RGM COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

Affiliated to JNTUA-Ananthapuramu, Approved by AICTE-New Delhi,
Accredited by NBA-New Delhi, Accredited by NAAC with A+ Grade-New Delhi
Nandyal – 518501, AP, India

DEPARTMENT OF MECHANICAL ENGINEERING

Regulations, Course Structure and Detailed Syllabus

RGM-R-2020

(ESTD-1995)

Applicable for students admitted into
B.Tech (Regular) from 2020-2021
B.Tech (Lateral Entry Scheme) from 2021-22

RGM 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/EAPCET

iii) examination conducted by AP State Council for Higher Education (APSCHE) for allotment of a seat by the Convener, EAMCET/EAPCET, 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/EAPCET) seats will be filled by the Convener, EAMCET/EAPCET.

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 160 credits with compulsory subjects as listed in Table-1.

Table 1: Compulsory Subjects

S.No	Subject Particulars		
1	All the subjects offered in B.Tech course / MOOCs	7	Technical Seminar
2	**Mandatory Learning Courses** [Environmental Science, Environmental Engineering, Universal Human Values, Indian Heritage and Culture, Constitution of India, Induction Program, Essence of Indian Traditional Knowledge]	8	2 Months Internships - Two
3	All Practical Subjects	9	6 Month Internship
4	All Skill Oriented Courses /Skill Advanced Courses/ Soft Skill Courses	10	Main Project Work
5	Comprehensive Viva	11	Universal Human Values as 03 credits course with effective from 2021 admitted students.
6	Environmental Sciences/ Universal Human Values/ Environmental Engineering/ Indian Heritage and Culture/ Constitution of India/ 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) **Electrical and Electronics Engineering**
3) **Mechanical Engineering**
4) **Electronics and Communication Engineering**
5) **Computer Science and Engineering**
6) **Computer Science and Engineering (Data Science)**
7) **Computer Science and Engineering and Business Systems**

Table 2: Credits

Subject	Semester			
	Periods/ Week	Credits	Internal Marks (IM)	External Marks (EM)
Theory	2+1*	3	30	70
Mandatory Learning Courses (Internal Evaluation)	2	-	-	-
Practical	3	1.5	25	50
Drawing	1+4 P	3	30	70
Skill Development Courses (Internal Evaluation)	1+2*	2**	30	70
Summer Internship /CSP Two months (Mandatory) after second year (to be evaluated along with 5th Semester end examinations)/ Community Service Project (Internal Evaluation)	-	1.5	-	100 Certificate from Internship Agency/ signed by any authorized person. Evaluation will be carried as per the guidelines of APSCHE
Industrial/Research Internship Two months (Mandatory) after third year (to be evaluated along with 7th Semester end examinations)	-	3	-	100 Certificate from Internship Agency Evaluation will be carried as per the guidelines of APSCHE ***40% for report, 60% Oral Presentation***
Comprehensive Viva (CV) in VII Semester	-	1	-	50
Major Project	-	6	50	100
Technical Seminar	-	1	50	-
6 Months Internship in Industry	-	5	-	Certificate from Internship Agency/ Industry

Note: * Tutorial

Note: ** [Skill Development Course/ Mandatory Learning Course 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. 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 2 hours. 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

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.

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 courses being offered by eligible external agencies and

prepare a fresh list every year incorporating latest courses based on industrial demand.

vi) 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.

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

viii) 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 Honours Programme**

i) Students of a 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 4th semester provided that the student must have acquired a minimum of 8.0 SGPA up to the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th 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. 160 credits).

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 has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.

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 4^{th} semester 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 2^{nd} semester without any history of backlogs. It is expected that the 3^{rd} semester results may be announced after the commencement of the 4^{th} semester. If a student fails to acquire 8 SGPA up to 3^{rd} 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. 160 credits).

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)

iii) 6 Months internship in industry (During 8th Semester)

The student has to (mandatory) undergo summer internship in II year–II Sem break in a reputed organization for two months. 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.

5.0 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 answer 5 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 7^{th} semester. 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 seminar (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 /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.

Table 4: 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	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.
4	Comprehensive Viva (CV)	50	External evaluation		This end viva-voce examination in all the subjects for 50 marks
5	Project work	50	Internal evaluation		Project work for 50 marks
		100	External evaluation		This end viva-voce in project work for 100 marks
6	Skill Oriented Courses/ Skill Advanced	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.

	Courses/ Soft Skill Courses	70	Internal Evaluation	Based on the performance in the end examination.
7	Internship/ Internal Project/ Study Report/ Work shop	100	Internal evaluation	As per the Guidelines of APSCHE
8	Mandatory Learning Courses	-	-	No examinations. Attendance minimum is required.
9	EAA	-	Internal evaluation	Based on performance and committee report.
10	Technical Seminar	50	Internal Evaluation	Based on Seminar Report, performance and committee report.

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.

6.7. A student is eligible to write the University examinations if he acquires a minimum of 50% in each subject and 75% of attendance in aggregate of all the subjects after Condonation. In case of the student having less than 50% of attendance in any one of the courses (**One subject / lab only**) during that particular semester, he/she will not be permitted to register and appear for that particular course in that particular semester end examinations. In such cases, the students need to register for makeup classes which will be notified by the CoE office after the completion of that particular semester or at appropriate time whichever is applicable. The students need to secure **90%** of the attendance in the make-up classes to appear for the supplementary examinations thereafter and this will be treated as a second attempt. The number of makeup classes to be conducted will be at least 35% of the regular class work taken in that particular course. **If the attendance is less than 50% in more than one subject/lab he/she will be completely detained in that semester**.

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 Courses or 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 year to III year	82	41
III year to IV year	125	62.5

7.4. The student shall register and put up minimum attendance in all 160 credits and earn 160 credits. Grades obtained in 160 credits shall be considered for the calculation of CGPA.

7.5. Students who fail to earn 160 credits 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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

