods	1	Apply the concepts of analytic functions, sequences and series of the complex functions.
222		2	Apply various probability distributions for both descret and continuous random variable.
222		3	Apply the terms of the sampling distribution and test the hypothesis for small samples.
222		4	Apply the terms of the sampling distribution and test the hypothesis for large samples.
223	Dynamics of Machinery	1	Compute the frictional losses, torque transmission of mechanical systems.
223		2	Analyze dynamic force analysis of slider crank mechanism and design of flywheel.
223		3	Analyze stabilization of sea vehicles, aircrafts and automobile vehicles.
223		4	Analyze the speed regulation of various types of governors.
223		5	Understand the balancing of reciprocating and rotary masses.
223		6	Determine the natural frequencies of continuous systems starting from the general equation of displacement.
224	Thermal Engineering - I	1	Compare the Air Standard Cycles, Fuel Air Cycles and Actual Cycles.

224		2	Explain working of internal combustion engines, IC engine systems and combustion phenomenon.
224		3	Apply concept of Air Standard Cycles to Calculate performance parameters of IC engines.
224		4	Explain working of gas turbines, jet propulsion engines and rockets.
224		5	Solve problems on gas turbines and jet propulsion engines.
225	Industrial Engineering & Management	1	Distinguish industrial engineering and production management, with a basis of through knowledge on the applications and quantitative measurement tools and understand the concepts and importance as given by F.W.Taylor and Fayol's principles and functions of management.
225		2	Summarize the various types of plant layouts based on the techniques of design and their maintenance.
225		3	Identify the applications of work study and various recording techniques and their comparisons.
225		4	Outline the applications of various statistical quality control tools, methods and charts, which should help him/her understand the concepts of total quality management like quality circles, zero defect, ISO Quality systems and six-sigma.
225		5	Analyze the importance of personnel management and industrial relations, based on the concepts of human resource management like job evaluation, merit rating, etc and Value Analysis.
226	Mechanics of Solids & Metallurgy Lab	1	Find mechanical properties of different materials using universal testing machine
226		2	Find shear modulus of given material using torsion test rig
226		3	Calculate Impact resistance of a given material using impact testing machine
226		4	Determine the hardness of different materials using vickers, rockwell and brinell hardness testing machines
227	Machine Drawing Practice	1	Sketch conventional representation of mechanical components.
227		2	Draw orthographic projections, sectional views of the mechanical components
227		3	Draw various types of screw fasteners, Riveted and welding joints.
227		4	Draw various types of shaft couplings, bearings and pipe joints.
227		5	Draw assemblies of engine parts, machine parts.
228	Theory of Machines Lab	1	Apply fundamentals of four bar mechanism, governors, cam and follower motions, gears, screw jack.

228		2	Analyze the single slider crank chain, gyroscope apparatus, static and dynamic balancing, various cam and follower systems
228		3	Determine the gyroscopic couple, coefficient of friction between belt and pulley, moment of inertia of flywheel, frequency of damped and undamped spring mass system
229	Python Programming Lab	1	Solve the different methods for linear, non-linear and differential equations
229		2	Learn the PYTHON Programming language
229		3	Familiar with the strings and matrices in PYTHON
229		4	Write the Program scripts and functions in PYTHON to solve the methods
311	Thermal Engineering-II	1	Explain the concept of combustion of fuels, working of Boilers, boiler mountings and accessories.
311		2	Explain the functionality and working of Steam nozzles, Steam turbines and Steam condensers.
311		3	Calculate performance parameters of Rankine cycle, Boilers, Steam nozzles, Steam Turbines and Steam Condensers.
311		4	Explain working of reciprocating and rotary compressors.
311		5	Calculate various performance parameters on reciprocating and rotary compressors.
312	Design of Machine Members -I	1	Apply the design procedure to select suitable materials by considering technical and manufacturing constraints.
312		2	Design of machine elements for failure of materials under fluctuating stress, fatigue.
312		3	Design of Riveted joints, Welded joints and Bolted joints.
312		4	Design different machine elements such as fasteners, shafts, keys etc.
312		5	Design different machine elements such as couplings.
312		6	Design different machine elements such as axially loaded joints, Springs etc.
313	Machining, Machine Tools & Metrology	1	Discuss the concepts of machining processes
313		2	Apply the principles of lathe, shaping, slotting and planing machines
313		3	Apply the principles of drilling, milling and boring processes
313		4	Analyze the concepts of finishing processes and the system of limits and fits
313		5	Demonstrate the concepts of surface roughness and optical measuring instruments.
314	Operations Research	1	Apply linear programming model to domain specific situations.
314		2	Describe the various methods under transportation and queuing theory mode and apply them for testing the closeness of their results to optimal results.

314		3	Analyze the concepts of replacement and game theory and apply them for arriving at optimal decisions.
314		4	Apply the concepts of PERT and CPM for decision making and optimally managing projects.
314		5	Explain the concepts of dynamic programming into real time applications.
315	Advanced Materials	1	Justify knowledge about metals and alloys and their utility in different environments.
315		2	Judge about polymers and ceramics and their applications.
315		3	Aanalyze composite materials along with reinforcements and their applications.
315		4	Utilize shape memory alloys and functionary graded materials for different applications.
315		5	Justify about the nano materials and their applications.
316	Machine Tools Lab	1	Apply operating principles to perform different operations of lathe
316		2	Apply operating principles required to get different shapes of products on machine tools
316		3	Operate different machine tools with understanding of work holders.
316		4	Apply the mechanics of metal cutting to produce tool angles for a single point cutting tool
317	Thermal Engineering Lab	1	Analyze the performance characteristics of an internal combustion engines
317		2	Draw the Heat balance sheet for diesel engine
317		3	Analyze the characteristics of air compressor.
317		4	Determine the properties of a given sample of fuel.
317		5	Explain different boilers models, mountings and their accessories
318	Advanced Communication Skills Lab	1	Acquire vocabulary and use it contextually
318		2	Listen and speak effectively
318		3	Develop proficiency in academic reading and writing
318		4	Increase possibilities of job prospects
318		5	Communicate confidently in formal and informal contexts
319	Professional Ethics and Human Values	1	Judge the concepts of human values.
319		2	Justify knowledge about the principles of engineering ethics.
319		3	Interpret engineering as social experimentation.
319		4	Realize engineers' responsibility for safety and risk.
319		5	Learn about the engineers' rights and responsibilities.
321	Heat Transfer	1	Explain and estimate the heat transfer rate in different cross sections under steady heat conduction and unsteady state heat conduction.
321		2	Relate, identify and solve the correlations for free and forced convection.

321		3	Explain and compute heat transfer rate in boiling and condensation processes.
321		4	Classify and Design parallel and counter flow heat exchangers.
321		5	Explain the principles of black body radiation and mass transfer
322	Design of Machine Members–II	1	Apply knowledge about the design of bearings.
322		2	Design various Engine parts.
322		3	Design curved beams and power screws.
322		4	Design power transmission systems and to design pulleys and gear drives.
322		5	Design various machine tool elements.
323	Introduction to Artificial Intelligence and Machine Learning	1	Discuss basic concepts of artificial intelligence, neural networks and genetic algorithms.
323		2	Apply the principles of knowledge representation and reasoning.
323		3	Learn about Bayesian and computational learning and machine learning.
323		4	Utilize various machine learning techniques.
323		5	Apply the machine learning analytics and deep learning techniques.
324	Statistical Quality Control	1	Discuss the concepts of quality systems and quality engineering in design and processes.
324		2	Utilize knowledge about the statistical process control charts and sampling techniques.
324		3	Analyze the loss function and quality function deployment.
324		4	Judge the models of reliability engineering.
324		5	Apply knowledge about the concepts of complex system and reliability engineering techniques.
325	Introduction to Automobile Engineering	1	Discuss various components of four wheeler automobile.
325		2	Apply the knowledge of different parts of transmission system.
325		3	Judge about steering and suspension systems.
325		4	Justify the braking system and electrical system used in automobiles.
325		5	Analyze the concepts about engine specifications and service, safety and electronic system used in automobiles.
326	Heat Transfer Lab	1	Perform steady state conduction experiments to estimate the thermal conductivity of a solid and overall heat transfer coefficient of a composite wall
326		2	Perform the heat transfer experiment on a Pin fin and obtain variation of temperature along the length of the Pin fin
326		3	Estimate the heat transfer coefficients in free and forced convection environments
326		4	Perform Radiation experiments to determine Stephen Boltzman constant and emissivity of a test plate

326		5	Estimate condensation heat transfer coefficients and to determine critical heat flux values in boiling
327	CAE/CAM Lab	1	Experiment with trusses and beams to determine stress, deflection, natural frequencies, harmonic analysis, HT analysis and buckling analysis.
327		2	Create part programmes using FANUC controller.
327		3	Apply G-codes for automated tool path using CAM software.
327		4	Analyze about rapid prototyping machine and to print simple parts.
327		5	Experiment with virtual 3D printing simulation using Vlabs.
328	Measurements & Metrology Lab	1	Demonstrate the use of instruments for measuring linear (internal and external), angular dimensions and surface roughness.
328		2	Perform alignment tests on various machine tools.
328		3	Demonstrate the use of instruments for measuring pressure, flow, speed, displacement and temperature
328		4	Calibrate the Bourdon tube pressure gauge
329	Artificial Intelligence and Machine Learning Lab	1	apply the knowledge of artificial intelligence and machine learning models along with image classifiers and automatic facial recognition using various software tools.
3210	Research Methodology and IPR	1	Understand objectives and characteristics of a research problem.
3210		2	Analyze research related information and to follow research ethics
3210		3	Understand the types of intellectual property rights.
3210		4	Learn about the scope of IPR.
3210		5	Understand the new developments in IPR.
411	Unconventional Machining Processes	1	Compare non-traditional machining, classification, material applications in material removal process
411		2	Summarize the principle and processes of ECM
411		3	Illustrate the principle and processes of ultrasonic machining
411		4	Apply the principles and procedure of thermal metal removal processes
411		5	Understand the principles, processes and applications of Plasma Machining, EBM and LBM
412	Power Plant Engineering	1	Explain the Layout and working of Steam Power Plants
412		2	Explain the Layout and working of Diesel, Gas turbine Power Plants
412		3	Explain the working of Nuclear and hydro Power plants, identification of Nuclear Hazards and

			disposal of radioactive waste
412		4	Explain the combined operations of different power plants and there Instrumentation and Control
412		5	Estimate the loads on power plants by considering various factors and the impact of pollutants on environment and methods of pollution control
413	Mechatronics	1	Describe the integrative nature of Mechatronics.
413		2	Apply the knowledge of Solid state electronics and analog signal conditioning circuits used in the development of mechatronics system.
413		3	Apply the knowledge of various sensors, actuators and controllers in the development of indigenous mechatronics system.
413		4	Explain the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O in development of data acquisition system.
414	Finite Element Methods	1	Apply finite element method to solve problems in solid mechanics.
414		2	Formulate and solve problems in one dimensional structures including trusses, beams and frames.
414		3	Formulate FE characteristic equations for two dimensional elements and analyze plane stress, plane strain, axi-symmetric problems and higher order elements such as quadratic bar element, 6-node triangle, 4,8,9-node quadrilateral elements
414		4	Apply numerical Integration for finding stiffness matrix of different elements.
415	Operations Management	1	Describe the scope of operations management and forecast the demand for products as well as services for a given organization.
415		2	Analyze managerial problems related to plant location and layout for a given organization.
415		3	Apply appropriate material control techniques and material requirement plans to manage the materials effectively.
415		4	Develop aggregate planning and Master production schedules in operation environment.
415		5	Apply Deterministic models and Contemporary management techniques to the service sector as well as manufacturing firms.
416	Universal Human Values	1	Understand and analyse the essentials of human values and skills, self exploration, happiness and prosperity.
416		2	Identify and evaluate the role of harmony in family, society and universal order.
416		3	Understand and associate the holistic perception of harmony at all levels of existence.
416		4	Develop appropriate technologies and management patterns to create harmony in professional and personal lives.

