R G M COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
NANDYAL-518501, KURNOOL DIST., A.P., INDIA

DEPARTMENT OF
MECHANICAL ENGINEERING (ME)

(ESTD-1995)

I B.TECH SYLLABUS 2020

Applicable for students admitted into
B.Tech (Regular) from 2020-2021
B.Tech (Lateral Entry Scheme) from 2021-22
REGULATIONS, Course Structure & Detailed Syllabus

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABI

B.Tech. (Regular) from 2020-21 and B.Tech. (Lateral Entry Scheme) from 2021-22

For pursuing four year Bachelor Degree Program (under graduate) of study in Engineering (B.Tech.), Two year Master (post graduate) Degree of study in Engineering (M.Tech.), Two year Master (post graduate) degree of study in Business Administration (MBA), Two-year Master (post graduate) Degree of study in Computer Applications (MCA) offered by Rajeev Gandhi Memorial College of Engineering and Technology, Nandyal -518501 under Autonomous status and herein referred to as RGMCET (Autonomous).

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2020-21 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for Rajeev Gandhi Memorial College of Engineering and Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation. As and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Rajeev Gandhi Memorial College of Engineering and Technology shall be the Chairman, Academic Council.

The candidate seeking admission into the first year of study of four year B.Tech degree Program should have:

i) Passed either Intermediate Public Examination (IPE) conducted by the Board of Intermediate Education, Andhra Pradesh with Mathematics, Physics and Chemistry as optional subjects (or any equivalent examination certified by Board of Intermediate Education) or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Andhra Pradesh (or any equivalent examination certified by State Board of Technical Education) for admission.

ii) Secured a rank in the EAMCET examination conducted by AP State Council for Higher Education (APSCHE) for allotment of a seat by the Convener, EAMCET, for admission.

Admission Procedure:

As per the norms of A.P. State Council of Higher Education (APSCHE), Government of Andhra Pradesh, admissions are made to the first year of Four year B.Tech. Degree program as follows:-

a) As per the norms of Government of Andhra Pradesh, A-Category (based on the rank obtained in EAMCET) seats will be filled by the Convener, EAMCET.

b) As per the norms of Government of Andhra Pradesh, B-Category seats will be filled by the management.

Admission to the Second year of Four year B.Tech. Degree Program in Engineering:

i) Candidates qualified in ECET and admitted by the Convener, ECET, in such cases for admission, when needed permission from the statutory bodies is to be obtained.

ii) 10% of the sanctioned strength in each program of study (of RGMCET) shall be filled by the Convener, ECET as lateral entry.

List of Programs offered

1. B.Tech – Regular & Lateral Entry
2. M.Tech – Regular
3. MBA – Regular
4. MCA – Regular

Academic Regulations for 2020-21 B. Tech. (Regular)

(Effective for the students admitted into the I year from the Academic Year 2020-2021)

The B.Tech. Degree be conferred by the Jawaharlal Nehru Technological University Anantapur, Anantapuramu, students who are admitted to the program and fulfill all the requirements for the award of the Degree as specified below:

1.0 Award of B.Tech. Degree

1.1 The student will be declared eligible for the award of the B. Tech. degree if he fulfils the following academic regulations:

1.2 Pursued a course of study for not less than prescribed course work duration and not more than double the prescribed course work duration.

1.3 Registered for 160 credits and secured 160credits with compulsory subjects as listed in Table-1.

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Table 1: Compulsory Subjects

S.No	SUBJECT PARTICULARS		
1	All the subjects offered in B.Tech course / MOOCs	7	Seminar
2	Mandatory Learning Courses [Environmental Science, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	8	2 months Internships-Two
3	All practical subjects	9	6 Month internship
4	All Skill Development Courses/ value added courses	10	Main Project Work
5	Comprehensive Viva-Voce	11	Universal Human values as credit Couse
6	Environmental Sciences, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses.		

2.0 Forfeit of seat

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.

3.0 Courses of study

The following courses of study are offered at present as specializations for the B.Tech. Course: and any other course as approved by the authorities of the University from time to time.

1) Civil Engineering
2) Computer Science and Engineering
3) Computer Science and Engineering (Data Science)
4) Computer Science and Engineering and Business Systems
5) Electrical and Electronics Engineering
6) Electronics and Communication Engineering
7) Mechanical Engineering

Table 2: Credits

Subject		Code	Semester			
			Periods/ Week	Credits	Internal Marks(IM)	External Marks(EM)
Theory			2+1*	03	30	70
Mandatory Learning Courses.(Internal Evaluation)			02	00	30	70
Mini project/Practical			03	1.5	25	50
Drawing			1+4P	03	30	70
Skill Development Courses/Value Added Course (Internal Evaluation)			1+2*	02**	30	70
Summer Internship 2 months (Mandatory) after second year(to be evaluated during V Semester)			00	1.5	00	Certificate from Internship Agency
Industrial/Research Internship 2 months(Mandatory) after third year(to be evaluated during VII Semester)			00	1.5	00	Certificate from Internship Agency
Comprehensive Viva (CV) in VII Semester			-	1.5	00	50
Major Project	(Project work, Seminar)	Project	-	06	50	100
6 Months Internship	Internship in Industry	-	-	06	00	Certificate from Internship Agency/Industry

*Tutorial

** [Skill Development / value Added Courses/ Mandatory Learning Courses credits will not be considered for the award of division. However, all these courses have to be cleared through internal evaluation by scoring minimum of 40% marks. The credits obtained in Skill development courses will be taken in to account for the award of degree.]

Note: -EAA will not carry any credits but attendance requirements of 75% should be fulfilled otherwise they have to reregister to fulfill academic requirements.

4.0 Distribution and Weightage of Marks

4.1 The performance of the student in each semester shall be evaluated subject - wise with a maximum of 100 marks for theory and 75 marks for practical subject. In addition, mini-project, Comprehensive Viva-Voce (CV) shall be evaluated for 50 marks each and the project work shall be evaluated for 100 marks.

4.2 For theory subjects, the distribution shall be 30 marks for Internal Evaluation (20 marks for internal test and 10 marks for assignment or field work/group task/online test) and 70 marks for the End-Examination.

4.3 During the semester there shall be 2 tests for theory subjects. In each Internal test there shall be one compulsory (short answers) question and 3 descriptive questions are to be answered. The duration of internal test will be for 2hours. First test to be conducted in 3 units and second test to be conducted in the remaining 3 units of each subject. For awarding of 20 Internal marks the performance of the student in two Internal examinations conducted one in the middle of the semester and the other towards the end of the semester giving a weight age of 0.75 for the better score and 0.25 for the other score will be considered. There shall be two assignments (***only online submission of Assignments will be accepted***) in each subject (problem based/ field work/group task/Online test) for award of 10 marks so that internal Component (marks) will be 30 marks (20 marks for internal test+10 marks for assignments / field work/group task).***Out of these two internal tests one internal test for 20 marks will be conducted in online mode.***

Table 3: Units for Internal Tests

Semester	
3 Units- First Internal test	3 Units- Second Internal test

4.4 In the case of Skill Development Courses/ Mandatory Learning courses, two Internal examinations shall be conducted one in the middle of the semester and the other at the end of the semester for 30 marks and the marks scored by the student in these exams with a weight age of 0.75 for better score and 0.25 for the other score will be awarded as Internal marks for 30. For the remaining 70 marks an end examination will be conducted along with other theory examinations. However skill development courses/Value added courses/ Mandatory Learning Courses, end examination will be evaluated internally.

4.5 No makeup test for internal examination or assignments/group tasks will be conducted in any subject or practical. The student, who is absent for any test shall be deemed to have scored zero marks in that subject.

4.6 Open and Professional Electives will commence from 3rd year first semester onwards. The open elective offered in 3-1 semester will be based on self-study/MOOCs. All the students have to opt for the MOOCs (Self Study) and should acquire the required credits. If the student fails to opt for MOOCs' (Under unavoidable circumstances) he/she has to write two internal tests besides the end examination conducted by the institute (Elective offered in place of MOOCs by the Dept.) like other subjects. However, he/she has to obtain the certificate from the organization in which he has registered. Any MOOCs course selected by the student should be of more than 45 hours duration/12 weeks course with a minimum of 3 credits and also from the reputed organization. Attendance of the student who has opted for MOOCs will be taken from the remaining subjects and labs only in that semester while finalizing the attendance for fulfilling the minimum requirements of attendance for promotion to the next semester. Attendance will not be recorded for MOOCs.

{Massive open online Courses (MOOCs') B.Tech students can avail the facility of earning up to a maximum of 5% credits of their degree requirements through MOOCs. MOOC courses eligible for this purpose are the courses offered by NPTEL/ SWAYAM/EDX/Course by any other reputed organisation approved by the department only. The student shall obtain prior approval of the Head of the Department before registering for MOOC's. MOOC courses can be taken in lieu of Elective courses such as Open Electives & Professional Electives (pertaining to their branch only) and Employability Enhancement Courses. No Core, Lab or Project Course can be dropped in lieu of MOOC. The student shall submit course Title, institute which offered MOOC, Examination system and Credits of the Course, duration of course. After deciding on the MOOC and a course which is approved as its equivalent in the curriculum a student can enrol for it and clear it any time as per his/her convenience and obtain the assessment certificate.

If the assessment certificate is submitted

i) Before the commencement of the semester in which the equivalent course is offered, the student will be exempted from attending the regular class work and internal assessment exams of the equivalent subject.

ii) During the semester the student is permitted to withdraw from the remaining part of the course work and internal assessment tests.

iii) After the semester is over but before the results of that semester are declared the student can request for considering his performance in the MOOC in lieu of its equivalent.

The student shall submit to the HOD the original certificate issued by MOOC authorities along with a photocopy of the same. The original will be returned after verification and verification shall be certified by the Head of the Department on the photocopy which shall be kept in records. An equivalent Grade corresponding to grade/marks awarded by MOOC agency shall be determined by a committee consisting of Principal, Controller of Examinations, Dean Student affairs and HoD concerned. This equivalent Grade shall be shown in the grade sheet and accounted in the SGPA and CGPA calculations.

4.7 Gap Year – Concept of student Entrepreneur in Residence shall be introduced and the outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I/II/III year to pursue full time entrepreneurship. This period may be extended for another one year (two years in total) and this period would not be counted for the maximum duration for completion of graduation. An evaluation committee shall be constituted to evaluate the proposal submitted by the student and committee shall decide on permitting the student for having the Gap Year. The committee consists of Principal as Chairman and all HODs as members.

4.8 In the open electives offered from III year I Sem onwards Student has to select the subjects among the list of open elective subjects by the other departments (inter - department). Student has to clear the subject as per norms to get the required credits. At least minimum of 40 students should register for any open elective; otherwise that open elective will not be offered.

4.9 Out of the professional electives offered from III Year I Semester onwards again one Professional elective in IV Year I Sem will be a MOOCs (Self Study) and the student has to acquire the required credits to clear the subject as specified in 4.6.

4.10 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., shall be included in the guidelines issued by AICTE .

4.11 All undergraduate students shall register for Extra - Academic Activity (EAA) such as a) NCC/NSS b) Games and Sports c) Yoga/Meditation d) Extension Activities e) Literary/ Cultural Activities and f) any other which may be offered in future. A student will be required to participate in an activity for two hours in a week during second and third semesters. The activities shall be carried out in the allotted hours. The activities will be monitored by the respective faculty in charge, senior faculty member of the department and the Department HOD. Grades will be awarded on the basis of participation, attendance, performance and behaviour. Grades shall be entered in the marks statement as GOOD, SATISFACTORY and UNSATISFACTORY and shall not be counted towards CGPA calculation. If any student gets an Unsatisfactory Grade, he/she has to repeat the activity in the immediate subsequent Semester / year.

4.12 Courses like Environmental Sciences, 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. ***Universal Human Values course*** shall be included in the curriculum as credit course in place of any open elective as per the convenience of department.

4.13 Students shall undergo ***two mandatory summer internships for a minimum of two months*** duration at the end of ***second and third*** year of the Programme. There shall also be ***mandatory 6 months internship*** in the ***final semester*** of the Programme along with the project work and seminar.