Table: 6: Course pattern

Year	Sem	No. of Subjects		Number of Labs		Total credits	
		CSE/ CSE(DS) /CSE&BS/ EEE	ECE/ CE/ Mech.	CSE/ CSE(DS) / CSE&BS/ EEE	ECE/ CE/ Mech.		
First	I	1) BSC - LA&AC 2) BSC - AP 3) ESC - PSP 4) ESC - BEE/BEE/BEE/FED 5) ESC - ED	1) BSC - LA &DE/ LA&AC/ LA&AC 2) BSC - MEC/AC/AC 3) ESC - PSP 4) ESC - FEE/EM /ED 5) HSS - English	1) ESC Lab - E&ITW 2) BSC Lab – EP Lab 3) ESC Lab - PSP	1) HSS Lab - DEL Lab 2) BSC Lab - EC Lab 3) ESC Lab - PSP Lab	Subjects - 5X3 = 15 Labs - 3X1.5 = 4.5	19.5
	II	1) BSC - DE&VC 2) BSC - MEC 3) ESC - DS 4) ESC - MFCS/MFCS/MFCS/BEE 5) HSS - English 6) ML - ES	1) BSC - AC&TT/ DE&VC 2) BSC - AP/ EP/ EP 3) ESC - DS 4) ESC - NWA/ BEEE/ MS 5) ESC - ED/ ED/ BEM 6) ML - ES	1) HSS Lab - DEL Lab 2) BSC Lab - EC Lab 3) ESC Lab - DS Lab	1) ESC Lab - E&ITW 2) BSC Lab - EP Lab 3) ESC Lab - DS Lab	Subjects - 5X3 = 15 ML – No Credits Labs - 3X1.5 = 4.5	19.5
Second	I	1) BSC 2) PCC 3) PCC 4) PCC 5) PCC 6) SOC 7) ML	1) BSC 2) PCC 3) PCC 4) PCC 5) PCC 6) SOC 7) ML	1) PCC Lab 2) PCC Lab 3) PCC Lab	1) PCC Lab 2) PCC Lab 3) PCC Lab	Subjects - 5X3 = 15 SOC - 1x2 = 2 ML – No Credits Labs - 3X1.5 = 4.5 EAA - No Credits	21.5
	II	1) ESC 2) BSC/PCC 3) PCC 4) PCC 5) HSS 6) SOC	1) ESC 2) BSC/PCC 3) PCC 4) PCC 5) HSS 6) SOC	1) ESC/PCC - Interdisciplinary Lab 2) PCC Lab 3) PCC Lab	1) ESC/PCC – Interdisciplinary Lab 2) PCC Lab 3) PCC Lab	Subjects - 4X3 = 12 HSS – 1X3 =3 SOC - 1x2 = 2 ML – No Credits Labs - 3X1.5 = 4.5	21.5
Third	I	1) PCC 2) PCC 3) PCC 4) OEC/JOE 5) PEC 6) SAC/SSC 7) ML	1) PCC 2) PCC 3) PCC 4) OEC/JOE 5) PEC 6) SAC/SSC 7) ML	1) PCC Lab 2) PCC Lab 3) Summer Internship/CSP	1) PCC Lab 2) PCC Lab 3) Summer Internship/CSP	Subjects - 3X3 = 9 OEC/JOE - 1X3 = 3 PEC – 1X3 = 3 SAC/SSC - 1x2 = 2 ML – No Credits Labs - 2X1.5 = 3 Internship - 1X1.5=1.5	21.5
	II	1) PCC 2) PCC 3) PCC 4) PEC 5) OEC/JOE 6) SAC/SSC 7) ML	1) PCC 2) PCC 3) PCC 4) PEC 5) OEC/JOE 6) SAC/SSC 7) ML	1) PCC Lab 2) PCC Lab 3) PCC Lab	1) PCC Lab 2) PCC Lab 3) PCC Lab	Subjects - 3X3 = 9 PEC – 1X3 = 3 OEC/JOE - 1X3 = 3 SAC/SSC - 1x2 = 2 ML - No Credits Labs - 3x1.5 = 4.5	21.5
Fourth	I	1) PEC 2) PEC 3) PEC 4) OEC/JOE 5) OEC/JOE 6) SAC/SSC 7) HSSE	1) PEC 2) PEC 3) PEC 4) OEC/JOE 5) OEC/JOE 6) SAC/SSC 7) HSSE	1) Industrial/ Research Internship 2) CVV	1) Industrial/ Research Internship 2) CVV	PEC - 3X3 = 9 OEC/JOE - 2X3 = 6 SAC/SSC - 1X2 = 2 HSSE - 1X2 = 2 Internship - 1X3 = 3 CVV - 1X1 = 1	23
	II	1) Technical Seminar 2) Internship in Industry 3) Major Project	1) Technical Seminar 2) Internship in Industry 3) Major Project			Seminar - 1X1 = 1 Internship - 1X5 = 5 Project - 1X6 = 6	12
						Total Credits	160

Note-1: 1) BSC – Basic Science Course
2) ESC – Engineering Science Course
3) HSS – Humanities and Social Science
4) ML – Mandatory Learning Course
5) SOC – Skill Oriented Course
6) SAC – Skill Advanced Course
7) PCC – Professional Core Courses
8) PEC – Professional Elective Course
9) OEC – Open Elective Course
10) JOE – Job Oriented Elective
11) SSC – Soft Skill Course
12) CSP – Community Service Project

Note-2: **Mandatory Learning Courses**

1) EC - Environmental Science
2) UHV - Universal Human Values
3) IHC - Indian Heritage and Culture
4) CI - Constitution of India

Note-3: 1) Summer Internship Two months (Mandatory) after Second Year (to be evaluated

during 5th Semester).

2) Industrial/Research Internship Two months (Mandatory) after Third Year (to be evaluated during 7th Semester).

3) Internship in Industry (during 8th 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 and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered subject to section 2.0 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	
First Class with Distinction	70% and above	First class With Distinction	≥ 7.5	CGPA Secured from 160 Credits
First Class	Below 70% but not less than 60%	First Class	≥ 6.5 to < 7.5	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 to < 6.5	
Pass Class	Below 50% but not less than 40%	Pass	≥ 4 to < 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 Oriented/ Skill Advanced/ 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 semesters 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 / ML / 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.

20.0 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.

21.0 Transfers

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

22.0 General:

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

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

22.3. 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.

22.4. Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

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 86 credits 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 121 credits 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	
First Class with Distinction	70% and above	First class With Distinction	≥ 7.5	CGPA secured from 121 Credits
First Class	Below 70% but not less than 60%	First Class	≥ 6.5 to < 7.5	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 to < 6.5	
Pass Class	Below 50% but not less than 40%	Pass	≥ 4 to < 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).

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 centers 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 Outcomes (POs)

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.

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 (PSOs)

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

Note: Program Outcomes (POs) and Program Specific Outcomes (PSOs) are mapped with Course Outcomes (COs) and they are correlated in following levels

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

I B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
Theory Subjects								
A0001201	Linear Algebra and Advanced Calculus	2	1	0	3	30	70	100
A0002201	Applied Chemistry	2	1	0	3	30	70	100
A0501201	Problem Solving and Programming	2	1	0	3	30	70	100
A0301201	Engineering Drawing	1	0	4	3	30	70	100
A0003201	English for Engineers	2	1	0	3	30	70	100
Laboratories								
A0091201	Digital English Language Lab	0	0	3	1.5	25	50	75
A0092201	Engineering Chemistry Lab	0	0	3	1.5	25	50	75
A0591201	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	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY SUBJECTS								
A0007202	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
A0009202	Engineering Physics	2	1	0	3	30	70	100
A0502202	Data Structures	2	1	0	3	30	70	100
A0303202	Material Science	2	1	0	3	30	70	100
A0304202	Basic Engineering Mechanics	2	1	0	3	30	70	100
MANDATORY LEARNING COURSE								
A0010202	Environmental Science	2	0	0	0	0	0	0
LABORATORIES								
A0592201	Engineering Workshop & IT Workshop	0	0	3	1.5	25	50	75
A0093201	Engineering Physics lab	0	0	3	1.5	25	50	75
A0593202	Data Structures Lab	0	0	3	1.5	25	50	75
	Total	**12**	**5**	**9**	**19.5**	**225**	**500**	**725**

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY SUBJECTS								
A0011203	Numerical Methods & Probability Theory	2	1	0	3	30	70	100
A0305203	Engineering Thermodynamics	2	1	0	3	30	70	100
A0306203	Mechanics of Solids	2	1	0	3	30	70	100
A0307203	Manufacturing Process	2	1	0	3	30	70	100
A0302202	Fluid Mechanics & Hydraulic Machinery	2	1	0	3	30	70	100
SKILL DEVELOPMENT COURSE								
A0012203	Design Thinking and Innovations	1	2	0	2	30	70	100
MANDATORY LEARNING COURSE								
A0022203	Constitution of India	2	0	0	0	0	0	0
LABORATORIES								
A0391203	Materials Science & Mechanics of Solids Lab	0	0	3	1.5	25	50	75
A0392203	Manufacturing Process Lab	0	0	3	1.5	25	50	75
A0393203	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	1.5	25	50	75
	Total	**13**	**7**	**9**	**21.5**	**255**	**570**	**825**