417	Mechatronics Lab	1	Measure load, displacement and temperature using analogue and digital sensors.
417		2	Develop PLC programs for control of traffic lights, water level, lifts and conveyor belts.
417		3	Simulate and analyse PID controllers for a physical system using MATLAB.
417		4	Develop pneumatic and hydraulic circuits using Automaton studio.
421	Major Project	1	Identify complex engineering problems relevant to the society and industry.
421		2	Apply modern technologies, tools and systems in the field of mechanical Engineering to analyze the identified problem.
421		3	Design and implement a viable solution to the problem.
421		4	Apply communication, report writing skills & Presentation skills.
421		5	Develop team work and leadership skills with professional and ethical values.

COURSE OUTCOME NUMBER	COURSEOUTCOMES
SEMESTER I	
COURSE NAME: Management and Organizational Behavior	
C-101-1	Understand various managerial skills, roles, functions and levelsand To make aware of management thinkers and their contributions.
C-101-2	understand the planning and decision making process , techniques and MBO in the organization
C-101-3	Demonstrate the ability to direct, lead and communicate effectively
C-101-4	Understand the conceptual framework of the discipline of OB and its practical applications in the organizational setup
C-101-5	Manage conflict , negotiation and change in organizational context
C-101-6	Develop creative and innovative ideas that could positively shape the organizations
COURSENAME: Managerial Economics	
C-102-1	Understand the basic principles of managerial economics
C-102-2	Analyze the responsiveness of consumers' demand to changes in the price of a good or service, other goods and services, and income
C-102-3	Students should be able to know how production efficiency can be optimized.
C-102-4	Studentscanalsoexposehowtoleveragegametheoryintakingstrategicmovesinoligopolymarketstructure.
C-102-5	Understand the different production costs and how they affect short and long-run decisions
COURSENAME: Accounting For Managers	
C-103-1	Develop an awareness and understanding of the accounting process and fundamental accounting principles that underpin the development of financial statements
C-103-2	Understand the nature and role of the four principal financial statements (i.e., the Income Statement, the Statement of Financial Position, the Statement of Cash Flows, and the Statement of Changes in Equity) ;
C-103-3	Understand and apply course concepts to analyze common business management decisions, such as pricing and outsourcing decisions, from a financial perspective
C-103-4	Understand the role of budgets in organizations, their limitations and the behavioral issues to consider when developing and using budgets for planning and control
C-103-5	Gaintheknowledgeondifferentaccountingstandardswhichweregivenbythedifferent bodies
COURSENAME: Quantitative Analysis for Business Decision	
C-104-1	To provide basic knowledge of analyzing data using various statistical and mathematical techniques for business decisions.
C-104-2	To enable better reporting for decision making.
C-104-3	To highlight the benefits as well as the limits of quantitative analysis in a real-world context.

C-104-4	To orient the students to various hypotheses testing methods as to how and where appropriately they can be applied.
COURSENAME: Legal and business environment	
C-105-1	Understand basic concepts of business environmental factors and environmental scanning.
C-105-2	Able to understand structure of Indian economy and economic planning in India.
C-105-3	Able to appreciate the importance of law and legal institutions in business
C-105-4	Able to have a basic understanding of the laws relating to contract, consumer protection, competition, companies and dispute resolution
C-105-5	Understand the basic concepts relating to negotiable instruments
COURSENAME: BusinessCommunication and Soft Skills	
C-106-1	To provide an overview of Prerequisites to Business Communication.
C-106-2	Apply business communication strategies and principles to prepare effective communication for domestic and international business situations
C-106-3	To provide an outline to effective Organizational Communication.
C-106-4	Select appropriate organizational formats and channels used in developing and presenting business messages
C-106-5	Communicate via electronic mail, Internet, and other technologies. and Deliver an effective oral business presentation
COURSENAME:Cross Cultural Management	
C-107-1	Discuss the main theories in cross-cultural management and Identify the key issues international business cases raise in cross-cultural management
C-107-2	Engage with the relevant contextual issues in cross-cultural management in relation to international business and the multi-cultural workforce;
C-107-3	Identity, analyze , evaluate and communicate information about negotiation and management formats in cross-cultural contexts and Incorporate theories, concepts and models relevant to the global and cultural context of an international business issue or case
C-107-4	Apply analytical and theoretical frameworks to cross-cultural management
COURSENAME: Information Technology(LAB)	
C-108-1	Identify various types of Information System for Business
C-108-2	Understand Information Technology Infrastructure
C-108-3	Define databases & identify types of Databases

COURSE OUTCOME NUMBER	COURSEOUTCOMES
SEMESTER II	
COURSENAME: Financial Management	
C-201-1	Gain the knowledge on application of different techniques of capital budgeting under risk less and risky conditions for the investment decisions.
C-201-2	Buildtheoptimumcapitalstructuretotaketheoptimumfinancingdecisions.
C-201-3	Gain the knowledge on application of relevance and irrelevance theories to take dividend decision.
C-201-4	Apply the Leverage and EBIT EPS Analysis associate with Financial Data in the corporate
C-201-5	Analyze the role of time value of money and its use for valuing asset Appraise different capital budgeting methods and their applications
COURSENAME: Human Resource Management	
C-202-1	Understanding of key terms, theories/concepts and practices within the field of HRM
C-202-2	Able to identify and appreciate the significance of the HR planning ,job analysis and HRD concepts
C-202-3	Demonstrate competence in Recruitment and selection , performance appraisal and Training and Development
C-202-4	Able to identify determinants of wages and statutory band non-statutory welfare measures.
C-202-5	Understand Industrial relations and various grievances and dispute resolution mechanisms.
COURSENAME:Marketing Management	
C-203-1	Students will demonstrate strong conceptual knowledge in the functional area of marketing management.
C-203-2	Students will demonstrate effective understanding of market segmentation ,Targeting and Positioning
C-203-3	Students will demonstrate analytical skills in identification of product mix , life cycle and pricing strategies
C-203-4	Students will demonstrate analytical skills in Marketing communication skills and sales force concepts.
C-203-5	Students will demonstrate analytical skills in Marketing distribution channels and channel strategies.
COURSENAME:Operation Management	
C-204-1	Understand recent trends in operation management and types of production system.
C-204-2	Understand product design process and job design
C-204-3	Gainknowledgeof capacity planning , inventory, purchase and supply chain management.
C-204-4	Understand various productivity factors and engineering and behavioral approaches.
C-204-5	Understand various Quality Management concepts.
COURSENAME:Business Research Methods	
C-205-1	Develop necessary critical thinking skills in order to evaluate different research approaches utilized in the service industries
C-205-2	Students should be able to identify the overall process of designing a research study from its inception to its report

C-205-3	Students should be able to define the meaning of a variable, and to be able to identify independent, dependent, and mediating variables.
C-205-4	Students should be familiar with good practices in conducting a qualitative interview and observation
C-205-5	Understand Multivariate analysis and Conceptualize the research process
COURSENAME: Project Management Technology	
C-206-1	Understand project characteristics and various stages of a project.
C-206-2	Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic.
C-206-3	Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
C-206-4	Apply the risk management plan and analyze the role of stakeholders.
C-206-5	Understand the contract management, Project Procurement, Service level Agreements and productivity.
COURSENAME:IT LAB-2 (Programming R)	
C-207-1	Describe Data Analytics and the skill sets needed to be a data analyst
C-207-2	Demonstrate programming skills in R to carry out statistical analysis
C-207-3	Convert data to business projections by applying statistical and visualization tools.
C-207-4	Explain real time business situations using data analysis tools.

COURSE OUTCOME NUMBER	COURSEOUTCOMES
SEMESTER III Finance Specialization	
COURSENAME: Strategic Management	
C-301.1	Explore participants to various perspectives and concepts in the field of Strategic Management
C-301.2	Develop skills in environmental scanning and tools o and techniques of strategies.
C-301.3	Understand value chain analysis and competitive advantage of a firm and exit and entry barriers.
C-301.4	Develop skills in strategy implementation and link strategies with other business concepts.
C-301.5	Understand various Qualitative and quantitative benchmarking to evaluate performance.
COURSENAME: Operations Research	
C-302.1	Apply Linear programming techniques to allocate scarce resources in an optimum manner in problems of scheduling, product mix etc.
C-302.2	Manage the Waiting line management to minimize the overall cost due to servicing and waiting.
C-302.3	Apply Network analysis to plan, schedule, monitor and control large projects such as construction of a building, making a ship, or planning for a space flight.
C-302.4	Make Decisions under the conditions of risk and uncertainty.
COURSENAME: Investment Analysis and Portfolio Management	
EF-301.1	Understand the concept process of investment
EF-301.2	Estimate the systematic and unsystematic risk involved in asecurity
EF-301.3	Analyze a security using fundamental analysis and technical analysis
EF-301.4	Calculate the return and risk of a portfolio and mutual funds
EF-301.4	Calculate the duration of a bond and understand implications of the sensitivity of bond price to interest rate changes
COURSENAME: Managing Banks and Financial Institutions	
EF-302.1	Understand Indian Financial system and phases of development of banking in India
EF-302.2	Understand organization, structure and functions of RBI and regulations of NBFCS and FDI in Banking sector.
EF-302.3	Know an idea about risk management concepts in banks and regulations on insurance companies.
EF-302.4	Understand various financial institutions and development banks in India.
EF-302.5	Understand elements of the Basel regulatory framework, with special emphasis on capital adequacy regulation, and calculate banks' required capital ratios given their balance sheets
COURSENAME: Financial Markets and Services	
EF-303.1	Know about the financial market structure and participants in the markets.
EF-303.2	Gain knowledge on the different financial services which are available in India.
EF-303.3	Understand the merchant banking , Hire purchase and Lease assistance to micro small, small, medium and large scale business units.
EF-303.4	Understand the different financial services like factoring, credit rating methods
EF-303.5	Understand Indian Rural Financial system and various models in India.

COURSENAME: Mergers, Acquisitions and Corporate Restructuring	
EF-304.1	Understand the implications of corporate bankruptcy and restructuring on stakeholders' wealth
EF-304.2	Identify legal aspects of corporate investments/divestiture decisions and the implications of legal risk on stakeholders' wealth
EF-304.3	Utilize ethical frameworks to analyze organizational decision-making as it relates to finance
EF-304.4	Evaluate the theoretical and applied research in the areas of mergers & acquisitions, public offerings, corporate carve-outs, and spinoffs.

COURSE OUTCOME NUMBER	COURSEOUTCOMES
SEMESTER III HR Specialization	
COURSENAME:Strategic Management	
C-301.1	Explore participants to various perspectives and concepts in the field of Strategic Management
C-301.2	Develop skills for applying these concepts to the solution of business problems
C-301.3	Create mastery in analytical tools of strategic management.
C-301.4	Understand qualitative and Quantitative benchmarking to evaluate performance
COURSENAME:Operations Research	
C-302.1	Apply Linear programming techniques to allocate scarce resources in an optimum manner in problems of scheduling, product mix etc.
C-302.2	Manage the Waiting line management to minimize the overall cost due to servicing and waiting.
C-302.3	Apply Network analysis to plan, schedule, monitor and control large projects such as construction of a building, making a ship, or planning for a space flight.
C-302.4	Make Decisions under the conditions of risk and uncertainty.
COURSENAME:Leadership and Change Management	
EH-301.1	Understanding the various components of leadership and remembering different models of leadership behavior.
EH-301.2	Analyzing the emerging challenges in leadership motivation and understanding the different dimensions of leadership motivation.
EH-301.3	Learning how to apply Creative Thinking in strategic leadership.
EH-301.4	Understanding and remembering different basics concepts of Change management.
EH-301.5	Applying different Tools and techniques for mapping the change with regard to case studies.
COURSENAME:Performance Evaluation and Compensation Management	
EH-302.1	To understand Historical Developments in Performance Management and Understanding the framework of performance management and its process
EH-302.2	Develop skills in competency mapping and strategic planning and Remembering various Tools and techniques for mapping performance management planning
EH-302.3	Explore knowledge in performance management system and Analysing the new trends in compensation management and understanding the compensation and retention strategies.