4.14 **Curricular Framework for Skill oriented**

i) For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.

ii) Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be

completed in second year. 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. (See Annexure 1 for model skill courses)

iii) A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements. The list of such courses shall be included in the curriculum structure of each branch of Engineering, so as to enable the student to choose from the list.

iv) 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 as approved by the concerned BoS.

v) The Board of studies of the concerned discipline of Engineering shall review the skill advanced

vi) Courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand.

vii) 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, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the Board of studies.

viii) 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 concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.

ix) 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. The recommended conversions and appropriate grades/marks are to be approved by the University/Academic Council.

4.15 Curricular Framework for Honors Programme

i) Students of or Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

ii) A student shall be permitted to register for Honors program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of 8.0 SGPA up to the end of 2^{nd} semester without any backlogs. In case of the declaration of the 3^{rd} semester results after the commencement of the 4^{th} semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

iii) Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

iv) In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B.Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160credits).

v) Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.

vi) It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

vii) The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

viii) Each pool can have theory as well as laboratory courses. If a course comes with a lab component,

that component as to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component. (Model pool list is enclosed in theAnnexure-2)

ix) MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.

x) The concerned BoS shall also consider courses listed under professional electives of the respective B.Tech programs for the requirements of B.Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

xi) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xii) In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii) Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

4.16 **Curricular Framework for Minor Programme:**

i) a) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

ii) The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc. or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

iii) The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

iv) There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

v) The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

vi) A student shall be permitted to register for Minors program at the beginning of 4thsemester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) up to the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA up to 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

vii) A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160credits).

viii) Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

ix) In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

x) Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

xi) A committee should be formed at the level of College/Universities/department to evaluate the Grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

xii) If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)"grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xiii) In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiv) Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

INDUSTRIAL COLLABORATIONS (CASE STUDY)

University-Industry linkages refer to the interaction between firms and universities or public research centers with the goal of solving technical problems, working on R&D, innovation projects and gathering scientific as well as technological knowledge. It involves the collaboration of Industries and Universities in various areas that would foster the research ecosystem in the country and enhance growth of economy, industry and society at large.

The Universities/Institutions (Autonomous) are permitted to design any number of Industry oriented minor tracks as the respective BoS feels necessary. In this process the Universities/Institutions can plan to have industrial collaborations in designing the minor tracks and to develop the content and certificate programs. Industry giants such as IBM, TCS, WIPRO etc., may be contacted to develop such collaborations. The Universities/Institutions shall also explore the possibilities of collaborations with major Industries in the core sectors and professional bodies to create specialized domain skills.

4.17 All the students have to undergo three mandatory internships namely i) Summer internship (During 2nd year break) ii) Industrial/ Research internship (During 3rd year break) and iii) 6 months internship(During 8th Semester)The student has to (mandatory) undergo summer internship in II year – II Sem break in a reputed organization for two month. The finalization of the internship organization will be done by HOD, two senior faculty members of the department and same will be recommended to the Principal for approval. The outcome of the summer internship will be evaluated during the 5th semester which carries 1.5 credits.

The student has to undergo research/ industry internship in III year –II Semester break for a period of two months in a reputed organization. The finalization of the summer internship organization will be done by HOD, two senior faculty members of the department and same will be recommended to the Principal for approval. The outcome of the research/industry internship will be evaluated during 7th semester which carries 3 credits.

The student has to undergo 6 months internship in IV year –II Semester for a complete period of 6 months in a reputed organization. The finalization of the summer internship organization will be done by HOD, two senior faculty members of the department and same will be recommended to the Principal for approval. The outcome of the research/industry internship will be evaluated during 7th semester which carries 3 credits. Certificate from the organization has to be submitted to this effect attested by HoD and Internship in charge to the academic section before the commencement of 3-2 semester.

4.18 The medium of instruction for all Course work, Examination, Seminar Presentations, Project Reports and all academic activities shall be English

5. Question Paper Pattern

5.1 Each Internal Test question paper shall contain 5 questions, of which the First question is compulsory and three questions are to be answered from the remaining four. Compulsory question carries 5 marks (It contains 5 questions of one marks - no choice in first question). The remaining 3 questions carry 5 marks each. Each question shall have a,b,c.... parts.

5.2 The End Examination question paper will have 7 questions and students have to answer5 questions. However, the first question is compulsory and it consists of 7 short answer questions, each carrying 2 marks. The next 4 questions are to be answered from the remaining 6 questions and each carries 14 marks. Each 14 marks question shall have a, b, c ..parts. Evaluation of answer scripts shall be done by either Internal or External examiners appointed by the Principal. A minimum of 50% of subjects will be evaluated by external examiners.

5.3 For practical subjects, there shall be a continuous evaluation during the semester for 25 internal marks and End Examination carries 50 marks. Of the 25 marks for Internal, 15 marks shall be awarded for day-to-day work, 5 marks to be awarded by conducting an internal laboratory test and 05 marks will be allotted for any creativity/ innovation/ additional learning in lab beyond prescribed set of experiments etc. The End Examination shall be conducted by the teacher concerned and an external Examiner from other institutions.

5.4 For the subject having design and/or drawing, (such as Engineering Graphics, Machine Drawing etc.) and estimation, the distribution shall be 30 marks for Internal evaluation (15marks for day-to-day work and 5 marks for Internal tests and 10 marks for assignments) and 70 marks for End Examination. There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marks for internal tests.

5.5 The Engineering drawing, wherever offered is to be treated as a theory subject. Evaluation method adopted for theory subjects shall be followed here as well.

5.6 There shall be comprehensive Viva-Voce examination at the end of 7thsemester.Comprehensive Viva Examination shall be conducted by the committee consisting of senior faculty (based on the recommendation of HOD), an external Examiner from other institutions and HOD and evaluated for 50 marks.

5.7 The project topic should be approved by Internal Department Committee (IDC) / Identified by organization where the student is carrying out 6 months internship. Out of total 150 marks for the project work, 50 marks shall be for Internal Evaluation and 100 marks for the End Semester Examination. The evaluation of project work shall be conducted at the end of the IV year II semester. The external project viva voce examination will be conducted by the committee consisting of an external Examiner from other institute, Head of the Department and the supervisor of the project. The Internal evaluation for 50 marks shall be on the basis of one technical seminars (25 marks) and remaining 25 for main project related activities. The Internal evaluation of the project work for 50 marks shall be conducted by the committee consisting of head of the Department or his nominee, senior faculty member and the supervisor of project.

5.8 For all practical /mini project/main project/CV etc. the HOD of the concerned dept. shall submit a panel of 4 external examiners from different institutes and one will be selected by the Chief Superintendent of the Examination for conducting of end examination.

5.9 **Revaluation of End Examination Scripts**: Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee. Procedure for Revaluation: The script will be revaluated by an examiner appointed by the Principal. The maximum of revaluation and regular end examination grade will be awarded for that subject. Student can apply for revaluation in a subject only once.

Table4: Distribution of weightages for examination and evaluation

S.No	Nature of subject	Marks	Type of examination and mode of assessment		Scheme of Examination
1	Theory	70	End Examination. Both internal and external Evaluation(at least a minimum of 50% subjects will be sent for external evaluation)		End Examination in theory subjects will be for 70 marks.
		30	20	Internal Examinations (Internal evaluation)	These 20 marks are awarded to the students based on the performance in two (per semester)Internal examinations with a weightage of 0.75 for better score and 0.25 for the other score.
			10	Assignments/Field work/Group task/Online Test	Average of two assignments/Field work/group task in a semester each evaluated for 10 marks.
2	Practical / Mini Project Work	50	End lab examination (External evaluation)		This End Examination in practical subjects will be for a maximum of 50 marks.
		25	15	Internal evaluation	Day-to-day performance in lab experiments and record.
			05	Internal evaluation	Internal lab examination at the end of year/semester.
			05	Internal evaluation	05 marks will be allotted for any creativity/ innovation/ additional learning in lab beyond prescribed set of experiments etc.
3	Comprehensive Viva-Voce(CV)	50	External evaluation		This end viva voce examinations in all the subjects for 50 marks.
4	Project work	50	Internal evaluation		project work for 50 marks
		100	External evaluation		This end viva voce in project work for 100 marks
5	Skill Development Courses/Value Added Course/ Mock interviews and Group Discussion/ Mandatory Learning Courses	30	Internal evaluation		These 30 marks are awarded to the students based on the performance of two Internal examinations with a weight age of 0.75 for better score and 0.25 for the other score.
		70	Internal Evaluation		Based on the performance in the end examination.
6	Internship/Internal Project/Study Report/Work shop	00	-----		Certificate form Internship Agency
7	Mandatory Learning Courses	70	Internal evaluation		End Examination in theory subjects will be for 70 marks.
		30	Internal evaluation		These 30 marks are awarded to the students based on the performance in two (per semester) Internal examinations with a weightage of 0.75 for better score and 0.25 for the other score.

6.0 Attendance Requirements:

6.1 The student shall be eligible to appear for End examinations of the semester if he acquires a minimum of 75% of attendance in aggregate of all the subjects of that semester.

6.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted by the College Academic Committee.

6.3 The student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester. They may seek re-admission for that semester when offered next.

6.4 Shortage of Attendance below 65% in aggregate shall in <u>NO</u> case be condoned.

6.5 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.

6.6 The stipulated fee shall be payable towards Condonation of shortage of attendance to the college.

7.0 Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No.6.0.

7.1 The student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical or design or CV or drawing subject or Skill Development Coursesor project if he secures not less than 35% of marks in the End Examination (If applicable)) and he has to score minimum of 40% marks from internal and external exam marks put together to clear the subject.

7.2 The student shall be promoted from II to III year only if he fulfils the academic requirement of securing a minimum of 50%(41 credits out of 82)credits from all the exams conducted up to and including II year II semester regular examinations irrespective of whether the candidate takes the examination or not.

7.3 The student shall be promoted from third year to fourth year only if he fulfils the academic requirements of securing minimum of 50% (62.5 credits out of 125)credits from all the exams conducted up to and including III year II semester regular examinations, whether the candidate takes the examinations or not.

Table 5: Promotion rules

Promotion from	Total credits to register	Minimum credits to obtain for promotion
II yr to III yr	82	41
III yr to IV yr	125	62.5

7.4 The student shall register and put up minimum attendance in all 160 credits and earn 160credits. Grades obtained in 150credits (excluding the credits obtained in Skill Development Courses/Value added courses) shall be considered for the calculation of CGPA.

7.5 Students who fail to earn 160credits as indicated in the course structure in Table-1 within eight academic years from the year of their admission shall forfeit their seat in B.Tech. Course and their admission shall stand cancelled.