II B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY SUBJECTS								
A0203204	Basic Electrical & Electronics Engg.	2	1	0	3	30	70	100
A0504203	Python Programming	2	1	0	3	30	70	100
A0308204	Kinematics of Machinery	2	1	0	3	30	70	100
A0309204	Applied Thermodynamics	2	1	0	3	30	70	100
A0310204	Industrial Management & Accountancy	2	1	0	3	30	70	100
SKILL DEVELOPMENT COURSE								
A0019203	Aptitude Arithmetic Reasoning and Comprehension	1	2	0	2	30	70	100
LABORATORIES								
A0295204	Basic Electrical & Electronics Engg. Lab	0	0	3	1.5	25	50	75
A0571203	Python Programming Lab	0	0	3	1.5	25	50	75
A0394204	Thermal Engineering Lab	0	0	3	1.5	25	50	75
	Total	**11**	**7**	**9**	**21.5**	**255**	**570**	**825**

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY SUBJECTS								
A0311205	Heat Transfer	2	1	0	3	30	70	100
A0312205	Metal Cutting & Machine Tools	2	1	0	3	30	70	100
A0313205	Design of Machine Elements	2	1	0	3	30	70	100
PROFESSIONAL ELECTIVE-I		2	1	0	3	30	70	100
A0314205	Tool Design							
A0315205	Engineering Metrology & Mechanical Measurements							
A0316205	Fuel Cell Technology							
OPEN ELECTIVE-I/JOB ORIENTED COURSE		2	1	0	3	30	70	100
A0317205	Industrial Waste Management							
A0318205	Electrical Vehicle Technology							
A0514205	Data Analytics using R							
SKILL DEVELOPMENT COURSE								
A0319205	Computer Aided Machine Drawing	1	2	0	2	30	70	100
LABORATORIES								
A0395205	Heat Transfer Lab	0	0	3	1.5	25	50	75
A0396205	Machine Tools Lab	0	0	3	1.5	25	50	75
A0023205	Community Service Project / Summer Internship	0	0	3	1.5	0	100	100
	Total	**11**	**7**	**9**	**21.5**	**230**	**620**	**850**

III B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY SUBJECTS								
A0320206	Design of Transmission Elements	2	1	0	3	30	70	100
A0321206	Dynamics of Machinery	2	1	0	3	30	70	100
A0322206	Refrigeration and Air-Conditioning	2	1	0	3	30	70	100
PROFESSIONAL ELECTIVE-II		2	1	0	3	30	70	100
A0323206	Mechanical Vibrations							
A0531206	Fundamentals of Java Programming							
A0324206	Gas Turbines							
OPEN ELECTIVE-II/JOB ORIENTED COURSE/MOOCs		2	1	0	3	30	70	100
A0325206	Industrial IoT							
A0326206	Power Plant Engineering							
A0327206	Industrial Safety Engineering							
SKILL DEVELOPMENT COURSE								
A0328206	Parametric Modelling-I	1	2	0	2	30	70	100
MANDATORY LEARNING COURSE								
A0014203	Indian Heritage & Culture	2	0	0	0	0	0	0
LABORATORIES								
A0397206	Numerical Simulation Lab	0	0	3	1.5	25	50	75
A0398206	Dynamics & Measurements Lab	0	0	3	1.5	25	50	75
A0584206	Fundamentals of Java Programming Lab	0	0	3	1.5	25	50	75
	Total	**13**	**7**	**9**	**21.5**	**255**	**570**	**825**

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
PROFESSIONAL ELECTIVE-III		2	1	0	3	30	70	100
A0330207	Finite Element Methods							
A0334207	Non Destructive Testing							
A0335207	Mechanics of Composite Materials							
PROFESSIONAL ELECTIVE-IV		2	1	0	3	30	70	100
A0329207	CAD/CAM							
A0332207	Micro and Nano Manufacturing							
A0333207	Energy Audit and Management							
PROFESSIONAL ELECTIVE-V/MOOCs		2	1	0	3	30	70	100
A0336207	Modern Machining Methods							
A0337207	Renewable Energy Sources							
A0338207	Nanotechnology							
OPEN ELECTIVE-III/JOB ORIENTED COURSE		2	1	0	3	30	70	100
A0331207	Industrial Automation & Robotics							
A0339207	Cryogenics							
A0340207	Production and Operations Management							
OPEN ELECTIVE-IV/JOB ORIENTED COURSE		2	1	0	3	30	70	100
A0542207	Fundamentals of AI & ML							
A0549207	Advanced Python Programming for Data Science							
A0550207	Fundamentals of Database Management System							
SKILL DEVELOPMENT COURSE								
A0342207	Modelling & Analysis	1	2	0	2	30	70	100
HUMANITIES AND SOCIAL SCIENCES								
A0341207	Operations Research	2	0	0	2	30	70	100
MANDATORY LEARNING COURSE								
A0015203	Universal Human Values	2	0	0	0	0	0	0
A0094207	Comprehensive Viva	0	0	0	1	0	50	50
A0095207	Industrial/Research Internship	0	0	0	3	0	100	100
	Total	**15**	**7**	**0**	**23**	**210**	**640**	**850**

IV B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
A0096208	Technical Seminar	0	0	0	1	50	0	50
A0097208	Internship in Industry	0	0	0	5	0	100	100
A0098208	Major Project	0	0	0	6	50	100	150
	Total	**0**	**0**	**0**	**12**	**100**	**200**	**300**

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
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, 11thReprint, 2010.
5) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
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.

RGM 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 OF 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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(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 OF 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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
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/

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME)

L	P	C
0	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 OF 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

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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

(I B.Tech, I-Sem(ME)

L	P	C
0	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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME) | L | P | C
0 | 3 | 1.5

(A0591201) PROBLEM SOLVING AND PROGRAMMING LAB
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- 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 OF 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

RGM 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.

RGM 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 & ME

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
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
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
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
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
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
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, 11thEdition 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, 4theds.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.

RGM 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 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	-	-	-	-	-
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.

RGM 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.

RGM 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.

RGM 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)

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, I-Sem(ME)

L	P	C
0	3	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.

RGM 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 OF 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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem(ME)

L	P	C
0	3	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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech, II-Sem(ME)

L	P	C
0	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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem. (M.E)

L	T	C
2	1	3

(A0011203) NUMERICAL METHODS & PROBABILITY THEORY
For branches: CE & ME

COURSE OBJECTIVES:
- To familiarize the students with the foundations of probability and Numerical methods.
- To impart probability concepts and Numerical methods in various applications in Engineering.

COURSE OUTCOMES:
After completion of the course the student will be able to:
- Understand various Numerical methods to solve transcendental equations and rate of convergence. Analyze the concept of Interpolation its applications in digital image processing, computer graphics and in many engineering disciplines.
- Understand the concept of Numerical differentiation and integration and its importance in mechanics.
- Identify various numerical methods to solve linear and non-linear ordinary differential equations and its applications in non-linear analysis.
- To know the importance of probability, random variables and distributions in solving various mechanical and civil engineering problems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	2	-	-	-	-	-	-	-				
CO2	3	3	2	2	3	-	-	-	-	-	-	-				
CO3	2	3	2	3	2	-	-	-	-	-	-	-				
CO4	3	2	3	2	3	-	-	-	-	-	-	-				
CO5	2	3	2	3	3	-	-	-	-	-	-	-				

UNIT – I
Solution of Algebraic and Transcendental Equations: Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

UNIT – II
Interpolation: Introduction – Finite differences – Forward Differences – backward Differences –Newton's forward and backward difference formulae for interpolation – Gauss forward and backward difference formulae for interpolation - Lagrange's Interpolation formula.