EH-302.4	Understand various dimensions of compensation programme
EH-302.5	Understanding and analyzing performance based and pay based compensation structures.
COURSENAME: Human Resource Metrics and Analytics	
EH-303.1	Understanding Various approaches for designing HR metrics Deciding what metrics are important to various business organizations.
EH-303.2	Understand Inside-Out Approach and Inside- Out Approach and Applying HR Metrics at various levels of Human Resource Management
EH-303.3	Applying HR analytics for taking various business decisions and Develop skills in creating levels of metrics measures
EH-303.4	Evaluating the reliability and validity of diversity analysis at various levels of Human Resource Management
EH-303.5	Align HR metrics with business strategy, goals and objectives.
COURSENAME: HUMAN CAPITAL MANAGEMENT	
EH-304.1	Understanding various economic theories of human capital
EH-304.2	Analyzing the accounting aspects and understanding various models of human capital.
EH-304.3	Understanding various Tools and techniques for evaluation of accounting human capital management.
EH-304.4	Evaluating the quality of work life at various levels human Resource management
EH-304.5	Understanding the statutory obligations regarding industrial accidents and safety

COURSENAME: Man Power Planning, Recruitment and Selection	
EH-305.1	Understanding the framework of Human Resource Planning and the factors affecting it.
EH-305.2	Understanding and remembering various Tools and techniques of demand forecasting and supply fore Casting at micro level planning.
EH-305.3	Analyzing downsizing strategies and its legal framework
EH-305.4	Evaluating the need for recruitment and selection.
EH-305.5	Analyzing the training needs and learning how to develop training and development programs.

COURSEOUTCOMENUMBER	COURSEOUTCOMES
SEMESTERIII MarketingSpecialization	
COURSENAME: Strategic Management	
C-301.1	Explore participants to various perspectives and concepts in the field of Strategic Management
C-301.2	Develop skills for applying these concepts to the solution of business problems
C-301.3	Create mastery in analytical tools of strategic management.
C-301.4	Understand qualitative and Quantitative benchmarking to evaluate performance
COURSENAME: LegalAspectsofBusiness	
C-302.1	Apply Linear programming techniques to allocates carceres our cesin an optimum manner In problems of scheduling, productmixetc.

C-302.2	ManagetheWaitinglinemanagementtominimizetheoverallcost duetoservicingand waiting.
C-302.3	ApplyNetworkanalysis toplan,schedule,monitorandcontrollargeprojectssuchas Construction of a building, making a ship,or planning for as pace flight.
C-302.4	MakeDecisionsundertheconditionsofriskanduncertainty.
COURSENAME: Business Ethics & Corporate Goverance	
C-302.1	Apply Linear programming techniques to allocates carceres our cesin an optimum manner in problems of scheduling, product mix etc.
C-302.2	Manage the Waiting line management to minimize the over all cost due to servicing and Waiting.
C-302.3	Apply Network analysis to plan, schedule, monitor and controller ge projects such as construction of a building, making a ship, or planning for as pace flight.
C-302.4	Make Decision sunder the conditions of risk and uncertainty.
COURSENAME: Consumer Behavior	
EM-301.1	Able to explain the basic. Concept sand models of consumer behaviour
EFM301.2	Able to analyse the effects of psychological, socio-cultural and demographic factors on the consumer decision process with their results.
EM-301.3	Able to analyse marketing segmentation ,positioning and consumer motivation.
EM-301.4	Able to explain the consumer purchasing decision process and various models..
EM-301.5	Able to analyse the various consumer perception and personality influencing factors
COURSENAME: RetailManagement	
EM-302.1	Understand Retail management significance , decision process and environmental issues in national and global business.
EM-302.2	Able to analyze retail segments and targets at local and regional level
EM-302.3	Understand retail store location and layout and retail pricing strategies.
EM-302.4	Able to understand strategies of CRM and loyalty programmes.
EM-302.5	Understand international retailing and benefits of going global
COURSENAME: Customer Relationship Management	
EM-303.1	Apply the concept of CRM, the benefits delivered by CRM, the contexts in which it is used, the technologies that are deployed and how it can be implemented
EM-303.2	Implement how CRM practices and technologies enhance the achievement of marketing, sales and service objectives throughout the customer life-cycle stages of customer acquisition, retention and development whilst simultaneously supporting broader organizational goals.
EM-303.3	Implement various technological tools for data mining and also successful implementation of CRM in the Organizations
EM-303.4	Design Sales force automation, data synchronization and reporting tools.
EM-303.5	Understand CRM in e-business and measuring CRM effectiveness
COURSENAME: Strategic Marketing Management	
EM-304.1	Understand strategic marketing management process ,strategy formulation of 4Ps

EM-304.2	Analyze corporate restructuring its forms , portfolio analysis and McKinsey's 7s frame work for improving organizational effectiveness .
EM-304.3	Understand integration of marketing strategies and their application.
EM-304.4	Able to analyze marketing performance and strategies for preventing disasters and preparedness measures.
EM-304.5	Understand recent trends in strategic marketing management and link inking CSR with profit and sustainability.
COURSENAME: Digital and Social Media Marketing	
EM-305.1	Understand the concepts of Digital marketing and its trends.
EM-305.2	Analyze the channels of digital marketing and able to acquire and retain new customers..
EM-305.3	Understand digital marketing plan and opportunities and issues.
EM-305.4	Able to understand search engine marketing ,CPM and CPC concepts.
EM-305.5	Understand social networking with social media and analyze advertising performance.

COURSE OUTCOME NUMBER	COURSEOUTCOMES
SEMESTERIV Finance Specialization	
COURSENAME: Supply Chain Management and Analytics	
C-401.1	Understand the different views of Supply chain and its strategies
C-401.2	Identify various supply chain drivers an analytics in SCM
C-401.3	Identify difference between SCM and CRM
C-401.4	Evaluate various channels of Distribution and Network Design in Supply Chain
COURSENAME: Innovation and Entrepreneurship	
C-402.1	understand different innovation and entrepreneurship theories and their implications
C-402.2	understand the dynamics of how teams develop and function as well as the various types of conflicts that can arise during teamwork
C-402.3	understand different methods that can be used to minimize uncertainties at different stages of the entrepreneurial process
C-402.4	understand what characterizes an attractive business opportunity and common pitfalls during the entrepreneurial process
COURSENAME: Financial Derivatives	
EF-401-1	Identifying the basic types of derivatives: forwards, futures, swaps and options.
EF-401-2	Identifying main factors affecting the price of the considered instruments and basic techniques leading to no-arbitrage pricing of derivatives with the basic relationships between adjacent instruments.
EF-401-3	Understanding the methods and principles of the mathematical theory of finance as the foundation for options pricing.
COURSENAME: Global Financial Management	
EF-402-1	Demonstrate basic understanding of foreign exchange market and exchange rates
EF-402-2	Demonstrate basic understanding of how to use foreign exchange derivatives and other techniques to manage foreign exchange exposures of firms.
EF-402-3	Demonstrate basic understanding of the issues pertaining to multinational financing and investment decisions
EF-402-4	Demonstrate critical and analytical skills wherein they should be able to make sense out of a mass of information to address relevant issues pertaining to international finance
COURSENAME: Financial Risk Management	
EF-403-1	Identifythedifferentsourcesofriskaffectingthecompanies.
EF-403-2	Tostatethedifferentriskmanagementapproaches.
EF-403-3	Integratedapproachtocorporateriskmanagement.
EF-403-4	Thetypesofplayersinderivativesmarkets.
EF-403-5	UnderstandingofDifferenttypesofproductsavailablein Derivatives Market.Valuationoffutures&forwardcontract.
COURSENAME: Strategic Financial Management	
EF-404-1	Knows the basic concepts of SFM, understands the principles of developing a strategic goal and objectives, establishing key performance indicators, could evaluate and interpret financial ratios.
EF-404-2	Has an understanding of the value-based management concept of forecasting models within it, could evaluate and analyze the business strategies from SFM point of view.

COURSE OUTCOME NUMBER	COURSEOUTCOMES
SEMESTERIV HR Specialization	
COURSENAME: Supply Chain Management and Analytics	
C-401.1	Understand the different views of Supply chain and its strategies
C-401.2	Identify various supply chain drivers an analytics in SCM
C-401.3	Identify difference between SCM and CRM
C-401.4	Evaluate various channels of Distribution and Network Design in Supply Chain
COURSENAME: Innovation and Entrepreneurship	
C-402.1	understand different innovation and entrepreneurship theories and their implications
C-402.2	understand the dynamics of how teams develop and function as well as the various types of conflicts that can arise during teamwork
C-402.3	understand different methods that can be used to minimize uncertainties at different stages of the entrepreneurial process
C-402.4	understand what characterizes an attractive business opportunity and common pitfalls during the entrepreneurial process
COURSENAME: Labour Welfare and Employment Laws	
EH-401.1	Understand rationale behind labour laws and apply various principles and philosophies of labour welfare
EH-401.2	Utilize provisions of various labour laws in their corporate life.
EH-401.3	Develop to utilize labour laws in their corporate life and aanalyse various labour welfare programs
EH-401.4	Equip with important provisions of various labour laws
COURSENAME: INTERNATIONAL HR MANAGEMENT	
EH-402.1	Understanding the challenges and role of globalization
EH-402.2	.Make the students to remember various staffing policies training and development policies and understanding the legal content Global of HRM.
EH-402.3	Understanding and analyzing the different models of cross cultural management.
EH-402.4	Understanding and remembering different methods of compensation management.
EH-402.5	Evaluating the challenges of globalization and new corporate culture.
COURSENAME: Employee Relations and Engagement	
EH-403.1	Understanding the framework of Industrial Relations in India and the factors influencing it.
EH-403.2	Remembering recent trends in Industrial Relations and Develop skills to settle various industrial disputes
EH-403.3	Analyzing the growth and problems of trade unions in India.
EH-403.4	Understand various elements of employee engagement and their strategies
EH-403.5	Evaluating the consequences of industrial disputes and applying the knowledge for prevention and settlement of industrial disputes in India.
COURSENAME: Human Resource Development	
EH-404-1	Understanding human resource development framework and techniques.
EH-404-2	Critique the relationship between organizational development (OD) and HRD contribution to organizational effectiveness;

EH-404-3	Apply and evaluate a learning process starting with training needs analysis to assessment and evaluation process;
EH-404-4	Understanding human resource development ethics and remembering the various applications for organizational change and HRD audit.
EH-404-5	Understanding human resource development ethics and remembering the various applications for organizational change and HRD audit.
COURSENAME: Strategic HRM	
EH-405-1	Understand the framework of strategic Human Resource Management .
EH-405-2	Analyzing business strategies to human resource strategies
EH-405-3	Understanding various levels of strategic human resource planning
EH-405-4	Remembering various employment practices and work force utilization
EH-405-5	Evaluating strategic contribution of emerging areas.