8.0 Course pattern:

8.1 The entire course of study is of four academic years. Each academic year consists of two semesters

8.2 The student is 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 supplementary examination.

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Table: 6: Course pattern

Year	Semester	CSE/ CSE(DS)/ CSE&BS/ EEE	ECE/CE/Mech.	Total credits	
First Year	First	1) BSC1 - LA&AC	1) BSC1 - LA&DE/LA&AC/ LA&AC	Subjects (5X3=15)	19.5
		2) BSC2 - AP	2) BSC2 - MEC/AC/AC	Labs (3X1.5=4.5)	
		3) ESC1 - PSP	3) ESC1 - PSP		
		4) ESC2 - BEE/BEE/BEE/FED	4) ESC2 - FEE/ED /EM		
		5) ESC3 - ED	5) HSS - EE		
		6) ESC Lab - E&ITW	6) HSC Lab - DEL		
		7) BSC Lab - EP	7) BSC Lab - EC		
		8) ESC Lab - PSP	8) ESC Lab - PSP		
	Second	1) BSC1 - DE & VC	1) BSC1 – AC&TT/DE&VC	Subjects (5X3=15)	19.5
		2) BSC2 - MEC	2) BSC2 - AP/EP/EP	MLC (1X0=0)	
		3) ESC1 - DS	3) ESC1 - DS	Labs (3X1.5=4.5)	
		4) ESC2 - MFCS/MFCS/MFCS/BEE	4) ESC2 - NWA/BEE/MS		
		5) HSS - EE	5) ESC3-ED/ED/BEM		
		6) MLC - ES	6) MLC - ES		
		7) HSC Lab - DEL	7) ESC Lab - E&ITW		
		8) BSC Lab - EC	8) BSC Lab - EP		
		9) ESC Lab - DS	9) ESC Lab - DS		
Second Year	First	1) BSC	1) BSC	Subjects (5X3=15)	21.5
		2) PCC	2) PCC	SOC (1X2=2)	
		3) PCC	3) PCC	MLC (1X0=0)	
		4) PCC	4) PCC	Labs (3X1.5=4.5)	
		5) PCC	5) PCC	EAA (1X0=0)	
		6) Skill Oriented Course (SOC)	6) Skill Oriented Course (SOC)		
		7) Mandatory Learning Course (MLC)	7) Mandatory Learning Course (MLC)		
		8) PCC Lab	8) PCC Lab		
		9) PCC Lab	9) PCC Lab		
		10) PCC Lab	10) PCC Lab		
	Second	1) ESC	1) ESC	Subjects (5X3=15)	21.5
		2) BSC/PCC	2) BSC/PCC	SOC (1X2=2)	
		3) PCC	3) PCC	MLC (1X0=0)	
		4) PCC	4) PCC	Labs (3X1.5=4.5)	
		5) HSS	5) HSS	EAA (1X0=0)	
		6) Skill Oriented Course (SOC)	6) Skill Oriented Course (SOC)		
		7) Mandatory Learning Course (MLC)	7) Mandatory Learning Course (MLC)		
		8) ESC/PCC (Interdisciplinary) Lab	8) ESC/PCC (Interdisciplinary) Lab		
		9) PCC Lab	9) PCC Lab		
		10) PCC Lab	10) PCC Lab		
Third	First	1) PCC	1) PCC	Subjects (4X3=12)	21.5
		2) PCC	2) PCC	OEC/JOE (1X3=3)	
		3) PCC	3) PCC	SAC/SSC (1X2=2)	
		4) OEC/JOE	4) OEC/JOE	MLC (1X0=0)	
		5) PEC	5) PEC	SI (1X1.5=1.5)	
		6) Skill Advanced Course/Soft Skill Course.	6) Skill Advanced Course/Soft Skill Course	Labs (2X1.5=3)	
		7) Mandatory Learning Course (MLC)	7) Mandatory Learning Course (MLC)		
		8) Summer Internship	8) Summer Internship		
		9) PCC Lab	9) PCC Lab		
		10) PCC Lab	10) PCC Lab		
	Second	1) PCC	1) PCC	Subjects (4X3=12)	21.5
		2) PCC	2) PCC	OEC/JOE (1X3=3)	
		3) PCC	3) PCC	SAC/SSC (1X2=2)	
		4) OEC/JOE	4) OEC/JOE	MLC (1X0=0)	
		5) PEC	5) PEC	Labs (3X1.5=4.5)	
		6) Skill Advanced Course/Soft Skill Course.	6) Skill Advanced Course/Soft Skill Course		
		7) Mandatory Learning Course (MLC)	7) Mandatory Learning Course (MLC)		
		8) PCC Lab	8) PCC Lab		
		9) PCC Lab	9) PCC Lab		
		10) PCC Lab	10) PCC Lab		
Fourth	First	1) PEC	1) PEC	Subjects (3X3=9)	23
		2) PEC	2) PEC	OEC/JOE (2X3=6)	
		3) PEC	3) PEC	SAC/SSC (1X2=2)	
		4) OEC/JOE	4) OEC/JOE	HSSE (1X2=2)	
		5) OEC/JOE	5) OEC/JOE	CVV (1X2=2)	
		6) Skill Advanced Course/Soft Skill Course.	6) Skill Advanced Course/Soft Skill Course.	I/RI (1X2=2)	
		7) HSSE	7) HSSE		
		8) Comprehensive Viva	8) Comprehensive Viva		
		9) Industrial/Research Internship	9) Industrial/Research Internship		
	Second	1) Technical Seminar	1) Technical Seminar	TS (1X1=1)	12
		2) Internship in Industry	2) Internship in Industry	I/RI (1X5=5)	
		3) Major Project	3) Major Project	Project (1X6=6)	

Note:

1) Mandatory Learning Courses
   a) Indian Heritage
   b) Culture Tradition
   c) Constitution of India
2) Industrial/Research Internship 2 Months (Mandatory) after third year evaluated during VII semester

9.0 Transitory Regulations:

Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone this course in earlier regulations or have discontinued andwish 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 2.0 and they continue to be in the academic regulations in which they were readmitted.

10.0 With-holding of results:

If the candidate has any dues not paid to the Institute or if any case of indiscipline of malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed/promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

11.0 Award of Class:

After the 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:

Table 7: Award of Division

Class Awarded	% of marks to be secured	Division/ Class	CGPA	CGPA secured from 150 Credits (Excluding the credits obtained in Skill Development Courses)
First Class with Distinction	70% and above	First class With Distinction	≥ 7.5	
First Class	Below 70% but not less than 60%	First Class	≥ 6.5 and < 7.5	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 and < 6.5	
Pass Class	Below 50% but not less than 40%	Pass	≥ 4 and < 5.5	

12.0 **Grading:**

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

Table 8: Conversion into Grades and Grade points assigned

Range in which the % of marks in the subject fall	Grade	Grade point Assigned	Performance
90 to 100	O	10	Outstanding
80 to 89.9	A^+	09	Excellent
70 to 79.9	A	08	Very Good
60 to 69.9	B^+	07	Good
50 to 59.9	B	06	Above Average
45 to 49.9	C	05	Average
40 to 44.9	P	04	Pass
<40	F	00	Fail
Ab	AB	00	Fail

12.1 Requirement for clearing any subject: The students have to obtain a minimum of 35% in End Examination and they have to score minimum of 40% marks from Internal and external exam marks put together to clear the subject. Otherwise they will be awarded fail grade.

12.2 F is considered as a fail grade indicating that the student has to reappear for the end supplementary examination in that subject and obtain a non-fail grade for clearing that subject.

12.3 In case of skill development/ value added course / soft skill subjects, as there is no end exam, all 100 marks are for internal assessment only. Student has to score 40% in these courses to complete the subject which will be evaluated internally. Marks obtained in these courses shall not be considered for award of Division.

12.4 To become eligible for the award of degree the student must obtain a minimum CGPA of 4.0.

13.0 Supplementary Examinations:

Apart from the regular End Examinations, the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day. For eighth semester, special (Advance) supplementary examinations will be conducted in second week following the results publication date of regular examination of eighth semester only.

14.0 Grade Point Average (GPA) and Cumulative Grade Point Average(CGPA)

The Grade Point Average (GPA) for each semester and Cumulative Grade Point Average (CGPA) up to any semester is calculated as follows:

i) Semester Grade Point Average will be computed as follows:

$$GPA = \frac{\sum_1^n C_j \times GP_j}{\sum_1^n C_j}$$

Where, n is the number of subjects in that semester. C_j is Credits for the subjects. GP_j is the grade point obtained for the subject and the summation is over all the subjects in that semester.

ii) A Cumulative Grade Point Average (CGPA) will be computed for every student at the end of each semester. The CGPA would give the cumulative performance of the student from the first semester up to the end of the semester to which it refers to and is calculated as follows:

$$CGPA = \frac{\sum_1^m GPA_j \times TC_j}{\sum_1^m TC_j}$$

Where 'm' is the number of semester under consideration. TC_j the total number of credits for a j^{th} semester and GPA_j is the Grade Point Average of the j^{th} semester. Both GPA and CGPA will be rounded off to the second digit after decimal and recorded as such.

While computing the GPA / CGPA, the subjects in which the student is awarded zero grade points will also be included.

For any academic/employment purpose the following formulae shall be used for conversion of CGPA to % of marks. % of marks = (CGPA –0.5) x 10.

15.0 Grade Sheet:

A grade sheet (Memorandum) will be issued to each student indicating his performance in all subjects of that semester in the form of grades and also indicating the GPA and CGPA.

16.0 Award of Degree

After having admitted into the program, B.Tech degree shall be conferred on a student who has satisfied the following conditions.

i) The student joining with Intermediate qualification must have, after admission into the Regular B.Tech programme of the college, pursued a regular course of study for not less than four academic years and not more than eight academic years.

ii) The student joining under lateral entry scheme with diploma qualification must have, after admission into III Semester B.Tech, pursued a regular course of study for not less than three academic years and not more than six academic years.

iii) The student must have satisfied the minimum academic requirements in appropriate branch of engineering in each semester of the program, herein after prescribed.

iv) Students must register for all the courses and earn the credits specified.

v) Students who fail to fulfil all the academic requirements for the award of degree within the specified period from the year of their admission shall forfeit their seat in B.Tech course and their admission stands cancelled.

vi) The student shall successfully complete non-credit courses like EAA/MC/Internship.

vii) The student has no dues to the institution, library, hostels etc.

viii) The student has no disciplinary action pending against him/her.

The Degree will be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Ananthapuramu on recommendations by the Academic council of RGMCET (Autonomous) basing on the eligibility as in clause 6.0 and 7.0.

17.0 Transcripts:

After successful completion of prerequisite credits for the award of degree, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

18.0 Rules of Discipline:

18.1 Any attempt by any student to influence the teachers, Examiners, faculty and staff of Examination section for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.

18.2 When the student absents himself, he is treated as to have appeared and obtained zero marks in that subject(s) and grading is done accordingly.

18.3 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject(s).

18.4 When the student's answer book is confiscated for any kind of attempted or suspected malpractice, the decision of the Chief Superintendent is final.

19.0 Minimum Instruction Days:

The minimum instruction days for each semester shall be 95 clear instruction days excluding the days allotted for tests/examinations and preparation holidays declared if any.

19.0 Amendment of Regulations:

The college may, from time to time, revise, amend or change the regulations, scheme of examinations and syllabi. However the academic regulations of any student will be same throughout the course of study in which the student has been admitted. However students will continue to be in the academic regulations in which they were readmitted.

20.0 Transfers

There shall be no branch transfers after the completion of admission process.

21.0 General:

21.1 The Academic Regulations should be read as a whole for the purpose of any interpretation.

21.2 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

21.3 The Institute 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 Institute.

21.4 Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

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Academic Regulations for B.Tech.
(Lateral Entry Scheme)

(Effective for the students getting admitted into II year from the Academic Year 2021-2022 onwards)

1.0 The Students have to acquire a minimum of 121 credits out of 121 from II to IV year of B.Tech. Program (Regular) for the award of the degree.

2.0 Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.

3.0 The same attendance regulations are to be adopted as that of B. Tech. (Regular).

4.0 **Promotion Rule:**

The student shall be promoted from third year to fourth year only if he fulfils the academic requirements of securing minimum of 43 credits out of 86credits from all the exams conducted up to and including III year II semester regular examinations, whether the candidate takes the examinations or not.

5.0 **Award of Class:**

After the 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: The marks obtained in the best 111credits (excluding the credits obtained in Skill Development Courses/Value added courses) will be considered for the calculation of percentage and award of class.