UNIT – III
Curve fitting: Fitting a straight line – Second degree curve – Exponential curve-Power curve by method of least squares.

UNIT –IV
Numerical Differentiation – Numerical Integration – Newton-cote's integration formula – Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations – Euler's Method –Euler's Modified Method- Runge – Kutta Method.

UNIT – V
Basic concept of probability – Random variables – Discrete and continuous Random variables –Moment generating function - Expectation

UNIT – VI

Distribution functions: Binomial Distribution – Poison Distribution and Normal Distribution – Related properties.

TEXTBOOKS:

1) T.K.V. Iyengar, B. Krishna Gandhi and Others, Probability and Statistics, S. Chand & Company
2) S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

REFERENCES:

1) R.K.Jain and S.R.K.iyngar,Advanced Engineering Mathematics, Alpha science International limited,2016
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
4) Reprint, 2010.
5) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem (M.E) | L | T | C
2 | 1 | 3

(A0305203) ENGINEERING THERMODYNAMICS

(Use of Standard Steam Tables, Mollier Diagram & Psychometric Chart are Permitted in End Examinations**)**

COURSE OBJECTIVES:
The students completing this course are expected:
- Concepts of heat, work, energy and governing rules for conversion of one form to other.
- Applications of I & II law of thermodynamics.
- To understand concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To familiarize steam properties to understand working of steam power plants.
- To familiarize psychometric properties to understand working of Refrigeration and Air conditioning systems.

COURSE OUTCOMES:
Students who have done this course will have a good idea of the basics of thermodynamics.
- The students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions.
- The students will be able to evaluate the performance of energy conversion devices based on I and II law of thermodynamics.
- The students will be able to evaluate the available energy and entropy of system at a desired state.
- The students can evaluate changes in thermodynamic properties of substances.

MAPPING OF COs & POs:

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

UNIT-1
Basic Concepts and Definitions: Classical and statistical thermodynamics, definitions of thermodynamic terms, quasi – static process, point and path functions, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.
Work and Heat: Non flow (P.dV) or displacement work in various reversible processes, Heat Transfer, comparison of work and heat.

UNIT-2
First Law of Thermodynamics: First law for a closed system undergoing a cycle and for a process, Joules experiment, PMM-I.
First Law Applied to Non-Flow and Flow Process, Corollaries and limitations of First Law of Thermodynamics. Simple problems.

UNIT-3
Second Law of Thermodynamics: Kelvin-Plank statement, Clausius statement, equivalence of Kelvin-plank and clausius statements, Heat engine, heat pump and refrigerator, reversibility and irreversibility, Carnot Cycle, Carnot's Theorem, PMM-II - simple problems.

UNIT-4
Entropy: Clausius theorem, Definition of entropy, principle of entropy increase, T-s plot, change in entropy in various reversible processes.

Availability & Irreversibility: Definition of; exergy and energy, Availability in steady flow, non-flow processes and irreversibility.

UNIT-5

Properties of Steam: Formation of steam form ice to super-heated steam with reference to T-V, P-V & T-S diagrams, properties of steam, Quality of steam, expressions for the change in internal energy, enthalpy, work, heat, entropy in various processes, Use of steam Tables and Mollier's chart. Simple problems.

UNIT-6

Psychometry

Definitions of - Dry Bulb temperature, Wet-Bulb Temperatures, Specific humidity (or) Humidity Ratio, Dew Point Temperature, Degree of Saturation, Relative Humidity, Sensible Heating, Sensible cooling, Humidification and Dehumidification. Measurement of psychometric properties using psychometric chart. Simple Problems.

TEXT BOOKS:

1) P.K. Nag Engineering Thermodynamics, 6th Edition 2019 Tata McGraw Hill, New Delhi.
2) Engineering Thermodynamics – Prof. K.Rama Krishna, Anuradha Pulications.

REFERENCE BOOKS:

1) B.P Mistra, Engineering Thermodynamics.
2) E. Ratha Krishna, Fundamentals of Engineering Thermodynamics, PHI Publishers, New Delhi.
3) Thermodynamics – Yadav" Central Publishers.
4) Cengel, Thermodynamics – An Engineering Approach, 6th Edition 2019 Tata McGraw Hill, New Delhi.
5) Thermodynamics (Van Wylen, Gordon J.; Sonntag, Richard E.)

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0306203) MECHANICS OF SOLIDS

COURSE OBJECTIVES:

- To impart basic principles of solid mechanics and their associated laws.
- To understand the behaviour of engineering materials for different types of loads
- To understand the behaviour of beams under different types of loads
- To understand the nature of stresses developed in material under complex loading system
- To analyse the cylindrical shells under circumferential and radial loading conditions

COURSE OUTCOMES:

Upon completion of this course, the students can able to

- Determine the deformations, stresses and strains in members subjected to the axial and thermal load.
- Evaluate and explain the variations of the shear forces and bending moments along the axis of the beam
- Use the bending stress concept to design the machine and structural components.
- Evaluate the deflections at various points in the beam and determine the critical buckling loads of columns under different boundary conditions.
- Analyse the principal stresses/strains and visualize the variations of normal and shear stresses in components.
- Apply the knowledge of thin cylinders in the design of boilers, pressure vessels, and lowpressure processing equipment etc., used in various industries.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	-	-	3	3	1	-	-	-	1	2	-	-	-
CO2	3	3	3	3	-	3	3	1	-	-	-	1	3	-	3	1
CO3	3	3	3	2	-	3	3	1	-	-	-	1	3	-	2	1
CO4	3	3	3	2	-	3	3	1	-	-	-	1	3	-	-	1
CO5	3	3	3	2	-	2	2	1	-	-	-	1	3	-	2	1
CO6	3	3	3	2	-	2	2	1	-	-	-	1	3	-	-	1

UNIT- I

SIMPLE STRESSES & STRAINS: Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT –II

SHEAR FORCE AND BENDING MOMENT: Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams subjected to point loads, UDL, Uniformly varying loads and combination of these loads- Point of Contra flexure- Relation between S.F, B.M and rate of loading at a section of a beam.

UNIT –III

FLEXURAL STRESSES: Theory of simple bending- Assumptions- Derivation of bending equation (M/I = f/y = E/R) – Neutral axis- Determination of Bending stresses- section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections.

UNIT- IV

BEAM DEFLECTION: Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method.

Columns: End conditions – Equivalent length of a column – Euler's equation – Slenderness ratio – Rankin's formula for columns.

UNIT- V

PRINCIPAL STRESSES & STRAINS: Principal stresses and Principal planes, Method of determining stresses on oblique sections, Mohr's circle.

UNIT -VI

CYLINDRICAL SHELLS: Thin cylindrical shells – Derivation of formula for longitudinal and circumferential stresses –hoop, longitudinal stresses and volumetric strains.