SEMESTERIV MarketingSpecialization	
COURSENAME: LogisticandSupplyChainManagement	
C-401.1	Understand the different views of Supply chain and its strategies
C-401.2	Identifyvarioussupplychaindriversananalytics inSCM
C-401.3	Identify difference between SCM and CRM
C-401.4	Evaluate various channels of Distribution and Network Design in Supply Chain
COURSENAME: EntrepreneurshipDevelopment	
C-402.1	Understand different innovation and entrepreneurship theories and their implications
C-402.2	Understand the dynamics of how teams develop and function as well as the various types of Conflicts that can arise during teamwork
C-402.3	Understand different methods that can be used to minimize uncertainties at different stages of the entrepreneurial process
C-402.4	Understand what characterizes an attractive business opportunity and common pit falls during the entrepreneurial process
COURSENAME: ServicesMarketing	
EM-401.1	Understandthe Concept of Services and intangible products and knowledge about emerging service environment and service market segmentation and targeting.
EM-401.2	Analyze various service pricing and service promotion strategies.
EM-401.3	Analyze the role and relevance of Quality in Services and Visualize future changes in the Services Industry
EM-401.4	Understand service delivery process and managing people for service advantage.
EM-401.4	Understand marketing of various services.
COURSENAME: PromotionalDistributionManagement	
EM-402.1	Identify, and respond to clients' advertising and marketing objectives by applying IMC
EM-402.2	Develop an integrated advertising and marketing communications plan and persuasively present and defend it with the help of media plan and strategy.
EM-402.3	Able to understand the role of personal selling in IMC and controlling sales force effort.
EM-402.4	Determine the optimum sales promotional tool(s) for use in the marketing communications plan and support media
EM-402.5	Able to understand the role of channels and its selection, motivation and management.
COURSENAME: GREEN MARKETING	
EM-403.1	Understand Green marketing and its importance to the environment from the perspective of consumers and business and able to analyze green consumers motives and buying strategies.
EM-403.2	Understand the Green spinning, selling , harvesting and other environmental concepts.

EM-403.3	Analyze various factors that affect purchase decisions and models
EM-403.4	Describe the current state of the environment resulting from the past and present practices of the human consumption. And exchange of E-waste and its guide lines.
EM-403.4	Able to know various green marketing initiatives of various Indian firms.
COURSENAME: ADVERTISING AND BRAND MANAGEMENT	
EM-404-1	Able to apply the fundamental concepts of Advertising concepts and strategies.
EM-404-2	Able to design and develop Advertising campaign and AD copy
EM-404-3	Understand AD agency and able to choose right agency and also acquaint about brand concepts.
EM-404-4	Understand brand personality, portfolio and able to develop communication for brand image and enhancement through sponsorships and event management.
EM-404-5	Able to identify brand equity and loyalty and able to build Indian brands for global markets.

COURSENAME: Global Marketing Management	
EM-405-1	Develop an understanding of and an appreciation for basic international marketing concepts, theories, principles, and terminology.
EM-405-2	Be able to demonstrate an awareness and knowledge of the Global marketing entry strategies of Indian firms.
EM-404-3	Be capable of identifying international customers through conducting marketing research and developing cross-border segmentation and positioning strategies.
EM-404-4	Be capable of developing a global marketing strategy by applying the basic concepts of product, pricing, promotion, and channels of distribution in international settings.
EM-404-5	Be able to apply an integrated understanding of the course material by conducting an analysis of international marketing issues in relevant case studies and current events.
EM-404-6	Identifying factors that contribute to the challenges faced by marketers internationally, and developing corresponding solution options based on multiple perspectives. And also develop knowledge on Exim policy of India

SIR C R REDDY COLLEGE OF ENGINEERING

ELURU-534007, ELURU DIST, ANDHRA PRADESH, INDIA

Autonomous, ApprovedbyAICTE,NewDelhi&AccreditedbyNBA,

(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

JNTUK-R23 REGULATION

COURSE OUTCOMES (2023-2027 BATCH)

I Year – I SEMESTER

COURSE	C.O CODE	COURSE OUTCOMES
Engineering Physics	**C1108.1**	Apply the knowledge of different optical phenomena in daily life.
	C1108.2	Study the structures and properties of solid-state materials and apply this knowledge to estimate the structure of the materials
	C1108.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1108.4	Explain fundamental concepts of quantum mechanics and analyze the behaviour of electron in metals according to various theories
	C1108.5	Estimate concentration of charge carriers in various types of semiconductors.
Linear Algebra and calculus	**C1105.1**	Define the concept of matrix rank and methods used to solve systems of linear equations.
	C1105.2	Describe the Cayley-Hamilton Theorem and the process of reducing quadratic forms to canonical formsthrough orthogonal transformations.
	C1105.3	Solve problems in calculus using the Mean Value Theorems.
	C1105.4	Solve optimization problems for functions of two variables by utilizing partial differentiation.
	C1105.5	Apply double integrals and triple integrals for the problems related to finding areas and volumes.
Basic Electrical And Electronics Engineering	**C1109.1**	Explain the fundamental laws and concepts to derive the various equations which are related to electrical circuits by applying mathematical tools.
	C1109.2	Demonstrate the working and operating principles of electrical machines, measuring instruments.
	C1109.3	Demonstrate the working of various power generation stations and calculate the electrical load and electricity bill of residential and commercial buildings.
	C1109.4	Illustrates the formation of PN junction Diode and Transistors
	C1109.5	Articulate the operation of Rectifiers and Amplifiers
	C1109.6	Understand the concepts of Combinational & Sequential Digital circuits
Engineering Graphics	**C1110.1**	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections
	C1110.2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
	C1110.3	Understand and draw projection of solids in various positions in first quadrant.
	C1110.4	Explain principles behind development of surfaces.
	C1110.5	Prepare isometric and perspective sections of simple solids

Introduction to programming	**C1107.1**	Discuss the Historical Development of Computers and their Basic Organization including the Key Components.
	C1107.2	Apply Conditional Statements and Loops to Solve Programming Problems Effectively.
	C1107.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1107.4	Apply Pointers and their role in Programming, differentiating user-defined data type such as Structures and unions
	C1107.5	Apply Variable Scope with in a program and File Handling Techniques for efficientdata input and output.
Physics Lab	**C1109L. 1**	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C1109L. 2	Analyze various electronic circuits and its components and verify the laws of stretched string.
	C1109L. 3	Apply the knowledge of phenomena like LASER diffraction and resonance in sound waves
Electrical And Electronics Engineering workshop	**C1110L.1**	Examine the Voltage, Current, Power and Resistance in various ElectricalCircuits
	C1110L.2	Discover the operating characteristics of DC Shunt Generator
	C1110L.3	Analyze the effect of reactive power and power factor inelectrical loads
	C1110L.4	Measure Voltage, Current and Resistance in Diode Circuits
	C1110L.5	Discover the Ripple factors of Rectifier & Characteristics of Transistor Circuits
	C1110L.6	Truth table verification of Digital logic circuits
Computer Programming Lab	**C1106L.1**	Discuss the Historical Development of Computers and their Basic Organization including the KeyComponents.
	C1106L.2	Apply Conditional Statements and Loops to Solve Programming Problems Effectively.
	C1106L.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1106L.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structuresand Unions
	C1106L.5	Apply Variable Scope with in a program and File Handling Techniques for efficient data input and output.
Nss/Ncc/Scouts &Guides/Community Service	**C1111L.1**	Understand the importance of discipline, character and service motto.
	C1111L.2	Solve some societal issues by applying acquired knowledge, facts, and techniques
	C1111L.3	Explore human relationships by analyzing social problems
	C1111L.4	Determine to extend their help for the fellow beings and downtrodden people
	C1111L.5	Develop leadership skills and civic responsibilities.

I Year – II SEMESTER

COURSE	C.O CODE	COURSE OUTCOME DESCRIPTION
Communicative English	**C1207.1**	Apply the four language learning skills-Listening, Speaking, Reading and Writing (LSRW) for professional success.
	C1207.2	Employ knowledge of vocabulary in speech and writing
	C1207.3	Apply effective communication skills in cross cultural context to enhance professional possibilities.
	C1207.4	Develop acceptable personality traits suitable for chosen profession.
Chemistry	**C1209.1**	Understand duel nature of electron and bonding between the atoms through the quantum mechanics.
	C1209.2	Describe Property based applications of semiconductors, super conductors, super capacitors and nano materials in different disciplines of the world.
	C1209.3	Explain the construction and working of batteries, sensors and fuel cells based on the principles of electrochemistry
	C1209.4	Understand the synthetic root and impact of different polymer based materials on environment based on theirproperties.
	C1209.5	Apply the principles of spectroscopy and HPLC in chemical analysis.
Differential Equations and Vector Calculus	**C1202.1**	Understand linear differential equations of first order, including Bernoulli's, exact, and equationsreducible to exact forms.
	C1202.2	Solve higher-order linear differential equations related to various engineering fields.
	C1202.3	Solve partial differential equations that model physical processes.
	C1202.4	Interpret the physical implications of vector operators like gradient, curl, and divergence.
	C1202.5	Apply Green's, Stokes, and the Divergence theorem to address problems related to the estimation of work doneagainst a field, circulation, and flux.
Basic Civil and Mechanical Engineering	**C1211.1**	Describe the various disciplines of civil Engineering and to appreciate their role in societal development.
	C1211.2	Outline the concepts of surveying and obtaining the theoretical measurement of distances, angles and levelsthrough surveying equipment
	C1211.3	Illustrate the fundamental principles involved in transportation network system and the quality parameters ofvarious water resources
	C1211.4	An ability to know about role of mechanical engineer in industry and societyand what are the types & properties and applications of engineering materials & know about smart materials
	C1211.5	Describe what are the fundamentals of manufacturing and types advantages disadvantages also applications andfundamentals of thermal engineering i.e., engine basicprinciples and its working, and also fundamentalsrefrigeration and air conditioning

	C1211.6	Illustrate the different types of power plants also its working and mechanical power transmission systems types of robotics and its working configurations
Network Analysis	**C1213.1**	To Define basic Electrical Quantities and associated units and relationship between charge, current, voltage and power.
	C1213.2	Apply the basic theorems to solve DC Circuits
	C1213.3	Analyze the basic concepts of DC Transients
	C1213.4	Analyze the concepts of sinusoidal steady state analysis and resonance
	C1213.5	Apply the Laplace transform techniques to solve electrical network problems
Communicative English lab	**C1207L.1**	Build confidence and overcome inhibitions while speaking in English.
	C1207L.2	Demonstrate acquired language skills in performing the designated activity.
	C1207L.3	Evaluate and exhibit professionalism in participating in debates and group discussions.
	C1207L.4	Recognize the sounds of English with the help of audio visual aids
Chemistry lab	**C1209L.1**	Select different analytical instruments such as Conductivity meter Potentiometer and Spectrophotometer duringthe chemical analysis
	C1209L.2	Demonstrate Preparation of advanced polymeric materials and nano materials
	C1209L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample
	C1209L.4	Analyze IR spectrum of some organic compounds
Engineering workshop	**C1211L.1**	Understand the Electrical circuit design concept; measurement of resistance, power, power factor;concept of wiring and operation of Electrical Machines and Transformer.
	C1211L.2	Apply the theoretical concepts and operating principles toderive mathematical models for circuits, Electrical machines and measuring instruments; calculations for themeasurement of resistance,power and power factor.
	C1211L.3	Apply the theoretical concepts to obtain calculations for themeasurement of resistance, power andpower factor.
	C1211L.4	Analyze various characteristics of electrical circuits, electrical machines and measuringinstruments.
	C1211L.5	Design suitable circuits and methodologies for themeasurement of various electrical parameters;Household and commercial wiring.
Network Analysis and simulation Lab	**C1214L.1**	To analyze RLC circuits and understand resonant frequency and q factor.
	C1214L.2	To determine first order RC/RL networks of non-sinusoidal waveforms.
	C1214L.3	Apply network theorems to analyze the electrical network.
	C1214L.4	Characterize and model the network in terms of all parameters

Health and wellness, yoga and sports	**C1215L.1**	Understand the importance of yoga and sports for Physical fitness and sound health.
	C1215L.2	Demonstrate an understanding of health-related fitness components.
	C1215L.3	Compare and contrast various activities that help enhance their health.
	C1215L.4	Assess current personal fitness levels.
	C1215L.5	Develop Positive Personality