Table 1: Award of Division

Class Awarded	**% of marks to be secured**	Division/ Class	CGPA	CGPA secured from 111Credits (Excluding the credits obtained in Skill Development Courses)
First Class with Distinction	70% and above	First class With Distinction	≥ 7.5	
First Class	Below 70% but not less than 60%	First Class	$6.5 and < 7.5$	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 and < 6.5	
Pass Class	Below 50% but not less than 40%	Pass	≥ 4 and < 5.5	

6.0 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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I B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
			Theory	Tutorial	Lab		Internal	External	Total
THEORY									
A0001201	BSC	Linear Algebra and Advanced Calculus	2	1	0	3	30	70	100
A0002201	BSC	Applied Chemistry	2	1	0	3	30	70	100
A0501201	ESC	Problem Solving and Programming	2	1	0	3	30	70	100
A0301201	ESC	Engineering Drawing	1	0	4	3	30	70	100
A0003201	HSC	English for Engineers	2	1	0	3	30	70	100
PRACTICALS									
A0091201	HSC	Digital English Language Lab	0	0	3	1.5	25	50	75
A0092201	BSC	Engineering Chemistry Lab	0	0	3	1.5	25	50	75
A0591201	ESC	Problem Solving and Programming Lab	0	0	3	1.5	25	50	75
		Total	**9**	**4**	**13**	**19.5**	**225**	**500**	**725**

I B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
			Theory	Tutorial	Lab		Internal	External	Total
THEORY									
A0007202	BSC	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
A0009202	BSC	Engineering Physics	2	1	0	3	30	70	100
A0502202	ESC	Data Structures	2	1	0	3	30	70	100
A0303202	ESC	Material Science	2	1	0	3	30	70	100
A0304202	ESC	Basic Engineering Mechanics	2	1	0	3	30	70	100
A0010202	MLC	Environmental Studies	2	0	0	0	30	70	100
PRACTICALS									
A0592201	ESC	Engineering Workshop & IT Workshop	0	0	3	1.5	25	50	75
A0093201	BSC	Engineering Physics lab	0	0	3	1.5	25	50	75
A0593202	ESC	Data Structures Lab	0	0	3	1.5	25	50	75
		Total	**12**	**5**	**9**	**19.5**	**225**	**570**	**825**

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DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME)

L	T	C
2	1	3

(A0001201) LINEAR ALGEBRA AND ADVANCED CALCULUS

For Branches: CE, EEE, ME, CSE, CSE (DS), CSE&BS

COURSE OBJECTIVES:

- To familiarize the concepts of matrices and mean value theorems and their applications in engineering.
- To equip the students to solve various application problems in engineering through evaluation of Gamma, Beta functions and multiple integrals etc.,

COURSE OUTCOMES:

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

- Understand the use of matrices and linear system of equations in solving Network analysis, encoding and decoding in Cryptography and Quantum mechanics problems.
- Apply the concept of Gamma and Beta functions in digital signal processing, discrete Fourier transform, digital filters and Oscillatory theory in engineering.
- Analyze differential and integral calculus to solve improper integrals and its applications in many engineering disciplines.
- Determine the process to evaluate double and triple integrals and understand its usage to find surface area and volumes of various bodies in engineering.
- Identify the applications of advanced calculus & Linear algebra in electro-magnetic theory and in telecommunication engineering.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-

UNIT – I

Matrices: Elementary row transformations – Rank – Echelon form, Normal form – Solutions of Linear System of Homogenous and Non Homogeneous equations.

UNIT – II

Eigen Values, Eigen vectors – Properties – Cayley – Hamilton Theorem – Inverse and Power of a matrix by Cayley – Hamilton theorem.

UNIT – III

Quadratic forms: Linear Transformation – Reduction of quadratic form to canonical form and their nature (Rank, Signature and Index).

UNIT – IV

Mean value theorems: Rolle's Theorem – Lagrange's Mean Value Theorem – (excluding proof). Simple examples of Taylor's and Maclaurin's Series.

Functions of several variables – Jacobian – Maxima and Minima of functions of two variables - Lagrange method of Multipliers with three variables only.

UNIT – V

Multiple integrals: – Evaluation of Double integrals (Cartesian and Polar) – Change of Variables – Change of order of Integration – Changing into Polar coordinates – Evaluation of triple integrals.

UNIT – VI

Special functions: Gamma function – Properties – Beta function – properties – Relation between Gamma and Beta functions – Evaluation of Integrals using Gamma & Beta functions.

TEXTBOOKS:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.
2) R. K. Jain, S. R .K. Iyengar, Advanced Engineering Mathematics, Alpha Science.
3) T.K.V. Iyengar, B. Krishna Gandhi, A Text Book of Engineering Mathematics, Vol – I, S. Chand & Company.

REFERENCES:

1) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2) Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons,2011.
3) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

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DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME)

T	L	C
2	1	3

(A0002201) APPLIED CHEMISTRY

For branches: CE & ME

COURSE OBJECTIVES:

- To impart the concept of soft and hard waters, softening methods of hard water.
- To train the students on the concepts and applications of electrochemistry.
- To provide an understanding of the corrosion principles and engineering methods used to minimize and prevent the corrosion.
- To learn about the properties of refractory materials.
- The course provides an introduction to polymer chemistry based on synthesis mechanisms associated with chain-growth and step-growth.
- To acquire knowledge about types of fuels, liquid and gaseous fuels.

COURSE OUTCOMES:

At the end of the course, the students will be able to

- Identify and apply suitable water softening techniques (L1)
- Apply the principles of some electrochemical techniques and electrodes (L3)
- Demonstrate the corrosion prevention methods and factors affecting corrosion (L2)
- Explain the preparation, properties, thermoplastics & elastomers (L2)
- Explain the preparation, setting and hardening of cement (L2)
- Explain calorific value, octane number, refining of petroleum (L2)

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	1	1	-	1	-	-	-	-	-
CO2	1	-	-	2	-	-	1	1	-	-	-	-
CO3	1	1	-	-	1	-	-	-	-	-	-	-
CO4	1	-	-	-	-	1	-	1	-	1	-	-
CO5	1	-	1	-	1	-	-	1	-	-	-	1
Course	1	1	-	1	-	1	1	-	-	-	1	-

UNIT 1: Water Technology

Introduction – Soft Water and hard water, hardness of water-Estimation of hardness of water by EDTA Method and Numerical problems on hardness – Water Softening methods (zeolite and ion-exchange processes)–Boiler troubles (Priming and foaming, scale and sludge, Boiler Corrosion, Caustic Embrittlement).

UNIT 2: Electrochemistry and Applications:

Introduction– Conductance, Specific conductance, Equivalent Conductance and molar conductance – Determination of equivalent conductance by Wheatstone bridge method – Conductometric titrations (acid-base titrations) –Numerical Problems on conductance –Electrodes –Reference electrode (Standard hydrogen electrode) – Daniel Cell.

UNIT 3: Corrosion:

Definition –Theories of Corrosion (Direct chemical attack type of corrosion, electrochemical type of corrosion and their mechanisms) – Typesof corrosion: (galvanic & pitting) – Factors affecting the rate of the corrosion –proper design and material selection –Cathodic protection.

UNIT-4 Advanced Engineering Materials

Refractories- Classification, Properties and its Applications, Reasons for failure of the refractory materials.

Cement: Introduction, classification, Types of cement, Composition of cement, Preparation of Portland cement, setting and hardening of the cement.

UNIT 5: Polymer Technology

Classification of polymers – Functionality – Chain growth, step growth polymerization and Copolymerization with specific examples – Mechanisms of additional polymerization.

Plastics**:** Preparation, properties and applications of PVC, Teflon and Bakelite.

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

UNIT 6: Chemistry of Fuels:

Introduction –Types of fuels – Calorific value – Numerical problems based on calorific value.
Solid Fuels: Analysis of coal – Proximate and Ultimate analysis.
Liquid Fuels: Extraction of petroleum, knocking, Octane and Cetane number.
Gaseous Fuels: Producer gas, water gas and biogas.

TEXT BOOKS:

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. K N Jayaveera, G V Subba Reddy and C Rama Chandraiah, Engineering Chemistry 1/e Mc Graw Hill Education (India) Pvt Ltd, New Delhi 2016
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME)

L	T	C
2	1	3

(A0501201) PROBLEM SOLVING AND PROGRAMMING

For Branches CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES:

- Introduce the internal parts of a computer, and peripherals.
- Introduce the Concept of Algorithm and use it to solve computational problems
- Identify the computational and non-computational problems
- Teach the syntax and semantics of a C Programming language
- Demonstrate the use of Control structures of C Programming language
- Illustrate the methodology for solving Computational problems

COURSE OUTCOMES:

- Construct his own computer using parts (L6).
- Recognize the importance of programming language independent constructs (L2)
- Solve computational problems (L3)
- Select the features of C language appropriate for solving a problem (L4)
- Design computer programs for real world problems (L6)
- Organize the data which is more appropriated for solving a problem (L6)

MAPPING WITH COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	2	-	-	-	2	1	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-
CO4	3	-	2	-	-	-	-	-	3	-	-	-
CO5	-	3	3	-	-	2	-	-	-	-	2	-
CO6	-	-	3	-	-	-	2	-	-	-	-	-

UNIT I

Computer Fundamentals: What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU.

Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

Learning Outcomes: Student should be able to

1. Identify the different peripherals, ports and connecting cables in a PC (L2)
2. Illustrate the working of a Computer (L3)
3. Select the components of a Computer in the market and assemble a computer (L4)
4. Solve complex problems using language independent notations (L3)

UNIT II

Introduction to computer problem solving: Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, the analysis of algorithms.

Fundamental algorithms: Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.

Learning Outcomes: Student should be able to

1. Solve Computational problems (L3)
2. Apply Algorithmic approach to solving problems (L3)
3. Analyze the algorithms (L4)

UNIT III

C Language Preliminaries: Keywords and Identifiers, Constants, Variables, Data Types, and Input Output Statements with suitable illustrative “C” Programs.

Operators: Assignment Operators, Relational and Logical Operators, Increment and Decrement Operators, Bitwise Operators, Ternary Operator, Type Conversion, Precedence and Associativity with suitable illustrative C Programs.

Learning Outcomes: Student should be able to

1. Understand keywords, data types in C (L2)
2. Use various operators in C program (L6)
3. Apply type conversions and also understand, analyse precedence and associativity (L2)

UNIT IV

Conditional/Decision Statements: if, if-else, Nested if-else, else-if ladder, Switch-Statement and goto statement with suitable illustrative C Programs.

Loop Control Statements: while, do-while and for with suitable illustrative "C" Programs, break, continue statements.

Learning Outcomes: Student should be able to

1. Select the control structures for solving the problem (L4)
2. Apply statements for solving the problem (L3)
3. Understand the statements in C language (L2)

UNIT V

Arrays: Definition, Importance of an array in C language, One-Dimensional Arrays, Two-Dimensional Arrays, Example programs on the topics mentioned above

Strings: Introduction to Strings, String I/O, String Operations and functions.

Functions: Introduction to Functions, benefits of functions, types of functions, Function calls, return vs. exit( ), Parameter Passing mechanisms, Call-by-Value, Recursion.

Learning Outcomes: Student should be able to

1. Design and develop C programs using functions and arrays. (L6)
2. Apply modular approach for solving the problem (L3)
3. Understand and apply various string handling functions (L2)

UNIT VI

Files : Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions(standard library input / output functions for files), file status functions (error handling),Positioning functions, command –line arguments, C program examples.

Storage Classes, pre-processor directives.

Learning Outcomes: Student should be able to

1. Describe the Files types and File operations. (L2)
2. Practice Command line arguments. (L3)
3. Perform Error handling in Filerelated programming in C.(L4)

TEXT BOOKS:

1. PradipDey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.

REFERENCE BOOKS:

1) P.Chenna Reddy, " Computer Fundamentals and C Programming" 2018, BS Publications
2) RS Bichkar" Programming with C", 2012, Universities Press.
3) PelinAksoy, and Laura Denardis, "Information Technology in Theory", 2017, Cengage Learning.

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AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME)

T	P	C
1	4	3

(A0301201) ENGINEERING DRAWING

For Branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES:

- Understand and appreciate the importance of basic concepts and principles of Engineering Drawing
- Realize and appreciate the importance of engineering drawing as a medium of communication to covey ideas in engineering field
- Enable the students to be aquatint with various basic engineering drawing formats
- Learn to take data and transform in to graphic drawings.

COURSE OUTCOMES:

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

- Understand the conventions and the methods adopted in engineering drawing.
- Understand the concepts of orthographic projection.
- Improve their visualization skills and to apply these skill in developing new products
- Improve technical communicative skills in the form of communicative drawings

MAPPING WITH COs& POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	-	-	2	2	3	2	-	3	2	3	2
CO2	3	2	3	2	3	-	-	2	2	3	-	-	3	2	2	2
CO3	3	2	2	1	3	-	-	2	2	3	-	1	1	2	2	2
CO4	3	2	2	2	3	-	-	2	2	3	1	-	1	2	3	2

UNIT I

Geometrical Constructions: Polygons-Construction of Regular Polygons using given length of a side; Conic sections- Ellipse- Arcs of Circles and Oblong Methods, Construction of Parabola and Hyperbola by eccentricity method only.