TEXT BOOKS:

1) S Strength of materials by Bhavikatti, Lakshmi Publications
2) R.K Bansal, Strength of Materials, 4th Edition, Laxmi publications (P) ltd, 2017.

REFERENCES:

1) Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co,
2) S. Ramamrutham, Strength of materials, 16th Edition, Dhanpat Rai publications, 2011.
3) Engineering Mechanics of Solids by Popov E.P, Prentice-Hall of India, New Delhi.
4) Mechanics of solids by Timo shenko, TMH Publications.
5) Singh D.K "Mechanics of Solids" Pearson Education.
6) Beer F. P. and Johnston R, Mechanics of Materials, McGraw-Hill Book Co, Third Edition.
7) James M. Gere, Barry J. Goodno, Mechanics of materials, 7th edition, Cengage learning, 2009

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem (M.E)

L	T	C
2	1	3

(A0307203) MANUFACTURING PROCESS

COURSE OBJECTIVES:

- The primary objective of this course is to introduce the concept of manufacturing technology with the help of various processes widely employed in industries.
- The course consists of casting, welding, sheet metal forming, extrusion and forging processes with the related details of equipment and applications.
- To understand various metal working process. To appreciate the capabilities, advantages and the limitations of the processes.
- To understand the various concepts of metal forming and forging along with their applications.

COURSE OUTCOMES:

After completing the course, the student can able to;

- Design patterns, cores and gating system for metal casing.
- Applying the concepts of manufacturing science in the design and development of mechanical systems.
- Design near net shaped components from metal to meet societal needs within realistic constraints.
- Develop joints using solid state and fusion joining and soldering techniques and also able to develop components form plastic.

MAPPING OF COs & POs

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

UNIT-1

METAL CASTING PROCESSES: Introduction, Steps involved in making a casting, casting terms, Pattern making - types of patterns, pattern materials, and pattern allowances. Mould making - type of moulding sands, moulding sand properties, methods of sand testing, moulding machines – types of moulding machines. Core making - Core sands, Types of cores, Core prints, Chaplets, Chills, Risers and Gating systems used in casting.

UNIT-2

SPECIAL CASTING PROCESSES: Shell Moulding, Precision Investment Casting, Permanent Moulding Casting, Die Casting, Vacuum Die Casting, Low Pressure Die Casting, Centrifugal Casting, Continuous Casting, Squeeze Casting. Melting of metals in casting-Cupola furnace, Casting Cleaning Casting Defects - Causes and Remedies.

UNIT-3

WELDING PROCESSES: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, Manual metal arc welding, submerged arc welding, and Inert Gas welding- TIG & MIG welding. Resistance welding, Solid state welding processes- Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma welding, Laser welding, electron beam welding, Soldering & Brazing. Welding Defects – Causes and Remedies.

UNIT-4

METAL FORMING PROCESSES: Plastic deformation in metals and alloys, Hot working and Cold working, Strain hardening and Annealing.

Bulk forming processes: Forging - Types Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

UNIT-5

SHEET METAL FORMING: Shearing operations- Punching, Blanking and piercing- Bending and forming- Drawing and its types- wire drawing and tube drawing- coining- Hot and cold spinning- Types of presses and press tools.

UNIT-6

PROCESSING OF PLASTICS: Types of Plastics, Properties, Applications and Plastic processing methods – Compression moulding, Transfer moulding, Injection moulding, Blow moulding, Rotomoulding, Extrusion, Thermoforming, Calendaring and Casting.

TEXT BOOK:

1) P N. Rao, "Manufacturing Technology", Vol-I, 4th Edition, Tata McGraw-Hill Publishing Limited,
2) P. Ghosh, A., and Malik, A. K., "Manufacturing Science, Affiliated East west Press Pvt. Ltd.2010

REFERENCE BOOKS:

1) P.C. Sharma, "A text book of Production Technology", S. Chand and Company, 2014
2) Begman, „Manufacturing Process", John Wilely & Sons,2011
3) Production Technology by K.L. Narayana, J.K. International Publications.3rd Edition,2014
4) Rajput R.K, "A text book of Manufacturing Technology", Lakshmi Publications, 2015
5) Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promoters Pvt. Ltd.Mumbai, 2020
6) Production Technology by R.K Jain, 6th edition, 2020.
7) S. Kalpakjian, Manufacturing Processes for Engineering Materials, Fifth edition. Pearson Education, 2009

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem (ME) | L | T | C
| 2 | 1 | 3

(A0302202) FLUID MECHANICS & HYDRAULIC MACHINARY
For branches: EEE & ME

COURSE OBJECTIVES:
- This course "Fluid Mechanics and Hydraulic Machines" lab imparts intensive and extensive practical knowledge of the lab so that students can understand the importance of concepts of "Fluid Mechanics and Hydraulic Machines" in the field of engineering.
- The student should able to develop theoretical / practical capabilities so that they can characterize, transform, use and apply in engineering from the knowledge gained in solving related engineering problems.

COURSE OUTCOMES:
At the end of the course, the student will be able to:
- Apply the knowledge of Fluid mechanics and hydraulic machines for practical applications.
- Develops the ability for running hydraulic machines lab.
- Students are able to understand the working function of various devices used in hydraulic Power plant.
- Students can understand the principle of Bernoulli"s theorem.
- Understand the concept of impact of jets.
- Student can understand how to determine friction of various pipe materials.

MAPPING OF CO & PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	2	1	2	2	2	1	1	1	1	2	1	1	2
CO 2	2	2	1	1	2	3	1	1	1	1	2	1	3	2	1	1
CO 3	3	2	2	2	2	2	2	2	2	2	1	2	2	1	2	2
CO 4	3	1	1	1	1	1	2	1	1	1	1	1	1	2	2	1
CO 5	2	1	2	3	1	2	1	1	1	1	1	1	2	2	1	2
CO 6	3	2	1	2	1	1	2	2	1	1	2	1	2	1	2	2

UNIT I:
Fluid Statics: Dimensions and units: fluid properties, mass density, weight density, specific gravity, viscosity, vapor pressure and their influence on fluid motion- atmospheric pressure, gauge pressure and vacuum pressure –measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT II:
Fluid Kinematics: classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow. Fluid dynamics: -Bernoulli's equation for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT III:
Closed conduit flow: Laminar and turbulent flow through pipes: Reynolds experiment significance of Reynolds's number, Darcy Weisbach equation, chezy"s formula, friction factor - Minor losses in pipes- pipes in series and pipes in parallel- Measurement of flow: Pitot tube (Derivation Only),

UNIT-IV:
Boundary Layer Flow: Introduction, Definitions, Drag force on a flat plate due to Boundary layer, Analysis of Turbulent Boundary layer, Separation of Boundary layer.

UNIT V:

Basics of Hydraulic Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency.

UNIT VI:

Hydraulic Turbines: Classification of turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory-Unit and specific quantities, Hydraulic Pumps: Working principle of Centrifugal and Reciprocating pump. (No-derivations and No Problems)

TEXT BOOKS

1) Fluid Mechanics and Hydraulic Machinery MODI and SETH, S.Chand & co, New Delhi
2) Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Standard Book House, New Delhi.

REFERENCES:

1) Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2) Fluid Mechanics and Machinery by Jagadeesh lal.
3) Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4) Fluid Mechanics and Hydraulic Machines by R. K. Rajput, Lakshmi Publications.
5) Instrumentation for Engineering Measurements by James W. Dally, William E. Riley, John Wiley & Sons Inc. (Chapter 12 – Fluid Flow Measurements).