II Year – I SEMESTER

COURSE	C.O CODE	COURSE OUTCOMES
Probability theory and stochastic process	**R2321041.1**	Perform operations on single and multiple Random variables.
	R2321041.2	Determine the Spectral and temporal characteristics of Random Signals.
	R2321041.3	Characterize LTI systems driven by stationary random process by using ACFs and PSDs.
	R2321041.4	Understand the concepts of Noise and Information theory in Communication systems
Universal Human values	**R2321042.1**	Define the terms like Natural Acceptance, Happiness and Prosperity
	R2321042.2	Identify one's self, and one's surroundings (family, society nature)
	R2321042.3	Apply what they have learnt to their own self in different day-to-day settings in real life
	R2321042.4	Relate human values with human relationship and human society.
	R2321042.5	Justify the need for universal human values and harmonious existence
	R2321042.6	Develop as socially and ecologically responsible engineers
Signals and systems	**R2321043.1**	Differentiate the various classifications of signals and systems
	R2321043.2	Analyze the frequency domain representation of signals using Fourier concepts
	R2321043.3	Classify the systems based on their properties and determine the response of LTISystems.
	R2321043.4	Know the sampling process and various types of sampling techniques.
	R2321043.5	Apply Lap lace and z-transforms to analyze signals and Systems (continuous&discrete).
Electronic Devices and circuits Electronic Devices and circuits	**R2321044.1**	Apply the basic concepts of semiconductor physics.
	R2321044.2	Understand the formation of p-n junction and how it can be used as a p-n junction asdiode in different modes of operation
	R2321044.3	Analyze the construction, working principle of Semiconductor Devices and DiodeCircuits
	R2321044.4	Know the need of transistor biasing, various biasing techniques for BJT and FET andstabilization concepts with necessary expressions
	R2321044.5	Apply small signal low frequency transistor amplifier circuits using BJT and FET indifferent configurations
Switching Theory and Logic Design	**R2321045.1**	Classify different number systems and apply to generate various codes.

	R2321045.2	Use the concept of Boolean algebra in minimization of switching functions
	R2321045.3	Design different types of combinational logic circuits.
	R2321045.4	Apply knowledge of flip-flops in designing of Registers and counters
	R2321045.5	The operation and design methodology for synchronous sequential circuits and algorithmic state machines.
	R2321045.6	Produce innovative designs by modifying the traditional design techniques.
Electronic Devices and Circuits Lab	**R2321046.1**	Identify various electronic components and devices with their specifications.
	R2321046.2	Analyze the characteristics of various junction diodes and transistors and calculate their parameters.
	R2321046.3	Verify the parameters of rectifier circuits with and without filter and voltage regulator.
	R2321046.4	Design various amplifiers and observe its frequency response
Switching Theory and Logic Design Lab	**R2321047.1**	Realize and implementation of Boolean function using digital IC's
	R2321047.2	Implementation of different Combinational logic circuits using IC's
	R2321047.3	Realize and implementation of synchronous and asynchronous counters using flip-flop IC's
	R2321047.4	Design a Finite state machine for Sequence detector
Data Structures using Python	**R2321048.1**	Understand basic data structures in python like Lists, Tuples, Dictionaries, Sets
	R2321048.2	Design and analyze simple linear data structures.
	R2321048.3	Identify and apply the suitable data structure for the given real world problem.
Environmental Science	**R2321049.1**	Grasp multi disciplinary nature of environmental studies and variousrenewable and non-renewable resources.
	R2321049.2	Understand flow and bio-geo- chemical cycles and ecological pyramids.
	R2321049.3	Understand various causes of pollution and solid waste managementand related preventive measures.
	R2321049.4	Understand the rainwater harvesting, watershed management, ozonelayer depletion and waste land reclamation.
	R2321049.5	Illustrate the causes of population explosion, value education and welfare programmes.

HOD-ECE

Head of the Department
Electronics & Communication Engg.
Sir C.R.R.College of Engineering
Eluru - 534 007

ELECTRONICS AND COMMUNICATION ENGINEERING		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Engineering Physics	**C1108.1**	Apply the knowledge of different optical phenomena in daily life.
	C1108.2	Study the structures and properties of solid state materials and apply this knowledge to estimate the structure of the materials
	C1108.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1108.4	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
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	C1105.4	Solve optimization problems for functions of two variables by utilizing partial differentiation.
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	C1109.3	Demonstrate the working of various power generation stations and calculate the electrical load and electricity bill of residential and commercial buildings.
	C1109.4	Illustrates the formation of PN junction Diode and Transistors (BJT)
	C1109.5	Articulate the operation of Rectifiers and Amplifiers
	C1109.6	Understand the concepts of Combinational & Sequential Digital circuits
Engineering Graphics	**C1110.1**	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections
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		Unions.
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	C1110L.3	Analyze the effect of reactive power and power factor in electrical loads
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II SEMESTER		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
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	C1209.3	Explain the construction and working of batteries, sensors and fuel cells based on the principles of electrochemistry
	C1209.4	Understand the synthetic root and impact of different polymer based materials on environment based on their properties.
	C1209.5	Apply the principles of spectroscopy and HPLC in chemical analysis.
Differential Equations and Vector Calculus	**C1202.1**	Understand linear differential equations of first order, including Bernoulli's, exact, and equations reducible to exact forms.
	C1202.2	Solve higher-order linear differential equations related to various engineering fields.
	C1202.3	Solve partial differential equations that model physical processes.
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	C1213.4	Analyze the concepts of sinusoidal steady state analysis and resonance

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	C1209L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample
	C1209L.4	Analyze IR spectrum of some organic compounds
Engineering workshop	**C1211L.1**	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
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	C1211L.5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
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INFORMATION TECHNOLOGY		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Engineering Physics	**C1108.1**	Apply the knowledge of different optical phenomena in daily life.

	C1108.2	Study the structures and properties of solid state materials and apply this knowledge to estimate the structure of the materials
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	C1110L.3	Analyze the effect of reactive power and power factor in electrical loads
	C1110L.4	Measure Voltage, Current and Resistance in Diode Circuits (L4)
	C1110L.5	Discover the Ripple factors of Rectifier & Characteristics of Transistor Circuits (L4)
	C1110LS.6	Truth table verification of Digital logic circuits (L4)
Computer Programming Lab	**C1106L.1**	Discuss the Historical Development of Computers and their Basic Organisation including the Key Components.
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	C1209.5	Apply the principles of spectroscopy and HPLC in chemical analysis.
Differential Equations and Vector Calculus	**C1202.1**	Understand linear differential equations of first order, including Bernoulli's, exact, and equations reducible to exact forms.
	C1202.2	Solve higher-order linear differential equations related to various engineering fields.
	C1202.3	Solve partial differential equations that model physical processes.
	C1202.4	Interpret the physical implications of vector operators like gradient, curl, and divergence.
	C1202.5	Apply Green's, Stoke's, and the Divergence theorem to address problems related to the estimation of work done against a field, circulation, and flux.
Basic Civil and Mechanical Engineering	**C1211.1**	Describe the various disciplines of civil Engineering and to appreciate their role in societal development.
	C1211.2	Outline the concepts of surveying and obtaining the theoretical measurement of distances,angles and levels through surveying equipment
	C1211.3	Illustrate the fundamental principles involved in transportation network system and the quality parametersof various water resources
	C1211.4	An ability to know about role of mechanical engineer in industry and society and what are the types & properties and applications of engineering materials & know about smart materials
	C1211.5	Describe what are the fundamentals of manufacturing and types advantages disadvantages also applications and fundamentals of thermal engineering i.c engine basic principles and its working, and also fundamentals refrigeration and air conditioning
	C1211.6	Illustrate the different types of power plants also its working and mechanical power transmission systems types of robotics and its working configurations
Data Structures	**C1205.1**	Analyze and implement searching and sorting techniques
	C1205.2	Implement algorithms for linked lists, demonstrating , understanding of memory location .
	C1205.3	Apply algorithm for stacks , manage program states and solve related problem
	C1205.4	Apply algorithm for queues and solve data management challenges
	C1205.5	Develop data structures to make use of Trees and hashing for efficient storage of data
Communicative English lab	**C1207L.1**	Build confidence and overcome inhibitions while speaking in English.
	C1207L.2	Demonstrate acquired language skills in performing the designated activity.
	C1207L.3	Evaluate and exhibit professionalism in participating in debates and group discussions.
	C1207L.4	Recognize the sounds of English with the help of audio visual aids

Chemistry lab	**C1209L.1**	Select different analytical instruments such as Conductivity meter Potentiometer and Spectrophotometer during the chemical analysis
	C1209L.2	Demonstrate Preparation of advanced polymeric materials and nano materials.
	C1209L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample.
	C1209L.4	Analyze IR spectrum of some organic compounds.
Engineering workshop	**C1211L.1**	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
	C1211L.2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
	C1211L.3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
	C1211L.4	Analyze various characteristics of electrical circuits, electrical machines and measuring instruments.
	C1211L.5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
DS LAB	**C1204L.1**	Implement linear data structures inorder to organize and access data efficiently
	C1204L.2	Apply linked list for dynamic data storage and understanding of memory location
	C1204L.3	Implimenting stack algorithms and solved related problems
	C1204L.4	Apply queue based algorithms and apply them appropriately to solve them approriately to solve data management challenges.
	C1204L.5	Implement tree, hash based solutions for specific problemws.
Health and wellness, yoga and sports	**C1215L.1**	Understand the importance of yoga and sports for Physical fitness and sound health.
	C1215L.2	Demonstrate an understanding of health-related fitness components.
	C1215L.3	Compare and contrast various activities that help enhance their health.
	C1215L.4	Assess current personal fitness levels.
	C1215L.5	Develop Positive Personality
MECHANICAL ENGINEERING		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Engineering Physics	**C1108.1**	Apply the knowledge of different optical phenomena in daily life.
	C1108.2	Study the structures and properties of solid state materials and apply this knowledge to estimate the structure of the materials
	C1108.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.

	C1108.4	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
	C1108.5	Estimate concentration of charge carriers in various types of semiconductors.
Linear Algebra and calculus	**C1105.1**	Define the concept of matrix rank and methods used to solve systems of linear equations.
	C1105.2	Describe the Cayley-Hamilton Theorem and the process of reducing quadratic forms to canonical forms through orthogonal transformations.
	C1105.3	Solve problems in calculus using the Mean Value Theorems.
	C1105.4	Solve optimization problems for functions of two variables by utilizing partial differentiation.
	C1105.5	Apply double integrals and triple integrals for the problems related to finding areas and volumes.
Basic Electrical And Electronics Engineering	**C1109.1**	Explain the fundamental laws and concepts to derive the various equations which are related to electrical circuits by applying mathematical tools.
	C1109.2	Demonstrate the working and operating principles of electrical machines, measuring instruments.
	C1109.3	Demonstrate the working of various power generation stations and calculate the electrical load and electricity bill of residential and commercial buildings.
	C1109.4	Illustrates the formation of PN junction Diode and Transistors (BJT)
	C1109.5	Articulate the operation of Rectifiers and Amplifiers
	C1109.6	Understand the concepts of Combinational & Sequential Digital circuits
Engineering Graphics	**C1110.1**	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections
	C1110.2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
	C1110.3	Understand and draw projection of solids in various positions in first quadrant.
	C1110.4	Explain principles behind development of surfaces.
	C1110.5	Prepare isometric and perspective sections of simple solids
Introduction to programming	**C1107.1**	Discuss the Historical Development of Computers and their Basic Organisationincluding the Key Components.
	C1107.2	Apply Conditional Statements and Loops to Solve Programming ProblemsEffectively.
	C1107.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1107.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions.
	C1107.5	Apply Variable Scope with in a program and File Handling Techniques for efficientdata input and output.
Physics Lab	**C1109L. 1**	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C1109L. 2	Analyze various electronic circuits and its components and verify the laws of stretched string.