UNIT II

Projection of Points and Lines: Introduction to Orthographic Projections- Projections of Points-Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane, inclined to both planes, determination of true lengths, angle of inclinations.

UNIT III

Projections of Planes: Regular Planes, Plane Perpendicular to one plane and Parallel to another Reference plane, Plane inclined to one Reference Plane.

UNIT IV

Projections of Solids: Prisms, Pyramids, Cones and Cylinders with the axis perpendicular to one plane and parallel to the reference plane, Plane inclined to one reference Plane only.

UNIT V

Section of solids: Sectioning of prism, pyramid, cone and cylinder– sectional view – true shape. Solids in simple position and cutting plane inclined to one reference plane only.

Development of surface of solids: Development of truncated prism, pyramid, cone and cylinder – frustum of cone and pyramid.

UNIT VI

Orthographic and Isometric Projections: Introduction to Isometric projections/ views, Construction of Isometric view/ projections of simple solids. Conversion of Isometric Views to Orthographic Views/Projections-Conversion of Orthographic Views to Isometric Projection/ Views.

TEXT BOOK:

1) Engineering Drawing. K.L Narayana, P. Kannaiah, Scitech Publications, 2011
2) Engineering Drawing by N.D. Bhatt, Chariot Publications,2014

REFERENCE BOOKS:

1) Engineering Drawing, B.V.R Gupta, J.K. Publishers,2008
2) Engineering Drawing and Graphics, Venugopal /New age publications,2007
3) Engineering Drawing by M.B. Shah and B.C. Rana, Pearson Publishers,2009
4) Engineering Drawing, Johle, Tata Mc Graw – Hill, 2008
5) K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai, 2006.

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DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME)

T	L	C
2	1	3

(A0003201) ENGLISH FOR ENGINEERS

For Branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES

- English for Engineers is prescribed to make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
- To equip students with professional skills & soft skills
- Develop Communication skills in formal and informal situations.

COURSE OUTCOMES

- Students will be able to use creativity in writing such as E-mails, Reports, Resume writing and Info- Graphics to enhance engineering abilities
- Students will analyze the concepts of critical and analytical Reading skills to understand needs of engineering in society by using modern tools
- Students will be able to develop flair for any kind of writing with rich vocabulary to enhance communicative skills
- Students will understand the basic Grammar techniques and utilize it for language development
- Students will apply the strategies of Soft skills & Ethical components

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	-	-	1	1	3	3	-	2
CO2	-	-	-	-	2	2	-	2	-	2	-	3
CO3	-	-	-	-	-	-	-	1	2	2	-	3
CO4	-	-	-	-	-	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	3	3	2	-	2

UNIT- I

a) Reading: Skimming the text for theme
Reading Text: Engineering in Society by Sarah Bell
b) Grammar: Types of Sentences - Demonstratives- Articles- Prepositions
c) Writing: Paragraph Writing & Practice
d) Vocabulary: Root words - Word lists from Word power Made Easy by Norman Lewis
Method of Teaching: Analyzing the theme of Reading Prescribed Text, Worksheets on Articles & Prepositions, Assignment on Short paragraphs, Vocabulary activities through worksheets.

UNIT- II

a) Reading: Scanning the text for specific details
Reading Text: Sultana's Dream by Begum Rokeya
b) Grammar: Tenses & Usage
c) Writing: Formal Letters and E-mail writing – Tips & Practice
d) Vocabulary: Homonyms - Word lists & Practice
Method of Teaching: Classroom discussion &critical appreciation of the Reading Lesson, Worksheets on Tenses, Practice of Formal Letters, Vocabulary Quizzes- Assignment.

UNIT- III

a) Reading: Note-making (identifying the main ideas and making notes)
Reading text: Satya Nadella: When Empathy is Good for Business
https://www.morningfuture.com
b) Grammar: Framing questions –Wh Qs - Yes/No questions - Question Tags
c) Writing: Resume & Cover letter Writing- Tips &Practice
d) Vocabulary: Synonyms & Antonyms
Method of teaching: Class room Discussions, Student Activity on Questions,E-mail writing, Vocabulary activities through games- Practice- Assignment.

UNIT – IV

a) Reading: Summarizing
Reading Text: Life is a Pizza by Richard Templar from Rules of Life
b) Grammar: If Clauses – Usage & Practice
c) Writing: Writing Definitions – Process of Writing - Tips & Practice
d) Vocabulary: Idioms & Phrases- Practice
Method of Teaching: Discussion & Assignment, If Clauses from Newspapers, Preparing profiles for Resume, Vocabulary activities through worksheets

UNIT – V

a) Reading: Intensive reading (reading for every detail)
Reading text: What is a Drone: Main Features & Applications of Today's Drones by Jack Brown
b) Grammar: Active Voice –Passive Voice- Usage
c) Writing: Report Writing- Types - Practice
d) Vocabulary: Technical Terms- Word Lists- Practice
Method of Teaching: Assignment on Drones, Worksheets on Active/ Passive voice**,** Watch a Documentary on social issues and draft a Report, Technical Terms- Quiz.

UNIT- VI

a) Reading: Appreciating a poem (focus on genre)
Reading text: Where the mind is without fear by Rabindranath Tagore
b) Grammar: Direct & Indirect Speech - Common Errors- Practice
c) Writing: Info-Graphics- Types- Practice
d) Vocabulary: Foreign Derived Words- Word Lists from Norman Lewis Word Power Made Easy
Method of teaching: Learner's interaction on the poem, Practicing Grammar through on line tests, practice reading and understanding graphs, Quiz & worksheets.

REFERENCE TEXTS:

1) English Language & Communication Skills for Engineers (AICTE Syllabus) by Sanjay Kumar & Pushpa Latha, Oxford University Press, 2018
2) Practical English Usage by Michael Swan, Oxford University Press.
3) Technical Communication, Principles and Practice by Meenakshi Raman & Sangeetha Sharama, Oxford University Press, 2016
4) Word Power Made Easy by Norman Lewis, Goyal Publications.
5) 4000 Essential English Words 3 by Paul Nation, Compass Publishing, 2009.
6) GRE/TOEFL Sources to teach vocabulary

ONLINE SOURCES FOR PRESCRIBED READING TEXTS:

https://www.morningfuture.com
https://www.raeng.org.uk/publications/reports/engineering-in-society
https://digital.library.upenn.edu/women/sultana/dream/dream.html,
https://www.mydronelab.com/blog/what-is-a-drone.html
https://www. Freealbaab.free.fr › The Rules of Life PDF
https://www.poetryfoundation.org ›Gitanjali 35 by Rabindranath Tagore | Poetry Foundation

ONLINE SOURCES FOR PRESCRIBED LISTENING SKILLS:

https://learnenglish.britishcouncil.org/skills/listening
https://agendaweb.org/listening/comprehension-exercises.html
https://www.123listening.com/
https://www.linguahouse.com/learning-english/skill-4-learners/listening
https://www.talkenglish.com/listening/listen.aspx
https://ed.ted.com/

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AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME) P C
3 1.5

(A0091201) DIGITAL ENGLISH LANGUAGE LAB

For Branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

The Digital English Language Lab focuses on the production and practice of sounds of language and equips students with the use of English and vocabulary in everyday situations and contexts.

COURSE OBJECTIVES:

- To facilitate the students to use language effectively in everyday social conversations
- To expose the students to the blend of self-instructional and modes of language learning teacher assisted through digital lab
- To improve the fluency and intelligibility of student in spoken English and neutralize their mother tongue influences
- To help the students to participate in group discussions, to face interviews and shape the individual language learning

COURSE OUTCOMES:

- Social interactions, greetings, self-introductions and group talk
- Improving standard pronunciation patterns and neutralize the mother tongue impact
- Developing communication through listening, reading, speaking and writing activities
- Enhancing vocabulary and grammar to develop professional language
- Improving life skills through GD and role plays practices

MAPPING WITH COS& POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	1	1	2	2	3	-	2
CO2	1	-	-	-	-	2	1	2	2	3	-	2
CO3	1	-	-	-	-	2	1	2	2	3	-	2
CO4	1	-	-	-	-	2	1	2	2	3	-	2
CO5	1	-	-	-	-	2	1	2	2	3	-	2

Digital English Language Lab consists of two parts:

1) CALL (Lab): Computer Assisted Language Learning
2) ICS (Lab): Interactivity Communication Skills

EXERCISE-I

a) Introduction to Phonetics - Speech Sounds - Vowels - Phonetic Transcription -CALL Lab
b) Ice Breaking Activity - Self Introductions (SWOT) –Social Interactions -Pair work - ICS Lab

EXERCISE-II

a) Diphthongs - Consonants - Phonetic Transcription - CALL Lab
b) Just A Minute (JAM) - ICS Lab

EXERCISE-III

a) Listening Comprehension (audio) - IELTS Testing Exercises -CALL Lab
b) Speaking Activity - Group talk - ICS Lab

EXERCISE-IV

a) Vocabulary Building - Synonyms & Antonyms - Analogy - Testing Exercises -CALL Lab
b) Narration of a Story/Event/ Describing an Object - ICS Lab

EXERCISE-V

a) Situational Dialogues - CALL Lab
b) Role Play - ICS Lab

EXERCISE-VI

a) Pronunciation Evaluation Testing Exercises through EPD - CALL Lab
b) Group Discussion - ICS Lab
   - Any student based activities

COURSE OUTCOMES:

Student is able to:

- ❖ Understand the spoken skills from CALL and ICS
- ❖ Know the variations in accent of native and non-native speakers of English and achieve accent neutralization
- ❖ Develop listening comprehension skills

PRESCRIBED SOFTWARE:

K-VAN Solutions (licensed software)

1) Advance Communication Skills Lab
2) English Language Communication Skills Lab
3) Cambridge Advanced Learners' English Dictionary with CD
4) IELTS Academic Preparation and Practice with CD

BOOKS SUGGESTED FOR DELL: (CENTRAL LIBRARY)

1) Skill Pro – A Course in Communication Skills and Soft Skills by Prof. K. Sumakiran et.al, EMESCO.
2) Skill Pro-I Foundation Course - 4 - by Dr. G. Gulam Tariq et.al, Maruthi Publications.
3) Strengthen YourSteps – A Multimodal Course in Communication skills by Dr. M. Hari
4) Prasad et.al
5) English Pronouncing Dictionary Daniel Jones Current Edition with CD
6) English Dictionary for Advanced Learners, (with CD) International edn.Macmillan 2009.

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AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME) P C
3 1.5

(A0092201) ENGINEERING CHEMISTRY LAB

For branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES:

- Verify the fundamental concepts with experiments

COURSE OUTCOMES:

At the end of the course, the students will be able to

- Learning the analytical skills while doing the experiments (L3)
- prepare simple and advanced polymer materials (L2)
- Measure the concentration of the solutions by conductometric titrations (L3)
- Analyse the IR and UV-Visible Spectra of some organic compounds (L3)

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	1	-	-	-	-	1	-	-	1
CO2	-	2	1	-	2	1	1	1	-	-	1	-
CO3	-	1	-	-	1	-	1	-	1	-	-	1
CO4	1	3	2	1	2	-	1	-	-	-	1	1
Course	1	2	1	-	2	1	-	-	1	1		1

LIST OF EXPERIMENTS:

1) Preparation of standard $K_2Cr_2O_7$ solution
2) Estimation of Hardness of Water by using Standard EDTA solution
3) Estimation of Copper by using Standard EDTA solution
4) Estimation of Magnesium by using Standard EDTA solution
5) Estimation of Ferrous Ion by Dichrometry.
6) Determination of Strength of given Hydrochloric Acid against standard sodium hydroxide solution by Conductometric titrations
7) Determination of Strength of given Acetic Acid against standard sodium hydroxide solution by Conductometric titrations
8) Determination of strength of mixture of acids against standard sodium hydroxide solution by conductometric method.
9) Verification of Beer-Lambert's law
10) Determine the strength of Cu(II) ion by colorimeter
11) Preparation of a simple polymer(PVC)
12) Preparation of Bakelite
13) Thin layer chromatography
14) Identification of simple organic compounds by IR and UV-Visible Spectroscopy graphs.
15) HPLC method in separation of liquid mixtures.