WEBSITES:

1) https://nptel.ac.in/courses/112/105/112105269/
2) https://nptel.ac.in/courses/112/105/112105171/
3) https://nptel.ac.in/courses/112/105/112105206/
4) https://nptel.ac.in/courses/112/105/112105183/
5) https://nptel.ac.in/courses/112/106/112106200/

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem. (M.E)

L	T	C
1	2	2

(A0012203) DESIGN THINKING AND INNOVATIONS

(Skill Development Course)

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

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To create awareness of design thinking among students of engineering
- To teach a systematic approach to identifying and defining a problem before brainstorming for a solution
- To instil a sense of significance towards applying creativity to product and service design
- To motivate students to apply design thinking while implementing a project focusing on local or global societal problems

COURSE OUTCOMES: After completion of this course, the student will be able to

- Identify design principles from an engineering perspective
- Cultivate sensitivity towards design aspects of Activities, Environments, Interactions, Objects and Users (A-E-I-O-U) in daily life
- Validate problem statements through user empathisation with societal and Environmental
- Consciousness
- Devise visual design and documentation to communicate more effectively
- Develop project management skills in a multidisciplinary environment

STUDENTS' RESPONSIBILITIES:

1) Forming diverse teams of 3–5 members each to work collaboratively throughout the semester.
2) Proactively engaging to observe the objects and interactions in their daily life and society from a design perspective.
3) Identifying general societal and social problems that may be effectively addressed using design thinking principles
4) Presenting and reporting the tasks to the concerned faculty members using their creative communication and people skills.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2																
CO3																
CO4																
CO5																
CO6																

UNIT – I

Introduction, what is design thinking, the traditional model of innovation, The model of design thinking, Design thinking is not old, Design thinking is to innovation, The sweet spot of design thinking.

Why design thinking now?: Products & Services, Multifaceted problems, fast becoming B2C, wide spread digitization, Customer knowledgeable, Clash of business models, Challenging markets.

UNIT – II

Key tenets of Design thinking, Human centric, Focus on subject not object, Problem solving with the customer not for the customer, Thinking beyond products, Striking balance, Think Broad, Solution Generation, validation, root causes, What else, visualize your thinking, Fail often.

Inspire: Create a stretch, Get the design brief right, Adopt the power of metaphors, Widen the aperture, Bring on diversity, The learning personas, the organizing personas, the building personas.

UNIT - III

Empathize and Define: The traditional market research is broken, Create new channels to listen to customers, Be the customer you wish to serve, Leverage technology, Get to the customers, Do not limit empathy to customers, Engineering empathy, Mind mapping, Stake holder map, Customer journey map, Empathy map, Picking problem worth solving, Framing problem sharply, Innovating in absence of customer.

UNIT - IV

Ideate: Ideas are like Lego blocks, Hybrid brain storming, Intersection of disciplines, Imitate with grace, Braking the pattern, Challenging assumptions, Value chain, Looking beyond current users, Designing for extreme, Analogous design, Triggering ideation.

Prototype and Test: The high cost of just doing it, seeking clarity, Be quick and dirty, Manageable hypotheses, Doing last experiment first, Visualize through storyboarding and scenarios, Engaging through stories, Is dogfooding enough?, Solicit feedback, Inventory prototypes.

UNIT - V

Scale: Keep the main thing as the main thing, cut some slack, Leaders must show up, Provide 'air cover', cultivate innovation evangelists, Measure for impact, Don't confuse empathy with good business sense.

Design Thinking in action: A two day Design thinking workshop, session objectives, Ground rules, workshop flow, mentoring programme, Build your own version of design thinking programme, offer avenues to practice design thinking, think beyond, Juggad, pay attention to the physical space, trust the process

UNIT - VI

How to be a Design Thinker Live curious, Listen with intent, observe with purpose, Defer your judgement, Hone multiple affiliations, Be a T-shaped person, develop failure tolerance.

Case studies of Design thinking like Chota Cool, Indian post box, Big Bazar, Reliance, royal Enfield etc. (Any other case studies may also be considered).

TEXT BOOKS:

1) Pavan Soni, Design your thinking, Penguin Random house India, 2020.
2) Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", John Wiley & Sons (2012) (ISBN: 978-1118083468)
3) Jeanne Liedtka and Tim Ogilvie , Designing for Growth: A Design Thinking Tool Kit for Managers, Columbia Business School Publishing, E-ISBN 978-0-231-52796-5
4) B. K. Chakravarthy, Janaki Krishnamoorthi, Innovation By Design: Lessons from Post Box Design & Development, Springer India, 2013
5) Donald A. Norman, "The Design of Everyday Things", MIT Press, 2013 (ISBN: 978-0262525671)
6) Tom Kelly, Jonathan Littman, "The Art of Innovation", HarperCollins Business, 2002 (ISBN: 978-0007102938)

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem. (M.E)

L	T	C
2	0	0

(A0022203) CONSTITUTION OF INDIA

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

COURSE OBJECTIVES:

- To understand the structure and composition of Indian Constitution
- To understand and analyze federalism in the Indian context.
- To study the Panchayati Raj institutions as a medium of decentralization
- To study and analyze the three organs of the governance in the contemporary scenario.

COURSE OUTCOMES: Students will be able to

- Be aware of historical background of the constitutional making and its importance for building a democratic India.
- Possess the knowledge of the History, features of Indian constitution, the role of Governor and Chief Minister, role of state election commission, the decentralization of power between central, state and local self-government.
- Know the status of Indian government, the structure of state government, the local Administration.
- Able to know the functioning of governments at the rural and national level and role of the electoral bodies.

UNIT-I

History of Indian Constitution: History of Making of the Indian Constitution - History Drafting Committee - Composition & Working of Constitution.

UNIT-II

Philosophy of the Indian Constitution: Preamble Salient Features of Indian Constitution.

UNIT-III

Contours of Constitutional Rights & Duties: Fundamental Rights: Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy.

UNIT-IV

Organs of Governance: Parliament - Composition - Qualifications and Disqualifications Powers and Functions of Executive - President - Governor - Council of Ministers – Judiciary – Qualifications, Appointment and Transfer of Judges.

UNIT-V

Local Administration: Role and Importance of Municipal Corporation Role and Importance Pachayati raj: Role and Importance Zilla Pachayat: Position and role - Village level: Role of Elected and Appointed officials - Importance of grass root democracy.

UNIT-VI

Election Commission: Role and Functioning of Election Commission Role and Functioning of Chief Election Commissioner and Election Commissioners - Role and Functioning of State Election Commission.

TEXT BOOKS:

1) M.P.Singh, Constitution of India with 101st Amendment,5th New Edition, Delhi Law House
2) V.N.Shukla, Constitution of India, 13th Edition,2017, Eastern book Company

3) Gopal Sankaranarayan, Eastern Book Company, 14th Edition
4) Subhash C.Kashyap, Constitution of India- A Handbook for Students, First Edition, (Jan 2019),Vista Publishing Pvt. Ltd.
5) Dr.B.R.Ambedkar, The Constitution of India, Sudhir Prakashan, 1st Edition,jn 2020.