	C1109L. 3	Apply the knowledge of phenomena like LASER diffraction and resonance in sound waves
Electrical And Electronics Engineering workshop	**C1110L.1**	Examine the Voltage, Current, Power and Resistance in various Electrical Circuits
	C1110L.2	Discover the operating characteristics of DC Shunt Generator
	C1110L.3	Analyze the effect of reactive power and power factor in electrical loads
	C1110L.4	Measure Voltage, Current and Resistance in Diode Circuits
	C1110L.5	Discover the Ripple factors of Rectifier & Characteristics of Transistor Circuits
	C1110L.6	Truth table verification of Digital logic circuits
Computer Programming Lab	**C1106L.1**	Discuss the Historical Development of Computers and their Basic Organisation including the Key Components.
	C1106L.2	Apply Conditional Statements and Loops to Solve Programming Problems Effectively.
	C1106L.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1106L.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions
	C1106L.5	Apply Variable Scope with in a program and File Handling Techniques for efficient data input and output.
Nss/Ncc/Scouts &Guides/Community Service	**C1111L.1**	Understand the importance of discipline, character and service motto.
	C1111L.2	Solve some societal issues by applying acquired knowledge, facts, and techniques
	C1111L.3	Explore human relationships by analyzing social problems
	C1111L.4	Determine to extend their help for the fellow beings and downtrodden people
	C1111L.5	Develop leadership skills and civic responsibilities.
II SEMESTER		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Communicative English	**C1207.1**	Apply the four languages learning skills-Listening, Speaking, Reading and Writing (LSRW) for professional success.
	C1207.2	Employ knowledge of vocabulary in speech and writing.
	C1207.3	Apply effective communication skills in cross cultural context to enhance professional possibilities.
	C1207.4	Develop acceptable personality traits suitable for chosen profession.
Chemistry	**C1209.1**	Understand duel nature of electron and bonding between the atoms through the quantum mechanics.
	C1209.2	Describe Property based applications of semiconductors, super conductors, super capacitors and nano materials in different disciplines of the world.
	C1209.3	Explain the construction and working of batteries, sensors and fuel cells based on the principles of electrochemistry
	C1209.4	Understand the synthetic root and impact of different polymer based materials on environment based on their

		properties.
	C1209.5	Apply the principles of spectroscopy and HPLC in chemical analysis.
Differential Equations and Vector Calculus	**C1202.1**	Understand linear differential equations of first order, including Bernoulli's, exact, and equations reducible to exact forms.
	C1202.2	Solve higher-order linear differential equations related to various engineering fields.
	C1202.3	Solve partial differential equations that model physical processes.
	C1202.4	Interpret the physical implications of vector operators like gradient, curl, and divergence.
	C1202.5	Apply Green's, Stoke's, and the Divergence theorem to address problems related to the estimation of work done against a field, circulation, and flux.
Basic Civil and Mechanical Engineering	**C1211.1**	Describe the various disciplines of civil Engineering and to appreciate their role in societal development.
	C1211.2	Outline the concepts of surveying and obtaining the theoretical measurement of distances, angles and levels through surveying equipment
	C1211.3	Illustrate the fundamental principles involved in transportation network system and the quality parameters of various water resources
	C1211.4	An ability to know about role of mechanical engineer in industry and society and what are the types & properties and applications of engineering materials & know about smart materials
	C1211.5	Describe what are the fundamentals of manufacturing and types advantages disadvantages also applications and fundamentals of thermal engineering i.e., engine basic principles and its working, and also fundamentals refrigeration and air conditioning
	C1211.6	Illustrate the different types of power plants also its working and mechanical power transmission systems types of robotics and its working configurations
Engineering Mechanics	**C1212.1**	Understand the fundamental concepts in mechanics and determine the frictional force for bodies in contact.
	C1212.2	Analyze different force systems such as concurrent, coplanar and spatial systems and calculate their resultant forces and moments.
	C1212.3	Calculate the centroids, center of gravity and moment of inertia of different geometrical shapes.
	C1212.4	Apply the principles of work-energy and impulse-momentum to solve the problems of rectilinear and curvilinear motion of a particle.
	C1212.5	Solve the problems involving the translational and rotational motion of rigid bodies.
Communicative English lab	**C1207L.1**	Build confidence and overcome inhibitions while speaking in English.
	C1207L.2	Demonstrate acquired language skills in performing the designated activity.
	C1207L.3	Evaluate and exhibit professionalism in participating in debates and group discussions.
	C1207L.4	Recognize the sounds of English with the help of audio visual aids
Chemistry lab	**C1208L.1**	Select different analytical instruments such as Conductivity meter Potentiometer and Spectrophotometer during

		the chemical analysis
	C1208L.2	Demonstrate Preparation of advanced polymeric materials and nano materials
	C1208L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample
	C1208L.4	Analyze IR spectrum of some organic compounds
Engineering workshop	**C1211L.1**	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
	C1211L.2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
	C1211L.3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
	C1211L.4	Analyze various characteristics of electrical circuits, electrical machines and measuring instruments.
	C1211L.5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
Engineering Mechanics lab	**C1213L.1**	Evaluate the coefficient of friction between two different surfaces and between inclined plane and the roller.
	C1213L.2	Verify Law of polygon of forces and law of moment using force polygon and bell crank lever.
	C1213L.3	Determine the centre of gravity and moment of inertia of different configurations.
	C1213L.4	Verify the equilibrium conditions of a rigid body under the action of different force systems.
Health and wellness, yoga and sports	**C1215L.1**	Understand the importance of yoga and sports for Physical fitness and sound health.
	C1215L.2	Demonstrate an understanding of health-related fitness components.
	C1215L.3	Compare and contrast various activities that help enhance their health.
	C1215L.4	Assess current personal fitness levels.
	C1215L.5	Develop Positive Personality
COMPUTER SCIENCE ENGINEERING		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Communicative English	**C1101.1**	Apply the four language learning skills-Listening, Speaking, Reading and Writing (LSRW) for professional success.
	C1101.2	Employ knowledge of vocabulary in speech and writing
	C1101.3	Apply effective communication skills in cross cultural context to enhance professional possibilities.
	C1101.4	Develop acceptable personality traits suitable for chosen profession.
Chemistry	**C1103.1**	Understand duel nature of electron and bonding between the atoms through the quantum mechanics.
	C1103.2	Describe Property based applications of semiconductors, super conductors, super capacitors and nano materials

		in different disciplines of the world.
	C1103.3	Explain the construction and working of batteries, sensors and fuel cells based on the principles of electrochemistry
	C1103.4	Understand the synthetic root and impact of different polymer based materials on environment based on their properties .
	C1103.5	Apply the principles of spectroscopy and HPLC in chemical analysis.
Linear Algebra and calculus	**C1105.1**	Define the concept of matrix rank and methods used to solve systems of linear equations.
	C1105.2	Describe the Cayley-Hamilton Theorem and the process of reducing quadratic forms to canonical forms through orthogonal transformations.
	C1105.3	Solve problems in calculus using the Mean Value Theorems.
	C1105.4	Solve optimization problems for functions of two variables by utilizing partial differentiation.
	C1105.5	Apply double integrals and triple integrals for the problems related to finding areas and volumes.
Basic Civil and Mechanical Engineering	**C1106.1**	Describe the various disciplines of civil Engineering and to appreciate their role in societal development.
	C1106.2	Outline the concepts of surveying and obtaining the theoretical measurement of distances,angles and levels through surveying equipment
	C1106.3	Illustrate the fundamental principles involved in transportation network system and the quality parametersof various water resources
	C1106.4	An ability to know about role of mechanical engineer in industry and society and what are the types & properties and applications of engineering materials & know about smart materials
	C1106.5	Describe what are the fundamentals of manufacturing and types advantages disadvantages also applications and fundamentals of thermal engineering i.c engine basic principles and its working, and also fundamentals refrigeration and air conditioning
	C1106.6	Illustrate the different types of power plants also its working and mechanical power transmission systems types of robotics and its working configurations
Introduction to programming	**C1107.1**	Discuss the Historical Development of Computers and their Basic Organisationincluding the Key Components.
		Apply Conditional Statements and Loops to Solve Programming ProblemsEffectively.
	C1107.2	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1107.3	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions
	C1107.4	Recognize the sounds of English with the help of audio visual aids
Communicative English lab	**C1101L.1**	Build confidence and overcome inhibitions while speaking in English.
	C1101L.2	Demonstrate acquired language skills in performing the designated activity.
	C1101L.3	Evaluate and exhibit professionalism in participating in debates and group discussions.
	C1101L.4	Recognize the sounds of English with the help of audio visual aids

Chemistry lab	**C1103L.1**	Select different analytical instruments such as Conductivity meter Potentiometer and Spectrophotometer during the chemical analysis
	C1103L.2	Demonstrate Preparation of advanced polymeric materials and nano materials
	C1103L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample
	C1103L.4	Analyse IR spectrum of some organic compounds
Engineering workshop	**C1105L.1**	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
	C1105L.2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
	C1105L.3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
	C1105L.4	Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
	C1105L.5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
Computer Programming Lab	**C1106L.1**	Discuss the Historical Development of Computers and their Basic Organisation including the Key Components.
	C1106L.2	Apply Conditional Statements and Loops to Solve Programming Problems Effectively.
	C1106L.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1106L.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions
	C1106L.5	Apply Variable Scope with in a program and File Handling Techniques for efficient data input and output.
Health and wellness, yoga and sports	**C1107L.1**	Understand the importance of yoga and sports for Physical fitness and sound health.
	C1107L.2	Demonstrate an understanding of health-related fitness components.
	C1107L.3	Compare and contrast various activities that help enhance their health.
	C1107L.4	Assess current personal fitness levels.
	C1107L.5	Develop Positive Personality
II SEMESTER		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Engineering Physics	**C1208.1**	Apply the knowledge of different optical phenomena in daily life.
	C1208.2	Study the structures and properties of solid state materials and apply this knowledge to estimate the structure of the materials
	C1208.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1208.4	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals

		according to various theories
	C1208.5	Estimate concentration of charge carriers in various types of semiconductors.
Differential Equations and Vector Calculus	**C1202.1**	Understand linear differential equations of first order, including Bernoulli's, exact, and equations reducible to exact forms.
	C1202.2	Solve higher-order linear differential equations related to various engineering fields.
	C1202.3	Solve partial differential equations that model physical processes.
	C1202.4	Interpret the physical implications of vector operators like gradient, curl, and divergence.
	C1202.5	Apply Green's, Stoke's, and the Divergence theorem to address problems related to the estimation of work done against a field, circulation, and flux.
Basic Electrical And Electronics Engineering	**C1209.1**	Explain the fundamental laws and concepts to derive the various equations which are related to electrical circuits by applying mathematical tools.
	C1209.2	Demonstrate the working and operating principles of electrical machines, measuring instruments.
	C1209.3	Demonstrate the working of various power generation stations and calculate the electrical load and electricity bill of residential and commercial buildings.
	C1209.4	Illustrates the formation of PN junction Diode and Transistors (BJT)
	C1209.5	Articulate the operation of Rectifiers and Amplifiers
	C1209.6	Understand the concepts of Combinational & Sequential Digital circuits
Engineering Graphics	**C1210.1**	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections
	C1210.2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
	C1210.3	Understand and draw projection of solids in various positions in first quadrant.
	C1210.4	Explain principles behind development of surfaces.
	C1210.5	Prepare isometric and perspective sections of simple solids
Data Structures	**C1205.1**	Analyze and implement searching and sorting techniques
	C1205.2	Implement algorithms for linked lists, demonstrating , understanding of memory location .
	C1205.3	Apply algorithm for stacks , manage program states and solve related problem
	C1205.4	Apply algorithm for queues and solve data management challenges
	C1205.5	Develop data structures to make use of Trees and hashing for efficient storage of data
Engineering Physics Lab	**C1209L. 1**	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C1209L. 2	Analyze various electronic circuits and its components and verify the laws of stretched string.
	C1209L. 3	Apply the knowledge of phenomena like LASER diffraction and resonance in sound waves