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DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME) P 3 C 1.5

(A0591201) PROBLEM SOLVING AND PROGRAMMING LAB

For Branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OUTCOMES:

- To learn about different types of operators
- To learn how decision making is done during programming
- To learn about various simple constructs used for programming
- To learn to define functions and call them with appropriate parameters
- To understand the usage of string libraries to do common string operations
- To understand pointer referencing and pointer dereferencing

COURSE OUTCOMES:

At the end of this course, the student would be able to

- Apply the specification of syntax rules for numerical constants and variables, data types
- Know the Usage of various operators and other C constructs
- Design programs on decision and control constructs
- Develop programs on code reusability using functions
- Implement various concepts of arrays and strings

MAPPING WITH Cos & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	2	-	-	-	-	-	-	-
CO2	2	-	-	-	3	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-
CO4	3	-	2	-	-	-	-	-	-	1	2	-
CO5	-	2	-	-	2	-	2	-	-	-	-	1

RECOMMENDED SYSTEMS /SOFTWARE REQUIREMENTS:

Intel based desktop PC with ANSI C Compiler and Supporting Editors

EXERCISE 1

Write a C program to demonstrate various operators used in C language.

EXERCISE 2

a) Write a C program to find the roots of a quadratic equation.
b) Write a C program to find both the largest and smallest number in a list of integers.

EXERCISE 3

a) Write a C program, which takes two integer operands and one operator from the user, performs the specified operation and then prints the result. (Consider the operators +,- ,*, /, % and use Switch Statement)
b) Write a C Program to find the reverse of a given number.

EXERCISE 4

a) Write a C program to find the sum of individual digits of a positive integer.
b) Write a C program to generate the first ‘n‘ terms of the Fibonacci sequence.

[**Note:** A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.]

c) Write a C program to generate all the prime numbers between 1 and n, where ‘n‘ value is given by the user.

[**Note:** Develop each of the above programs by using different loop constructs supported by C language. (i.e., while, do while and for Loops)]

EXERCISE 5

a) Write a C Program to mask the most significant digit of the given number.
b) Write a program which Prints the following pattern

EXERCISE 6

a) Write a C program to find all the even numbers in the given one dimensional array.
b) Write a C program to print the elements of an array in reverse order.
c) Write a C program to construct a pyramid of numbers.

EXERCISE 7

Write a C program to perform the following operations:

a) Addition of Two Matrices
b) Multiplication of Two Matrices

[Note: Use functions to implement the above specified operations]

EXERCISE 8

Write C programs that use both recursive and non-recursive functions

a) To find the factorial of a given integer.
b) To find the GCD (greatest common divisor) of two given integers.

EXERCISE 9

a) Write a C Program to solve the Towers of Hanoi problem by using recursive function.
b) Write a C Program to demonstrate the various storage classes, which are supported by the C language. [i.e., automatic, external, static and register]

EXERCISE 10

a) Write a C Program to demonstrate that, how to pass an entire array as an argument to a function with a suitable example.
b) Write a C Program to perform various operations on given two strings using string handling functions.

EXERCISE 11

a) Write a C program that uses functions to perform the following operations:
   i) To insert a sub-string in to a given main string from the specified position.
   ii) To delete '**n**' Characters from a given position in a given string.
b) Write a C program to determine if the given string is a palindrome or not.

EXERCISE 12

a) Write a C program that displays the position or index in the string 'S' where the string 'T' begins, or – 1 if 'S' doesn't contain 'T'.
b) Write a C program to count the lines, words and characters in a given text.

EXERCISE 13

a) Write a C program to reverse the first 'n' characters in a file.
b) Write a C program to merge two files into a third file.

REFERENCE BOOKS

1) Programming in C, Pradeep Dey, Manas Ghosh, Oxford Heigher Education
2) The Spirit of C, an introduction to modern programming, M.Cooper, Jaico Publishing House.
3) Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.
4) Computer Basics and C Programming, V. Raja Raman, PHI Publications

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem (ME)

L	T	C
2	1	3

(A0007202) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

For Branches: CE, EEE, ME, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES:

- To familiarize the concepts of ordinary and partial differential equations.
- To equip the students to analyze vector differentiation and the evaluation of line, surface and volume integrals and their applications in electromagnetic theory, transmission lines etc.,

COURSE OUTCOMES:

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

- Obtain the knowledge of first and higher order differential equations and its use in solving Circuit analysis, heat transfer problems in engineering.
- Analyze solving higher order linear differential equations with variable coefficients and its applications.
- Understand about formation and solution of partial differential equations and importance in thermodynamics, continuum mechanics and fluid mechanics.
- Understand about vector differentiation and its applications in Electromagnetic theory.
- Apply the concept of vector integration to solve many problems in field theory, Electromagnetic theory and transmission lines.

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	-	-	-
CO2	3	2	2	3	3	-	-	-	-	-	-	-
CO3	2	2	3	2	2	-	-	-	-	-	-	-
CO4	3	2	2	3	2	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-

UNIT-I

Differential equations of first order and first degree – Formation of ODEs – Solution of ODEs - Exact, Non – Exact, Linear and Bernoulli's equations – Applications of ODEs to L – R & C – R circuits.

UNIT – II

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type, e^{ax}, $\sin ax, \cos ax$, Polynomials in x, $e^{ax}V(x)$, $xV(x)$, Method of Variation of parameters.

UNIT – III

Higher Order linear Differential Equations with variable coefficients: Cauchy's and Legendre's linear Differential equations, simultaneous linear differential equations with constant coefficients.

UNIT – IV

Partial Differential Equations of First order:

First order partial differential equations, Formation of partial differential equations, solutions of first order linear and non – linear Partial differential equations. Method of separation of variables.

UNIT - V

Vector Differentiation: Introduction of Vector differentiation– Scalar and vector point functions – Gradient of scalar function– Directional derivatives – Divergence of a vector function – Curl of a vector function – Properties of Grad, Div and Curl.

UNIT – VI

Vector integration: Line integral - Potential function – Area, Surface and volume integrals. Vector integral theorems: Green's theorem – Stoke's and Gauss Divergence Theorem (excluding their proof), Verification of Green's, Stoke's and Gauss Theorems.

TEXTBOOKS:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.
2) R. K. Jain, S. R .K. Iyengar, Advanced Engineering Mathematics, Alpha Science.
3) T.K.V. Iyengar, B. Krishna Gandhi, A Text Book of Engineering Mathematics, Vol – 1, S. Chand & Company.

REFERENCES:

1) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2) Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.
3) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem (ME)

L	T	C
2	1	3

(A0009202) ENGINEERING PHYSICS

For branches: CE & Mech

COURSE OBJECTIVES:

- To provide basic concepts of interaction of light with matter, nanomaterials, ultrasonics and quantum physics to the engineering students.

COURSE OUTCOMES:

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

- Apply the concept of light to test the material properties
- Construct a quantum mechanical model to explain the behavior of a system at the microscopic level.
- Apply the knowledge of nanomaterials in the development of nanotechnology.
- Detect the flaws present in the materials using ultrasonics
- Apply the functional materials for the benefit of mankind.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	1	1	-	-	-	-	-	-	1
CO2	3	-	1	1	2	-	-	-	-	-	-	-
CO3	3	-	2	2	2	-	1	-	-	-	-	1
CO4	1	3	2	1	1	-	-	-	-	-	-	-
CO5	1	3	2	-	2	-	-	-	-	-	-	1

UNIT-I: WAVE OPTICS (9 h)

Interference: Introduction –Division of amplitude–Newton's rings and its applications. **Diffraction:** Introduction – Fraunhofer diffraction at single slit– Diffraction Grating– Grating spectra – Determination of wavelength of light.

UNIT-II: QUANTUM MECHANICS (9 h)

Introduction to quantum physics – Wave-Particle duality – de Broglie hypothesis – Verification of wave character of Matter waves (Davison–Germer experiment)– Uncertainty principle– Thought experiment (Electron diffraction) – Wave function (ψ) –Schrodinger's one-dimensional time-independent wave equation – Particle in 1D-potential box.

UNIT III: THE CRYSTAL STRUCTURE OF SOLIDS (9 h)

Introduction –Space lattice – Basis – Unit cell (primitive and Non-primitive) – Crystal systems – Bravais lattices –Atomic radius, Nearest neighbouring distance, Coordination numberand packing factor for SC, BCC, FCC lattices – Diamond structure – Crystal planes and directions–Miller Indices – calculation of interplanar distance.

UNIT-IV: ULTRASONICS (9 h)

Introduction – Production of ultrasonics by magnetostriction and piezoelectric method – Detection methods – Properties – Cavitation – Pulse-echo & Transmission mode of non-destructive testing (NDT) methods – General applications of ultrasonics.

UNIT-V: NANOMATERIALS (9 h)

Introduction – Properties of nanomaterials: Surface area to volume ratio and Quantum confinement – Synthesis of nanomaterials – Ball milling – Sol-gel – chemical vapour deposition (CVD) techniques– Carbon nanotubes (CNTs) –Applications.

UNIT-VI: FUNCTIONAL MATERIALS (9h)

Introduction –Fiber reinforced plastics (FRPs), Constituents of FRP reinforcement, Properties, Applications; Shape memory alloys (SMAs), Different phases, SAME (one-way and two-way), Applications.

TEXT BOOKS

1) M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" AText book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2) R. K. Gaur and S.C. Gupta, "Engineering Physics",DhanpatRai Publications, New Delhi.

REFERENCES

1) "Concepts of Modern Physics",Arthus Beiser, Tata Mc Graw Hill Publications, New Delhi.
2) "Physics Volume – II", Resnick, Halliday and Krane, Wiley, New Delhi.
3) "Elements of Solid State Physics", J.P. Srivastava, PHI Learning, 4th eds.New Delhi.
4) "Introduction to Nanotechnology", Charles P. Poole and Frank J. Ownen, Wiley.
5) "Applied Physics", S.P.Basavaraju, Subhas Stores, Bangalore.
6) "Nanotechnology", M.Ratner & D. Ratner, Pearson Ed, New Delhi.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem(ME)

L	T	C
2	1	3

(A0502202) DATA STRUCTURES

For Branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES:

- To make students aware about structures and unions in C language.
- To provide exposure on various searching and sorting techniques.
- To provide exposure on various data structures like stacks, queues, circular queues and linked lists etc.,
- To develop solutions for various problems by using C Programming.

COURSE OUTCOMES:

At the end of this course, the student would be able to

- Develop programs with user defined data types.
- Apply various file handling techniques for better data management
- Apply stacks in various applications
- Apply queues in various applications and distinguish between stacks and queues.
- Analyse various dynamic data structures.
- Implement various searching and sorting techniques

MAPPING WITH COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	2	-	-	-	2	-	-	2
CO2	3	-	3	-	-	2	-	-	-	-	2	-
CO3	3	2	-	-	-	-	3	-	-	-	-	-
CO4	-	3	-	-	-	-	2	-	-	-	-	-
CO5	3	3	2	-	-	2	3	-	-	-	-	-
CO6	3	-	-	2	3	3	-	-	-	-	-	-

UNIT I

Pointers: Pointer variable and its importance, Pointer variable declaration, initialization of pointer variables, how to access a value from a memory location through it‘s pointer variable. Arithmetic operations on pointer variables, Scale factor length. Pointers and functions - pointers as function arguments (i.e., call-by-reference), Pointers and Arrays, Pointers and Strings, Generic Pointers.

Learning Outcomes: Student should be able to

1) Explain different types of pointers and their usage. (L2)
2) Understand, solving of arithmetic operations on pointer variables (L2)
3) Apply pointers on functions, arrays and strings (L4)

UNIT II

Structure and Unions In C Language: Structures – Introduction, Features of Structures. Declaration and Initialization of Structures, Accessing structure members, structure initialization. Nested Structures, Array of Structures, Arrays within structures and Pointers to Structures, Structures and Functions, Unions, typedef. Example Programs on the topics mentioned above.