REFERENCES: (URL)
https://legislative.gov.in/constitution-of-india
http://www.ilo.org

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem (ME)

L	P	C
0	3	1.5

(A0391203) MATERIALS SCIENCE & MECHANICS OF SOLIDS LAB

COURSE OBJECTIVES:
- To develop capability to of mount the specimen on the matrix material and able to identify the given metal by observing the micro structure
- To Distinguish the Ferrous and non-Ferrous structures
- To study the effect of heat treatment on microstructures
- To understand the some fundamental aspects and failure modes of engineering materials with the applications of sudden and gradually applied loads.
- To find out the hardness of the various materials with the help of Brinell‟s & Rockwell hardness testing machines.
- To conduct the tests for elastic constants using flexural and torsional apparatus.

COURSE OUTCOMES:
At the end of the course, the student will be able to:
- Apply the knowledge of preparing the sample for micros scopic observations
- Identify the material based on its micro structure and also assess its mechanical properties
- Realize the effect of heat treatment on the mechanical properties of the material.
- Determine the Elastic constants and strength of the given material using Tension compression, torsion & Deflection tests.
- Determine the strain energy stored in the material under impact loads
- Determine the hardness of the given material

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	2	1	-	-	1	2	-	1	1	2	1
CO2	3	1	1	1	-	1	1	-	-	1	-	-	1	1	2	1
CO3	3	3	2	2	1	2	1	-	-	1	2	-	2	1	2	1
CO4	3	3	2	2	1	2	1	-	-	1	1	1	1	2	1	1
CO5	3	3	2	2	-	2	1	-	-	1	1	1	1	1	1	1
CO6	3	3	2	2	-	1	1	-	-	1	1	1	1	1	1	1

LIST OF EXPERIMENTS:

Cycle-I: Materials Science Lab
1. Specimen preparation and study of the Microstructure of Low carbon steel, Medium carbon steels and high carbon steels.
2. Study of the Micro Structures of Cast Irons.
3. Study of Micro Structure of Austenitic- stainless steel and High speed steel.
4. Study of the Micro Structures of Non-Ferrous alloys (Al-alloy, Cu-alloy)
5. Magna Flux testing method.

Cycle-II: Mechanics of Solids Lab
1. Torsion test on mild steel rod.
2. Determination of Impact strength of the metals.
3. Hardness test on metals – using Brinnel & Rockwell hardness testing machine.
4. Determination of modulus of Elasticity and flexural rigidity of beams.
5. Determination of modulus of rigidity of helical springs.

Experiments beyond Curriculum:
1. Determination of hardenability of steels by Jominy End Quench Test.
2. Determination of stress-strain characteristics of Mild steel rod using UTM.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem (ME)

L	P	C
0	3	1.5

(A0392203) MANUFACTURING PROCESS LAB

COURSE OBJECTIVES:

- The student should understand some fundamental aspects and design concepts of manufacturing, pattern and pattern makings for the casting process.
- To determine the sand Viz., strengths and permeability of a sand materials and moisture percentages of green sand.
- To teach techniques adopted in welding processes like arc, gas, spot, plasma and brazing processes and also deep drawing process for making a small size part with the help of blanking, piercing operations.
- To extrusion operations, bending and processing of plastics like injection moulding and blow moulding.
- The student should be prepared to continue the study and analysis of the production machine parts.

COURSE OUTCOMES:

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

- Imparting intensive and extensive practical knowledge of the lab so that students can understand the importance of machines.
- Enriching the student's knowledge towards production of machines elements
- Developing theoretical/practical capabilities of students so that they can characterize, transform, use and apply in engineering from the knowledge gained in solving related engineering problems.

MAPPING OF POs & COs:

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

I. METAL CASTING LAB:

1) Pattern Design and Making : 1 Exercise - for one casting
2) Sand Properties Testing : 2 Exercises - Strength and Permeability

II. WELDING LAB:

1) Arc Welding : 3 Exercises (Lap joint, Butt Joint & T- Joint)
2) Spot welding : 1 Exercises
3) Soldering of thin sheets : 1 Exercises

III. MECHANICAL PRESS WORKING:

1) Hydraulic Press: Deep Drawing : 1 Exercise
2) Pipe Bending : 1 Exercise

IV. PROCESSING OF PLASTICS:

1) Injection Moulding : 1 Exercise
2) Blow Moulding : 1 Exercise

Experiments beyond Curriculum:

1. Casting
2. Plasma Welding and Brazing
3. TIG Welding
4. Gas welding (O_2, CO_2)
5. Welding simulator

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, I-Sem (ME)

L	P	C
0	3	1.5

(A0393203) FLUID MECHANICS & HYDRAULIC MACHINARY LAB
For branches: CE & ME

COURSE OBJECTIVES:

- This course "Fluid Mechanics and Hydraulic Machines" lab imparts intensive and extensive practical knowledge of the lab so that students can understand the importance of concepts of "Fluid Mechanics and Hydraulic Machines" in the field of engineering. The student should able to develop theoretical / practical capabilities so that they can characterize, transform, use and apply in engineering from the knowledge gained in solving related engineering problem.

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

- Apply the knowledge of Fluid mechanics and hydraulic machines for practical applications.
- Develops the ability for running hydraulic machines lab.
- Students are able to understand the working function of various devices used in hydraulic Power plant.
- Students can understand the principle of Bernoulli's theorem.
- Understand the concept of impact of jets.
- Student can understand how to determine friction of various pipe material.

MAPPING OF CO & PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	2	1	2	2	2	1	1	1	1				
CO 2	2	2	1	1	2	3	1	1	1	1	2	1				
CO 3	3	2	2	2	2	2	2	2	2	2	1	2				
CO 4	3	1	1	1	1	1	2	1	1	1	1	1				
CO 5	2	1	2	3	1	2	1	1	1	1	1	1				
CO 6	3	2	1	2	1	1	2	2	1	1	2	1				

LIST OF EXPERIMENTS:

1) Verification of Bernoulli's Equation
2) Calibration of mouth piece/orifice
3) Calibration of Triangular Notch/Rectangular Notch
4) Calibration of Venturi & orifice meter
5) Impact of Jet on Vanes
6) Performance Test on Pelton Wheel
7) Performance Test on Francis Turbine
8) Performance Test on Kaplan Turbine
9) Performance Test on Single Stage Centrifugal Pump
10) Performance Test on Reciprocating Pump

EXPERIMENTS BEYOND CURRICULUM:

1) Performance Test on Multi Stage Centrifugal Pump
2) Performance Test on Hydraulic Jump
3) Determination of Friction Factor for a given pipe line

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (ME) L T C
2 1 3

(A0203202) BASIC ELECTRICAL & ELECTRONICS ENGG.
For branches: CE & ME

COURSE OBJECTIVES:
- This course introduces the basic concepts in electric circuits and networks
- This course also introduces the working principles of D.C Generator, DC motor.
- It also helps to study the operating principles of Transformers and their working.
- To understand the fundamental principles of basic electronic devices.
- To provide theoretical prerequisites necessary to do lab work on DC machines and Electronic Devices.

COURSE OUTCOMES:
At the end of the course student is able to;
- Know the basic knowledge of conducting materials and electrical circuit parameters.
- Understand the principles of dc machines.
- Analyze the working operation of Transformer.
- Determine the efficiency of machines, half wave and full wave rectifiers.
- Observe the different tests and calculations of all machines.
- Applications of dc machines, transformers and rectifiers.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	-	-	-	-	2	-	1	2				
CO2	3	3	1	2	-	-	-	-	2	-	1	2				
CO3	3	1	2	3	-	-	-	-	1	-	2	1				
CO4	3	3	2	2	-	-	-	-	2	-	2	2				
CO5	3	3	1	2	-	-	-	-	1	-	2	2				
CO6	3	1	3	2	-	-	-	-	2	-	1	1				
Avg.	3	3	2	2	-	-	-	-	2	-	2	2				

UNIT – I
ELECTRICAL DC CIRCUITS: Basic definitions (electrical conductor, insulator, semiconductor, electrical circuit, electric current, electric potential, EMF and electric potential difference) - Types of elements(active and passive elements)- Ohm's Law and its limitations- electric power-electrical energy- Kirchhoff's Laws- Resistances in series- Resistances in parallel- Star to delta and delta to star transformations- simple problems.