Electrical And Electronics Engineering workshop	**C1210L.1**	Examine the Voltage, Current, Power and Resistance in various Electrical Circuits
	C1210L.2	Discover the operating characteristics of DC Shunt Generator
	C1210L.3	Analyze the effect of reactive power and power factor in electrical loads
	C1210L.4	Measure Voltage, Current and Resistance in Diode Circuits (L4)
	C1210L.5	Discover the Ripple factors of Rectifier & Characteristics of Transistor Circuits (L4)
	C1210L.6	Truth table verification of Digital logic circuits (L4)
DS LAB	**C1204L.1**	Implement linear data structures in order to organize and access data efficiently
	C1204L.2	Apply linked list for dynamic data storage and understanding of memory location
	C1204L.3	Implementing stack algorithms and solved related problems
	C1204L.4	Apply queue based algorithms and apply them appropriately to solve them appropriately to solve data management challenges.
	C1204L.5	Implement tree, hash based solutions for specific problems.
Nss/Ncc/Scouts &Guides/Community Service	**C1211L.1**	Understand the importance of discipline, character and service motto.
	C1211L.2	Solve some societal issues by applying acquired knowledge, facts, and techniques
	C1211L.3	Explore human relationships by analyzing social problems
	C1211L.4	Determine to extend their help for the fellow beings and downtrodden people
	C1211L.5	Develop leadership skills and civic responsibilities.
ELECTRICAL AND ELECTRONIC ENGINEERING		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Communicative English	**C1101.1**	Apply the four language learning skills-Listening, Speaking, Reading and Writing (LSRW) for professional success.
	C1101.2	Employ knowledge of vocabulary in speech and writing
	C1101.3	Apply effective communication skills in cross cultural context to enhance professional possibilities.
	C1101.4	Develop acceptable personality traits suitable for chosen profession.
Chemistry	**C1103.1**	Understand duel nature of electron and bonding between the atoms through the quantum mechanics.
	C1103.2	Describe Property based applications of semiconductors, super conductors, super capacitors and nano materials in different disciplines of the world.
	C1103.3	Explain the construction and working of batteries, sensors and fuel cells based on the principles of electrochemistry
	C1103.4	Understand the synthetic root and impact of different polymer based materials on environment based on their properties .
	C1103.5	Apply the principles of spectroscopy and HPLC in chemical analysis.
Linear Algebra and calculus	**C1105.1**	Define the concept of matrix rank and methods used to solve systems of linear equations.

	C1105.2	Describe the Cayley-Hamilton Theorem and the process of reducing quadratic forms to canonical forms through orthogonal transformations.
	C1105.3	Solve problems in calculus using the Mean Value Theorems.
	C1105.4	Solve optimization problems for functions of two variables by utilizing partial differentiation.
	C1105.5	Apply double integrals and triple integrals for the problems related to finding areas and volumes.
Basic Civil and Mechanical Engineering	**C1106.1**	Describe the various disciplines of civil Engineering and to appreciate their role in societal development.
	C1106.2	Outline the concepts of surveying and obtaining the theoretical measurement of distances,angles and levels through surveying equipment
	C1106.3	Illustrate the fundamental principles involved in transportation network system and the quality parametersof various water resources
	C1106.4	An ability to know about role of mechanical engineer in industry and society and what are the types & properties and applications of engineering materials & know about smart materials
	C1106.5	Describe what are the fundamentals of manufacturing and types advantages disadvantages also applications and fundamentals of thermal engineering i.c engine basic principles and its working, and also fundamentals refrigeration and air conditioning
	C1106.6	Illustrate the different types of power plants also its working and mechanical power transmission systems types of robotics and its working configurations
Introduction to programming	**C1107.1**	Discuss the Historical Development of Computers and their Basic Organisationincluding the Key Components.
		Apply Conditional Statements and Loops to Solve Programming ProblemsEffectively.
	C1107.2	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1107.3	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions
	C1107.4	Recognize the sounds of English with the help of audio visual aids
Communicative English lab	**C1101L.1**	Build confidence and overcome inhibitions while speaking in English.
	C1101L.2	Demonstrate acquired language skills in performing the designated activity.
	C1101L.3	Evaluate and exhibit professionalism in participating in debates and group discussions.
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Chemistry lab	**C1103L.1**	Select different analytical instruments such as Conductivity meter Potentiometer and Spectrophotometer during the chemical analysis
	C1103L.2	Demonstrate Preparation of advanced polymeric materials and nano materials
	C1103L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample
	C1103L.4	Analyse IR spectrum of some organic compounds
Engineering workshop	**C1105L.1**	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.

	C1105L.2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
	C1105L.3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
	C1105L.4	Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
	C1105L.5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
Computer Programming Lab	**C1106L.1**	Discuss the Historical Development of Computers and their Basic Organisation including the Key Components.
	C1106L.2	Apply Conditional Statements and Loops to Solve Programming Problems Effectively.
	C1106L.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1106L.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions
	C1106L.5	Apply Variable Scope with in a program and File Handling Techniques for efficient data input and output.
Health and wellness, yoga and sports	**C1107L.1**	Understand the importance of yoga and sports for Physical fitness and sound health.
	C1107L.2	Demonstrate an understanding of health-related fitness components.
	C1107L.3	Compare and contrast various activities that help enhance their health.
	C1107L.4	Assess current personal fitness levels.
	C1107L.5	Develop Positive Personality
II SEMISTER		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Engineering Physics	**C1208.1**	Apply the knowledge of different optical phenomena in daily life.
	C1208.2	Study the structures and properties of solid state materials and apply this knowledge to estimate the structure of the materials
	C1208.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1208.4	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
	C1208.5	Estimate concentration of charge carriers in various types of semiconductors.
Differential Equations and Vector Calculus	**C1202.1**	Understand linear differential equations of first order, including Bernoulli's, exact, and equations reducible to exact forms.
	C1202.2	Solve higher-order linear differential equations related to various engineering fields.
	C1202.3	Solve partial differential equations that model physical processes.
	C1202.4	Interpret the physical implications of vector operators like gradient, curl, and divergence.

	C1202.5	Apply Green's, Stoke's, and the Divergence theorem to address problems related to the estimation of work done against a field, circulation, and flux.
Basic Electrical And Electronics Engineering	**C1209.1**	Explain the fundamental laws and concepts to derive the various equations which are related to electrical circuits by applying mathematical tools.
	C1209.2	Demonstrate the working and operating principles of electrical machines, measuring instruments.
	C1209.3	Demonstrate the working of various power generation stations and calculate the electrical load and electricity bill of residential and commercial buildings.
	C1209.4	Illustrates the formation of PN junction Diode and Transistors (BJT)
	C1209.5	Articulate the operation of Rectifiers and Amplifiers
	C1209.6	Understand the concepts of Combinational & Sequential Digital circuits
Engineering Graphics	**C1210.1**	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections
	C1210.2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
	C1210.3	Understand and draw projection of solids in various positions in first quadrant.
	C1210.4	Explain principles behind development of surfaces.
	C1210.5	Prepare isometric and perspective sections of simple solids
Data Structures	**C1205.1**	Analyze and implement searching and sorting techniques
	C1205.2	Implement algorithms for linked lists, demonstrating , understanding of memory location .
	C1205.3	Apply algorithm for stacks , manage program states and solve related problem
	C1205.4	Apply algorithm for queues and solve data management challenges
	C1205.5	Develop data structures to make use of Trees and hashing for efficient storage of data
Engineering Physics Lab	**C1209L. 1**	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C1209L. 2	Analyze various electronic circuits and its components and verify the laws of stretched string.
	C1209L. 3	Apply the knowledge of phenomena like LASER diffraction and resonance in sound waves
Electrical And Electronics Engineering workshop	**C1210L.1**	Examine the Voltage, Current, Power and Resistance in various Electrical Circuits
	C1210L.2	Discover the operating characteristics of DC Shunt Generator
	C1210L.3	Analyze the effect of reactive power and power factor in electrical loads
	C1210L.4	Measure Voltage, Current and Resistance in Diode Circuits (L4)
	C1210L.5	Discover the Ripple factors of Rectifier & Characteristics of Transistor Circuits (L4)
	C1210L.6	Truth table verification of Digital logic circuits (L4)

DS LAB	**C1204L.1**	Implement linear data structures in order to organize and access data efficiently
	C1204L.2	Apply linked list for dynamic data storage and understanding of memory location
	C1204L.3	Implementing stack algorithms and solved related problems
	C1204L.4	Apply queue based algorithms and apply them appropriately to solve them appropriately to solve data management challenges.
	C1204L.5	Implement tree, hash based solutions for specific problems.
Nss/Ncc/Scouts &Guides/Community Service	**C1211L.1**	Understand the importance of discipline, character and service motto.
	C1211L.2	Solve some societal issues by applying acquired knowledge, facts, and techniques
	C1211L.3	Explore human relationships by analyzing social problems
	C1211L.4	Determine to extend their help for the fellow beings and downtrodden people
	C1211L.5	Develop leadership skills and civic responsibilities.
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Engineering Physics	**C1108.1**	Apply the knowledge of different optical phenomena in daily life.
	C1108.2	Study the structures and properties of solid state materials and apply this knowledge to estimate the structure of the materials
	C1108.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1108.4	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
	C1108.5	Estimate concentration of charge carriers in various types of semiconductors.
Linear Algebra and calculus	**C1105.1**	Define the concept of matrix rank and methods used to solve systems of linear equations.
	C1105.2	Describe the Cayley-Hamilton Theorem and the process of reducing quadratic forms to canonical forms through orthogonal transformations.
	C1105.3	Solve problems in calculus using the Mean Value Theorems.
	C1105.4	Solve optimization problems for functions of two variables by utilizing partial differentiation.
	C1105.5	Apply double integrals and triple integrals for the problems related to finding areas and volumes.
Basic Electrical And Electronics Engineering	**C1109.1**	Explain the fundamental laws and concepts to derive the various equations which are related to electrical circuits by applying mathematical tools.
	C1109.2	Demonstrate the working and operating principles of electrical machines, measuring instruments.
	C1109.3	Demonstrate the working of various power generation stations and calculate the electrical load and electricity bill of residential and commercial buildings.
	C1109.4	Illustrates the formation of PN junction Diode and Transistors (BJT)
	C1109.5	Articulate the operation of Rectifiers and Amplifiers

	C1109.6	Understand the concepts of Combinational & Sequential Digital circuits
Engineering Graphics	**C1110.1**	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections
	C1110.2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
	C1110.3	Understand and draw projection of solids in various positions in first quadrant.
	C1110.4	Explain principles behind development of surfaces.
	C1110.5	Prepare isometric and perspective sections of simple solids
Introduction to programming	**C1107.1**	Discuss the Historical Development of Computers and their Basic Organization including the Key Components.
	C1107.2	Apply Conditional Statements and Loops to Solve Programming ProblemsEffectively.
	C1107.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1107.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions.
	C1107.5	Apply Variable Scope with in a program and File Handling Techniques for efficientdata input and output.
Physics Lab	**C1109L. 1**	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
	C1109L. 2	Analyze various electronic circuits and its components and verify the laws of stretched string.
	C1109L. 3	Apply the knowledge of phenomena like LASER diffraction and resonance in sound waves
Electrical And Electronics Engineering workshop	**C1110L.1**	Examine the Voltage, Current, Power and Resistance in various Electrical Circuits
	C1110L.2	Discover the operating characteristics of DC Shunt Generator
	C1110L.3	Analyze the effect of reactive power and power factor in electrical loads
	C1110L.4	Measure Voltage, Current and Resistance in Diode Circuits (L4)
	C1110L.5	Discover the Ripple factors of Rectifier & Characteristics of Transistor Circuits (L4)
	C1110LS.6	Truth table verification of Digital logic circuits (L4)
Computer Programming Lab	**C1106L.1**	Discuss the Historical Development of Computers and their Basic Organisation including the Key Components.
	C1106L.2	Apply Conditional Statements and Loops to Solve Programming Problems Effectively.
	C1106L.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1106L.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions
	C1106L.5	Apply Variable Scope with in a program and File Handling Techniques for efficient data input and output.