Learning Outcomes: Student should be able to

1) Use Structures and Unions in applications using C programming. (L3)
2) Apply the structures and union concepts to solve real world problems. (L2)

UNIT III

Introduction to Data Structures: Classification of data structures, dynamic memory allocation functions in C language. **Stacks:** Definition, Various representation methods, operations on stacks and their implementation in C language, applications of stacks.

Learning Outcomes: Student should be able to

1) Apply the concepts of Data structures to solve the real world problems (L4)
2) Understand the concepts of Stacks and also its applications (L2)
3) Describe the operations of Stacks. (L2)

UNIT IV

Queues: Definition, Various representation methods, operations on queues and their implementation in C language, applications of queues. Circular queues- operations on circular queues and their implementation in C language.

Learning Outcomes: Student should be able to

1) Understand the concepts of Queues and also its applications (L2)
2) Describe the operations of Queues. (L2)

UNIT V

Linked Lists: Definition, Various representation methods, operations on linked lists and their implementation in C language.

Learning Outcomes: Student should be able to

1) Understand the concepts of Linked list (L2)
2) Use the linked lists in various operations. (L3)

UNIT VI

Searching and Sorting Techniques: Searching Techniques - Linear search and Binary Search Techniques. Sorting techniques - Bubble Sort, Selection Sort, Insertion Sort. Implementation of all the above mentioned techniques in C language and trace them by giving different test data.

Learning Outcomes: Student should be able to

1) Design the different sorting techniques (L6)
2) Use Linear search and Binary search methods. (L3)

TEXT BOOKS:

1) PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2) B.A.Forouzon and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016

REFERENCE BOOKS:

1) Byron Gottfried, “Programming with C”, Schaum’s Outlines, 2nd Edition, TATA McGraw-Hill.
2) M.T.Somashekara, “Problem Solving Using C”, PHI, 2nd Edition 2009.
3) A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press
4) Rajaraman V., "The Fundamentals of Computers", 4th Edition, Prentice Hall of India, 2006.
5) R S Bichker, "Programming in C", University Press, 2012.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem(ME)

L	T	C
2	1	3

(A0303202) MATERIAL SCIENCE

[For Mech. Engg. Only]

COURSE OBJECTIVES:

- To gain knowledge of different material crystal structures and their mechanical Properties.
- To able to understand the phase transformations of metals and its alloys with help of equilibrium diagrams.
- Able to understand the characterization of the materials.
- Able to select the suitable ferrous metals, nonferrous metals and alloys for the given application.

COURSE OUTCOMES:

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

- Understand basic concepts of crystallography of metals, material properties.
- Construct the Phase diagrams and interpret the data.
- Perform experiments to evaluate the properties of the Engineering Materials.
- Identify, formulate and solve material science and metallurgical problems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	2	2	1	-	-	2	-	1	2	3	2	2
CO2	2	3	2	2	1	-	-	1	-	1	-	-	1	2	3	2
CO3	2	3	2	3	2	1	-	-	1	-	-	1	2	2	2	3
CO4	3	3	2	-	2	-	-	-	-	-	1	-	1	2	1	2

UNIT: I

Structure of Metals: Space lattice, Unit cell-Crystal structures (BCC, FCC and HCP)-Crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys - Mechanical properties of Engineering materials.

Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rothery's rules.

UNIT II

Crystal Defects and Deformation of Metals: Types of imperfections: point, line and surface defects. **Deformation of Metals:** Comparison between elastic and plastic deformation of metals, Modes of Plastic Deformation: Slip, Twinning. Types of Dislocations: Edge dislocation, Screw dislocation.

UNIT III

Testing of engineering materials: Testing of materials under tension, Compression and shear loads, Hardness tests- Brinell, Vicker's and Rockwell, Impact test- Izod and Charpy tests, Fatigue and creep tests.

UNIT IV

Steels and Cast Iron: Allotropy and phase changes of pure iron- Iron-Iron carbide ($Fe-Fe_3C$) equilibrium diagram-Lever rule, Gibb's Rule, Types of steels- Low, medium and high carbon steels. Alloy steels-Stainless steel, Tool steels & die steels and their applications.

Cast Irons: Types- White, grey, malleable and nodular cast irons and properties and applications.

UNIT V

Heat Treatment of Alloys: Effect of alloying elements on $Fe-Fe_3C$ system, Annealing, Spheroidizing, normalizing, Hardening, Tempering- Surface hardening methods.

UNIT VI

Non-Ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

TEXT BOOKS:

1) Introduction to Physical Metallurgy / Sidney H. Avener.TMH Publications,2nd Edition, 1997
2) Material Science and Engineering / V. Raghavan, 5th Edition, PHI Publications, 2011

REFERENCES:

1) Material Science and Metallurgy for Engineers by V.D kodgire, Everest publishing house, 2011.
2) Introduction to Engineering Materials, B.K Agarwal, 21st Reprint, TMH publications, 2007
3) Essential of Materials science and engineering/ Donald R.Askeland/Thomson publications, 2004
4) Engineering Materials and Metallurgy, R.K Rajput, S. Chand Ltd, 2006.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem(ME)

L	T	C
2	1	3

(A0304202) BASIC ENGINEERING MECHANICS

[For Mech. Engg. Only]

COURSE OBJECTIVE:

- To apply the knowledge of mathematics, Science and Engineering and to expand this into the vast area of 'rigid body mechanics'
- To impart knowledge about the basic laws of statics and their applications in problem solving.
- To enhance the ability to design and solve open ended problems.
- To prepare the students for higher level of courses in the demine of mechanical engineering.

COURSE OUTCOMES:

After completion of the course the student will be able to

- Apply the various laws of engineering mechanics for solving simple and complex problems
- Apply analytical skills for analysing statically equilibrium problems
- Calculate and analyse the properties (C.G and M.I) of the rigid bodies and also solve problems related to friction
- Plan and conduct appropriate experimentation and interpret the data.

MAPPING OF COs & POs:

	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	2	-	-	-	2	2	-	3	2	3	2
CO2	3	2	3	2	3	1	-	-	-	2	-	-	3	2	3	2
CO3	3	2	2	1	3	1	-	-	2	2	-	1	2	2	2	2
CO4	3	2	2	2	3	1	-	-	2	2	1	-	2	-	3	2

UNIT-I

Introduction to Engineering Mechanics- classification of engineering mechanics – basic terminologies in mechanics - units and dimensions – laws of mechanics – parallelogram and triangular law of forces – Lame's theorem- principle of transmissibility – single equivalent force – simple problems

UNIT-II

Equilibrium of rigid body- composition system of forces – resolution of forces – general method of composition of forces – equilibrium of bodies – equilibrium of connected bodies – simple examples - Moment of a force – Varignon's theorem – couple – resultant of non-concurrent force system- x and y intercept of resultant- simple problems

UNIT-III

Support Reactions- introduction – types of supports – types of loading – analytical method for finding out the reactions of a beam – simple problems on simply supported beams, overhanging beams and roller and hinged supports beams.

UNIT-IV

Center of gravity and centroid – Determination of areas – First moment of area and the centroid of sections – Rectangle, circle, triangle from integration – T-section, I-section, angle section, hollow sections by using standard formula

UNIT-V

Area moment of inertia and mass moment of inertia – Introduction – radius of gyration – theorem of perpendicular axis – theorem of parallel axis – second moment of area – rectangle, circle, triangle from integration – T-section, I-section, angle section, hollow section by using standard formula – polar moment of inertia – mass moment of inertia

UNIT-VI

Friction- Introduction - Types of friction - laws of Coulomb friction – Frictional force –Angle of repose –Equilibrium of a body lying on rough inclined plane – Analysis of ladder friction – Analysis of wedge friction

TEXT BOOKS

1) Engineering Mechanics by Shames & Rao – Pearson Education, 2005
2) Engineering Mechanics by Dr.R.K.Bansal, Lakshmi Publications, 2009
3) Engineering Mechanics – B. Bhattacharyya, Oxford University Publications, 2008
4) Engineering mechanics by S S Bhavikatti, New age International Publications, 2017.

REFERENCE BOOKS:

1) Engineering Mechanics by FedrinandL.Singer – Harper Collings Publishers, 1994
2) Engineering Mechanics by SeshigiriRao, Universities Press, Hyderabad, 2005
3) Engineering Mechanics by Rajsekharan, Vikas Publications, 2005
4) Engineering Mechanics (Statics and Dynamics) by Hibller and Gupta; Pearson Education, 2016
5) Engineering Mechanics by S.Timoshenko, D.H.Young and J.V.Rao, Tata McGraw-Hill Company, 2013
6) Engineering Mechanics by Chandramouli, PHI publications, 2011
7) Engineering Mechanics –Arthur P. Boresi and Richard J. Schmidt. – Brooks/Cole – Cengage, 2002.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem(ME)

L	T	C
2	0	0

(A0010202) ENVIRONMENTAL SCIENCE

(Mandatory Learning Course)

For branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES:

- Creating the awareness about environmental problems among people.
- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
- Environmental education should have an interdisciplinary approach by including physical, chemical, biological as well as socio-cultural aspects of the environment. It should build a bridge between biology and technology.

COURSE OUTCOMES:

- Understand environmental problems arising due to developmental activities.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify the natural resources and suitable methods for conservation of environment.
- Identify the environmental pollutants and abatement devices.
- Adopt practices that help in promoting balance in nature by making judicious utilization of recourses.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL SCIENCE

Environment - Definition, Scope, Importance and Need for public awareness. Segments of Environment (Atmosphere, Lithosphere, Hydrosphere and Biosphere).

UNIT II RESOURCES AND UTILIZATION

Renewable and Non-renewable resources.

a) Natural Resources: Soil &Water sources (conflicts of over utilization of water Resources - Hydro power project-problems), forest & mineral resources – Utilization-problems.
b) Non-conventional resources of energy(Solar Energy, wind energy and their applications)

UNIT III

a) **CONCEPTS OF ECO-SYSTEM**
   Structure and functions of an ecosystem: Producers, Consumers and Decomposers- Interaction between biotic and abiotic factors in an ecosystem- Trophic levels- Food chain- Food web –Ecological Pyramid.
b) **TYPES OF ECOSYSTEM**
   Understanding the types of ecosystem: (i) Terrestrial (forest)(ii) Aquatic – (Marine)

UNIT IV BIODIVERSITY

Introduction – Definition – Value of biodiversity- Biodiversity at global, National and Local levels- India as a mega diversity nation-Hot-spots of biodiversity-Threats to biodiversity- IUCN Red data book - Conservation of bio diversity (Insitu and Exsitu conservation methods).

UNIT V ENVIRONMENTAL POLLUTION

Introduction- Causes, effects and control measures of

a) Air pollution
b) Water pollution
c) Soil pollution
d) Noise pollution
e) Plastic pollution

Disaster management: Floods, Earthquake.

UNIT-VI

HUMAN POPULATION ISSUES

a) Demography-problems related to Population explosion- Age structure-Family welfare and family planning programme
b) Diseases- AIDS, Malaria, COVID, Cancer.
c) Human rights, Fundamental duties and Value of education.

ENVIRONMENTAL ISSUES

a) Climatic changes
b) Greenhouse effect and global warming.
c) Ozone layer depletion.
d) Acid rain.

TEXT BOOKS:

1) Deswal, S and Deswal A., (2004), A Basic Course in Environmental Studies, DhanpatRai & Co. Delhi.
2) Anubha Kousik and C P Kousik., New age international publishers.

REFERENCES:

1) Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,
3) Ahmedabad –380 013, India, Email:mapin@icenet.net (R)
4) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME) P 3 C 1.5

(A0592201) ENGINEERING WORKSHOP & IT WORKSHOP

For Branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

ENGINEERING WORKSHOP

COURSE OBJECTIVES:

- To familiarize with the basic manufacturing processes and to study the various tools and equipment used, hands-on training is given in different sections. Essentially student should know the labour involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work.