Nss/Ncc/Scouts &Guides/Community Service	**C1111L.1**	Understand the importance of discipline, character and service motto.
	C1111L.2	Solve some societal issues by applying acquired knowledge, facts, and techniques
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	C1111L5	Develop leadership skills and civic responsibilities
II SEMESTER		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Communicative English	**C1207.1**	Apply the four language learning skills-Listening, Speaking, Reading and Writing (LSRW) for professional success.
	C1207.2	Employ knowledge of vocabulary in speech and writing
	C1207.3	Apply effective communication skills in cross cultural context to enhance professional possibilities.
	C1207.4	Develop acceptable personality traits suitable for chosen profession.
Chemistry	**C1209.1**	Understand duel nature of electron and bonding between the atoms through the quantum mechanics.
	C1209.2	Describe Property based applications of semiconductors, super conductors, super capacitors and nano materials in different disciplines of the world.
	C1209.3	Explain the construction and working of batteries, sensors and fuel cells based on the principles of electrochemistry
	C1209.4	Understand the synthetic root and impact of different polymer based materials on environment based on their properties .
	C1209.5	Apply the principles of spectroscopy and HPLC in chemical analysis.
Differential Equations and Vector Calculus	**C1202.1**	Understand linear differential equations of first order, including Bernoulli's, exact, and equations reducible to exact forms.
	C1202.2	Solve higher-order linear differential equations related to various engineering fields.
	C1202.3	Solve partial differential equations that model physical processes.
	C1202.4	Interpret the physical implications of vector operators like gradient, curl, and divergence.
	C1202.5	Apply Green's, Stoke's, and the Divergence theorem to address problems related to the estimation of work done against a field, circulation, and flux.
Basic Civil and Mechanical Engineering	**C1211.1**	Describe the various disciplines of civil Engineering and to appreciate their role in societal development.
	C1211.2	Outline the concepts of surveying and obtaining the theoretical measurement of distances,angles and levels through surveying equipment
	C1211.3	Illustrate the fundamental principles involved in transportation network system and the quality parametersof various water resources
	C1211.4	An ability to know about role of mechanical engineer in industry and society and what are the types & properties and applications of engineering materials & know about smart materials
	C1211.5	Describe what are the fundamentals of manufacturing and types advantages disadvantages also applications

		and fundamentals of thermal engineering i.c engine basic principles and its working, and also fundamentals refrigeration and air conditioning
	C1211.6	Illustrate the different types of power plants also its working and mechanical power transmission systems types of robotics and its working configurations
Data Structures	**C1205.1**	Analyze and implement searching and sorting techniques
	C1205.2	Implement algorithms for linked lists, demonstrating , understanding of memory location .
	C1205.3	Apply algorithm for stacks , manage program states and solve related problem
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	C1205.5	Develop data structures to make use of Trees and hashing for efficient storage of data
Communicative English lab	**C1207L.1**	Build confidence and overcome inhibitions while speaking in English.
	C1207L.2	Demonstrate acquired language skills in performing the designated activity.
	C1207L.3	Evaluate and exhibit professionalism in participating in debates and group discussions.
	C1207L.4	Recognize the sounds of English with the help of audio visual aids
Chemistry lab	**C1209L.1**	Select different analytical instruments such as Conductivity meter Potentiometer and Spectrophotometer during the chemical analysis
	C1209L.2	Demonstrate Preparation of advanced polymeric materials and nano materials.
	C1209L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample.
	C1209L.4	Analyze IR spectrum of some organic compounds.
Engineering workshop	**C1211L.1**	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
	C1211L.2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
	C1211L.3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
	C1211L.4	Analyze various characteristics of electrical circuits, electrical machines and measuring instruments.
	C1211L.5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
DS LAB	**C1204L.1**	Implement linear data structures inorder to organize and access data efficiently
	C1204L.2	Apply linked list for dynamic data storage and understanding of memory location
	C1204L.3	Implimenting stack algorithms and solved related problems
	C1204L.4	Apply queue based algorithms and apply them appropriately to solve them approriately to solve data management challenges.
	C1204L.5	Implement tree, hash based solutions for specific problemws.
Health and wellness, yoga and	**C1215L.1**	Understand the importance of yoga and sports for Physical fitness and sound health.

sports		
	C1215L.2	Demonstrate an understanding of health-related fitness components.
	C1215L.3	Compare and contrast various activities that help enhance their health.
	C1215L.4	Assess current personal fitness levels.
	C1215L.5	Develop Positive Personality
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Engineering Physics	**C1108.1**	Apply the knowledge of different optical phenomena in daily life.
	C1108.2	Study the structures and properties of solid state materials and apply this knowledge to estimate the structure of the materials
	C1108.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1108.4	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
	C1108.5	Estimate concentration of charge carriers in various types of semiconductors.
Linear Algebra and calculus	**C1105.1**	Define the concept of matrix rank and methods used to solve systems of linear equations.
	C1105.2	Describe the Cayley-Hamilton Theorem and the process of reducing quadratic forms to canonical forms through orthogonal transformations.
	C1105.3	Solve problems in calculus using the Mean Value Theorems.
	C1105.4	Solve optimization problems for functions of two variables by utilizing partial differentiation.
	C1105.5	Apply double integrals and triple integrals for the problems related to finding areas and volumes.
Basic Electrical And Electronics Engineering	**C1109.1**	Explain the fundamental laws and concepts to derive the various equations which are related to electrical circuits by applying mathematical tools.
	C1109.2	Demonstrate the working and operating principles of electrical machines, measuring instruments.
	C1109.3	Demonstrate the working of various power generation stations and calculate the electrical load and electricity bill of residential and commercial buildings.
	C1109.4	Illustrates the formation of PN junction Diode and Transistors (BJT)
	C1109.5	Articulate the operation of Rectifiers and Amplifiers
	C1109.6	Understand the concepts of Combinational & Sequential Digital circuits
Engineering Graphics	**C1110.1**	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections
	C1110.2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
	C1110.3	Understand and draw projection of solids in various positions in first quadrant.
	C1110.4	Explain principles behind development of surfaces.
	C1110.5	Prepare isometric and perspective sections of simple solids

Introduction to programming	**C1107.1**	Discuss the Historical Development of Computers and their Basic Organization including the Key Components.
	C1107.2	Apply Conditional Statements and Loops to Solve Programming ProblemsEffectively.
	C1107.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1107.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions.
	C1107.5	Apply Variable Scope with in a program and File Handling Techniques for efficientdata input and output.
Physics Lab	**C1109L. 1**	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
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Electrical And Electronics Engineering workshop	**C1110L.1**	Examine the Voltage, Current, Power and Resistance in various Electrical Circuits
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	C1110L.3	Analyze the effect of reactive power and power factor in electrical loads
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Computer Programming Lab	**C1106L.1**	Discuss the Historical Development of Computers and their Basic Organisation including the Key Components.
	C1106L.2	Apply Conditional Statements and Loops to Solve Programming Problems Effectively.
	C1106L.3	Illustrate the use of Arrays in Programming and their indexing and manipulation.
	C1106L.4	Apply Pointers and their role in Programming, differentiating user-defined data types such as Structures and Unions
	C1106L.5	Apply Variable Scope with in a program and File Handling Techniques for efficient data input and output.
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	C1111L.4	Determine to extend their help for the fellow beings and downtrodden people
	C1111L5	Develop leadership skills and civic responsibilities
II SEMESTER		

COURSE	C.O CODE	COURSE OUTCOME DESCRIPTION
Communicative English	**C1207.1**	Apply the four language learning skills-Listening, Speaking, Reading and Writing (LSRW) for professional success.
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	C1209.3	Explain the construction and working of batteries, sensors and fuel cells based on the principles of electrochemistry
	C1209.4	Understand the synthetic root and impact of different polymer based materials on environment based on their properties .
	C1209.5	Apply the principles of spectroscopy and HPLC in chemical analysis.
Differential Equations and Vector Calculus	**C1202.1**	Understand linear differential equations of first order, including Bernoulli's, exact, and equations reducible to exact forms.
	C1202.2	Solve higher-order linear differential equations related to various engineering fields.
	C1202.3	Solve partial differential equations that model physical processes.
	C1202.4	Interpret the physical implications of vector operators like gradient, curl, and divergence.
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	C1211.3	Illustrate the fundamental principles involved in transportation network system and the quality parametersof various water resources
	C1211.4	An ability to know about role of mechanical engineer in industry and society and what are the types & properties and applications of engineering materials & know about smart materials
	C1211.5	Describe what are the fundamentals of manufacturing and types advantages disadvantages also applications and fundamentals of thermal engineering i.c engine basic principles and its working, and also fundamentals refrigeration and air conditioning
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	C1209L.2	Demonstrate Preparation of advanced polymeric materials and nano materials.
	C1209L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample.
	C1209L.4	Analyze IR spectrum of some organic compounds.
Engineering workshop	**C1211L.1**	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
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	C1211L.5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
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	C1215L.2	Demonstrate an understanding of health-related fitness components.
	C1215L.3	Compare and contrast various activities that help enhance their health.
	C1215L.4	Assess current personal fitness levels.
	C1215L.5	Develop Positive Personality
CYBER SECURITY ENGINEERING		

COURSE	C.O CODE	COURSE OUTCOME DESCRIPTION
Engineering Physics	**C1108.1**	Apply the knowledge of different optical phenomena in daily life.
	C1108.2	Study the structures and properties of solid state materials and apply this knowledge to estimate the structure of the materials
	C1108.3	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
	C1108.4	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
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	C1105.5	Apply double integrals and triple integrals for the problems related to finding areas and volumes.
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	C1109.3	Demonstrate the working of various power generation stations and calculate the electrical load and electricity bill of residential and commercial buildings.
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II SEMESTER		
COURSE	**C.O CODE**	**COURSE OUTCOME DESCRIPTION**
Communicative English	**C1207.1**	Apply the four language learning skills-Listening, Speaking, Reading and Writing (LSRW) for professional success.
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Communicative English lab	**C1207L.1**	Build confidence and overcome inhibitions while speaking in English.
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	C1207L.3	Evaluate and exhibit professionalism in participating in debates and group discussions.
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Chemistry lab	**C1209L.1**	Select different analytical instruments such as Conductivity meter Potentiometer and Spectrophotometer during the chemical analysis
	C1209L.2	Demonstrate Preparation of advanced polymeric materials and nano materials.
	C1209L.3	Estimate the strength of an acidic and reducing chemicals present in the given sample.
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DS LAB	**C1204L.1**	Implement linear data structures inorder to organize and access data efficiently
	C1204L.2	Apply linked list for dynamic data storage and understanding of memory location
	C1204L.3	Implimenting stack algorithms and solved related problems
	C1204L.4	Apply queue based algorithms and apply them appropriately to solve them approriately to solve data management challenges.
	C1204L.5	Implement tree, hash based solutions for specific problemws.
Health and wellness, yoga and sports	**C1215L.1**	Understand the importance of yoga and sports for Physical fitness and sound health.
	C1215L.2	Demonstrate an understanding of health-related fitness components.
	C1215L.3	Compare and contrast various activities that help enhance their health.
	C1215L.4	Assess current personal fitness levels.
	C1215L.5	Develop Positive Personality