COURSE OUTCOMES:

At the end of the Engineering Work Shop:

- A student should know the basic knowledge of various tools and their use in different sections of manufacturing such as fitting, carpentry, tin smithy, welding etc. and basic engineering practices such as plumbing, electrical wiring, electronic circuits, machine shop practice.
- Ability to design and model various basic prototypes in the trade of fitting such as Straight fit, V- fit.
- Ability to make various basic prototypes in the trade of Tin smithy such as rectangular tray, and open Cylinder.
- Ability to perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring, Go down wiring.

MAPPING OF COs& POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	2	2	1	-	-	-	2	-	2	1	1	-	-
CO2	-	-	-	-	2	1	-	-	2	2	2	-	2	-	-
CO3	-	-	-	-	2	1	-	-	2	2	2	-	2	-	-
CO4	-	-	-	-	2	1	-	-	2	2	2	-	2	-	-

Note: At least two exercises should be done from each trade.

1. TRADES FOR EXERCISES:

A] Carpentry

1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint
4. Mortise and Tennon Joint

B] Fitting

1. Vee Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

C] House Wiring

1. Parallel / Series Connection of two/three bulbs
2. Stair Case wiring
3. Tube Light Wiring
4. Measurement of Earth Resistance/Go down Wiring

D] Tin Smithy

1. Rectangular Tray
2. Square Box without lid
3. Open Scoop
4. Funnel

E] Welding

1. Single V butt joint
2. Lap joint

3. Double V butt joint
4. T fillet joint.
5. Gas Welding

F] Soldering

1. Soldering & Desoldering Practice
2. Series Circuit
3. Parallel Circuit

2. TRADES FOR DEMONSTRATION:

a) Plumbing
b) Machine Shop
c) Bosch Power Tools

REFERENCE BOOKS:

1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers, 2013
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas, 2009
4. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House, 1999.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

IT WORKSHOP

COURSE OBJECTIVES:

- The modules include training on PC Hardware, and Productivity tools including text processor, spread sheet, presentation tools. It enables the students to understand and fix the common hardware, software issues & makes the students to install either Windows or UNIX based Operating system in the machines.
- Enable students to understand how computers work, different types of computers, functions of applications, input and data storage devices, different operating systems,
- It makes the students to understand and use the common office suite tools like word, excel etc. effectively in their daily usage.

COURSE OUTCOMES:

By the end of module students will be expected to demonstrate

- PC Hardware- introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer. The students should work on working PC to disassemble and assemble to working condition.
- To do installation of system software like MS Widows and Linux and the required device drivers.
- Productivity tools- module would enable the students in crafting professional word documents; excel spread sheets and power point presentations using the Microsoft suite of office tools.

MAPPING WITH COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	2	-	-	-	-	-	-	-	-			
CO2	2	2	-	2	-	-	-	-	-	-	-	-			
CO3	2	2	-	-	-	-	-	-	-	3	-	-			

PC HARDWARE

Exercise 1 - Identify the peripherals of a computer, components in a CPU and its functions.

Exercise 2 - Every student should disassemble and assemble the PC back to working condition.

Exercise 3 – Every student should individually install MS windows on the personal computer and also install Linux as dual boot with Windows.

OFFICE TOOLS

Exercise 4 - Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office equivalent tool word: Importance of LaTeX and MS office tool Word as word Processors, Details of the four tasks and features that would be covered in each. Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 1-Task III: Using Word Processor to create 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 Word.

SPREAD SHEET

Exercise 5–Spread Sheet Orientation: The mentor needs to tell the importance of MS office 2007,2010/ equivalent 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-Task III: Features to be covered: - Gridlines, Format Cells, Summation, auto fill, Formatting Text, Formulas, Functions

PRESENTATION

Exercise 6 -Students will be working on basic presentation utilities and tools which help them create basic power point presentation. Topic covered during this Exercise includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

REFERENCES:

1) Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2) LaTeX Companion – Leslie Lamport, PHI/Pearson.
3) Introduction to Computers, Peter Norton, 6/e Mc Graw Hill
4) Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education
5) Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dreamtech
6) IT Essentials PC Hardware and Software Companion Guide, Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem(ME) P 3 C 1.5

(A0093201) ENGINEERING PHYSICS LAB

For branches: CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES:

- The laboratory should help the student to develop a broad array of basic skills and tools of experimental physics and data analysis.
- The laboratory should help students to understand the role of direct observation in physics and to distinguish inferences based on theory and the outcomes of experiments.
- To learn about the optical experiments in establishing the fundamentals in Interference and Diffraction phenomena which will be visualized with the light and laser experiments mentioned in the syllabus.
- To learn about the basic electronic experiments such as energy band gap determination, Hall Effect to know the type of extrinsic semiconductors, Stewart-Gee's experiment in field intensity determination and Solar I-V characteristics.

COURSE OUTCOMES:

After completion of the course the students will be able to

- Operate optical instruments like microscope and spectrometer
- Estimate the wavelength of different colors using diffraction grating
- Study the variation of intensity of the magnetic field due to circular coil carrying current with distance
- Identify the type of semiconductor (i.e., n-type or p-type) using Hall Effect

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	2	-	-	-	-	-	-	1	-	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	1	1	-	-	-	-	-	-	1	-	-	-
CO4	2	3	-	1	2	-	-	-	-	-	-	1	-	-	-

LIST OF EXPERIMENTS (Any10 Experiments)

1) Determination of radius of curvature of a given plano-convex lens using Newton's rings method.
2) Determination of thickness of a thin wire/film by Wedge shape method.
3) Determination of wavelength of spectral lines using Transmission Grating and Spectrometer.
4) Determination of wavelength of a sodium light by normal incidence method.
5) Determination of dispersive power of a prism using spectrometer.
6) Determination of wavelength of a laser using transmission grating.
7) Determination of particle size by laser diffraction.
8) Determination of numerical aperture of an optical fiber.
9) Study of variation of magnetic field along the axis of a circular coil carrying current using Stewart and Gee's method.
10) Determination of rigidity modulus of a given wire using Torsional Pendulum.
11) Determination of energy band gap of a Si or Ge semiconductor by Four probe method.
12) Study of B – H Curve of a ferromagnetic material.
13) Determination of carrier density and Hall coefficient or magnetic flux density of an extrinsic semiconductor using Hall effect.
14) Study current (I) and voltage (V) characteristics of a Solar Cell.
15) Measurement of Curie temperature of a given ferroelectric material by studying the temperature dependence of dielectric constant.

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3 | 1.5

(A0593202) DATA STRUCTURES LAB

For Branches CE, EEE, ME, ECE, CSE, CSE(DS), CSE&BS

COURSE OBJECTIVES:

- To understand how to use structures and unions as a compound data types
- To understand various basic file operations
- To understand various stack and queue operations
- To understand various linked list operations
- To understand basic searching and sorting techniques

COURSE OUTCOMES:

At the end of this course, the student would be able to

- Develop applications on user defined data types
- Apply dynamic memory allocation through pointers
- Use different data structures for create/update basic data files
- Implement linear data structures through stacks and queues
- Implement various searching and sorting techniques, Linked lists.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	2	-	-	-	2	-	-	2
CO2	3	-	3	-	-	2	-	-	-	-	2	-
CO3	3	2	-	-	-	-	3	-	-	-	-	-
CO4	-	3	-	-	-	-	2	-	-	-	-	-
CO5	3	3	2	-	-	2	3	-	-	-	-	-

RECOMMENDED SYSTEMS /SOFTWARE REQUIREMENTS:

Intel based desktop PC with ANSI C Compiler and Supporting Editors

EXERCISE 1

a) Write a C Program to perform various arithmetic operations on pointer variables.
b) Write a C Program to demonstrate the following parameter passing mechanisms:
   i) Call-by-value
   ii) Call-by-reference

EXERCISE 2

a) Write a C Program to copy the contents of one structure variable to another structure variable.
b) Write a C program to implement nested structure to store and display the student information. The structure student contains the field‘s S.no, name, and date. Date is the nested structure and it contains the fields day, month and year.

EXERCISE 3

a) Write a C program to add two distances which is in feet and inches
b) Write a C program to illustrate passing the whole structure as argument to a function.

EXERCISE 4

Write a C program that uses functions to perform the following operations:

a) Reading a complex number
b) Writing a complex number
c) Addition of two complex numbers
d) Multiplication of two complex numbers (Note: represent complex number using a structure.)

EXERCISE 5

a) Write a C program to implement Union Concept.
b) Write a C program which copies last ‘n‘ characters from one file to another.

EXERCISE 6

Write a C program to implement the following operations on Stack using array representation

a) Push
b) Pop
c) Display

EXERCISE 7

Write a C program to implement the following operations on Queue using array representation

a) Insert
b) Delete
c) Display

EXERCISE 8

Write a C program to implement the following operations on Singly Linked list using linked representation

a) Insert
b) Delete
c) Display
d) Search

EXERCISE 9

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order.

a) Bubble sort
b) Selection sort
c) Insertion sort

EXERCISE 10

Write C program to implement the following searching methods to search an element in a given list of integers

a) Linear Search
b) Binary Search

REFERENCE BOOKS:

1) Programming in C, Pradeep Dey, Manas Ghosh, Oxford Heigher Education
2) Computer programming and Data Structures, E.Balaguruswamy, Tata Mc Graw Hill. 2009 revised edition.
3) Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.

R G M COLLEGE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

INSTITUTE VISION

- To develop this rural based engineering college into an institute of technical education with global standards
- To become an institute of excellence which contributes to the needs of society
- To inculcate value based education with noble goal of "Education for peace and progress"

INSTITUTE MISSION

- To build a world class undergraduate program with all required infrastructure that provides strong theoretical knowledge supplemented by the state of art skills
- To establish postgraduate programs in basic and cutting edge technologies
- To create conductive ambiance to induce and nurture research
- To turn young graduates to success oriented entrepreneurs
- To develop linkage with industries to have strong industry institute interaction
- To offer demand driven courses to meet the needs of the industry and society
- To inculcate human values and ethos into the education system for an all-round development of students

INSTITUTE QUALITY POLICY

- To improve the teaching and learning
- To evaluate the performance of students at regular intervals and take necessary steps for betterment
- To establish and develop centres of excellence for research and consultancy
- To prepare students to face the competition in the market globally and realize the responsibilities as true citizen to serve the nation and uplift the country's pride.

VISION OF THE DEPARTMENT

- To be a center of excellence by offering UG, PG and Research programs in cutting edge technologies of Mechanical Engineering in collaboration with industries.

MISSION OF THE DEPARTMENT

- To Produce Mechanical Engineers who are exceptionally competent, disciplined and have a sense of devotion to their profession by adapting modern teaching and learning process.
- To establish modern laboratory facilities to impart quality education in association with Industry-Institute interaction.
- To inculcate research orientation among the student community

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

1) PEO-1 is Consistent with the mission statement that the Mechanical Engineers who are exceptionally competent to face the challenges in Mechanical engineering stream
2) PEO-2 is consistent with mission statement that, the Mechanical Engineers are able to design and construct mechanical systems with industry collaboration
3) PEO-3 is consistent with the mission statement that, the mechanical engineers have an ethical attitude and have an interest towards research
4) PEO-4 is Consistent with the mission statement that, the mechanical engineers can learn leadership quality and entrepreneurial skills when they are working with industry

PROGRAM SPECIFIC OUTCOMES

1) The graduate will be able to design systems, components or process for broadly defined engineering technology problems appropriate to programme educational objectives.
2) The graduates will be able to apply modern engineering tools viz., CAD/CAM packages for modeling, analysis and predicting simple to complex engineering activities with an understanding of the limitations.
3) The graduate will be able to apply oral and graphical communication in both technical and non-technical environment.
4) The graduate will be able to engage in self-directed continuing professional development and have a strong commitment to address ethical and professional responsibilities

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DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1) Engineering knowledge: Apply the knowledge of mathematics, science, and engineering specialization to the solution of complex engineering problems.
2) Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
4) Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
5) Modern tool usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
8) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9) Individual and team work: Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.
10) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team to manage projects and in multi-disciplinary environments.
12) Life-Long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.