UNIT – II
DC-GENERATOR: CONSTRUCTION AND OPERATION**:** D.C Generators**-**Working Principle – construction of DC Generator - Action of commutator, types of armature windings, induced emf equation, – Classification of DC Generators-separately excited, self-excited-series, shunt, short & long shunt compound generator-simple problems regarding EMF.

UNIT – III
DC MOTOR: DC motors-principle of operation -back emf –voltage and power equation of dc motor, condition for maximum power -types of DC Motors- series, shunt, short & long shunt compound motor, torque & speed equation –speed control of DC Shunt Motor –armature control method, field control method-losses in DC machines- efficiency calculation –simple problems on types and torque equation.

UNIT – IV
TRANSFORMERS: Necessity of transformer-classification of transformers-Principle of operation of single phase transformers- Theory of an Ideal Transformer –Constructional

features – core type & shell type transformers, induced emf equation, transformation ratio's-losses in a transformer- efficiency of transformer-transformer on no-load & R-load –simple problems.

UNIT – V

DIODE AND ITS CHARACTERISTICS: Formation of n- type and p-type semiconductor – Construction of P-N junction diode, symbol - V-I Characteristics- Diode Applications-Rectifiers – Half wave-Full wave-mid-point only-simple Problems.

UNIT - VI

TRANSISTORS and CRO: Formation of PNP and NPN transistors – CE configuration of NPN and PNP transistors- applications -Transistor as an amplifier- construction and Principle of CRO(operation only)-Applications.

TEXT BOOKS:

1) Electrical and Electronic Technology – 10th Edition – Edward Hughes, Pearson Publications
2) Engineering Circuit Analysis – 8th Edition – W.Hayt & J.E.Kemmerly, Mc Graw Hill Publications
3) Basic Electrical Engineering – 2nd Edition – Kothari & Nagrath, TMH Publications
4) Principles of Electrical & Electronics Engineering – 1st Edition – V.K.Mehta, S.Chand Publications

REFERENCES:

1) Introduction to Electrical Engineering – 3rd Edition – M.SNaidu & S.Kamakshaiah, TMH Publ.
2) Electrical Circuit Analysis – 3rd Edition – Sudhakar & Shyam Mohan, TMH Publications
3) A Text Book of Electrical Technology–8th Edition- B.L.Theraja & A.K.Theraja, S.Chand Publications

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (M.E)	L	T	C
	2	1	3

(A0504203) PYTHON PROGRAMMING
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES: This course will enable students to:
- Learn Syntax and Semantics of various Operators used in Python.
- Understand about Various Input, Output and Control flow statements of Python.
- Understand Strings, List, Tuple, Set and Dictionary in Python.
- Implement Object Oriented Programming concepts in Python.
- Understand Exception handling and File I/O in Python.
- Understand Functions, Modules and Regular Expressions in Python.

COURSE OUTCOMES: The students should be able to:
- Examine Python syntax and semantics and be fluent in the use of various Operators of Python.
- Make use of Flow Control statements, Input / Output functions and Strings of Python.
- Demonstrate proficiency in handling of data structures like List, Tuple, Set and Dictionary.
- Demonstrate the use of Functions, Modules and File I/O operations in in Python.
- Interpret the Concepts of Object-Oriented Programming in Python.
- Interpret the various issues of Exception handling mechanisms and Regular Expressions in Python.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1			2				1	1		1	1	1		
CO2	3	2	1		2				1	1		1	1	1		
CO3	3	3	2	1	2				1	1		2	1	2	2	
CO4	3	2	1	1	2				1	1		1	1	1	1	
CO5	3	3	2	1	2	1			1	1		2	2	2	2	
CO6	3	3	2	1	2	2			1	1		2	2	2	2	

UNIT – I:
Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Overview on Fundamental data types of Python.
Operators in Python: Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Shift Operators, Ternary operator, Membership Operators, Identity Operators, Expressions and order of evaluations. Illustrative examples on all the above operators.

UNIT – II:
Input and Output statements: input() function, reading multiple values from the keyboard in a single line, print() function, 'sep' and 'end' attributes, Printing formatted string, replacement operator ({}). **Control flow statements:** Conditional statements. Iterative statements. Transfer statements.
Strings: Operations on string, String slicing, important methods used on string.

UNIT – III:
Lists: Operations on List, important methods used on list. List comprehensions
Tuples: Operations on tuples, important methods used on tuple.
Sets: Operations on sets, important methods used on set.
Dictionaries: Operations on Dictionaries, important methods used on dictionaries.

UNIT – IV:

Functions - Defining Functions, Calling Functions, Types of Arguments - Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful functions, Scope of the Variables in a Function. Recursive functions.

Modules: Creating modules, import statement, from Import statement.

File I/O: Need of files concept, Types of files, Opening and Closing a Text file, Reading & Writing operations on files, Setting offsets in a file, Traversing a Text file.

UNIT – V:

Object Oriented Programming (OOP) in Python: Classes and Objects, 'self-variable', Types of Variables and Methods used in Classes, Constructor Method, Inheritance, Overriding Methods, Abstract Classes, Data hiding.

UNIT – VI:

Error and Exceptions: Difference between an Error and Exception, Types of Exceptions, Handling Exceptions, try, except, else and finally blocks, control flow in try-except-else-finally blocks, Raising Exceptions, Customized Exceptions.

Regular Expressions: Character matching in regular expressions, extracting data using regular expressions.

TEXT BOOKS

1) Allen B. Downey, “Think Python”, 2nd edition, SPD/O’Reilly, 2016.
2) Martin C. Brown, “The Complete Reference: Python”, McGraw-Hill, 2018**.**

REFERENCE BOOKS

1) R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press, 2019Core Python Programming, 2016 W.Chun, Pearson.
2) Introduction to Python, 2015 Kenneth A. Lambert, Cengages
3) https://www.w3schools.com/python/python_reference.asp
4) https://www.python.org/doc/

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (M.E)

L	T	C
2	1	3

[A0308204] KINEMATICS OF MACHINERY

COURSE OBJECTIVES:

- To study about terms used in kinematics of machinery.
- To learn how to analyze the motions of link mechanisms and to analyze forces in machines.
- To analyze the motions of Cam and follower assembly.
- To locate the instantaneous centre for the given planer mechanism.
- To determine the velocity and accelerations of the linkages in a planer mechanism.
- To study about the toothed gears and related terminology.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

- Understand the basic principles of mechanisms in mechanical engineering.
- Apply the concepts of kinematic analysis in determining the velocity and acceleration of various links.
- Understand the straight-line mechanisms.
- Design and draw the Cam profile for the given application
- Analyse gears and gear trains of industrial applications

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	3	-	2	-	2	-	1	-	-	-
CO2	3	2	2	2	-	-	2	-	2	-	-	-	1	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	2	-	2	1	-	-
CO4	3	2	3	2	2	-	-	-	-	-	2	-	2	-	-	-
CO5	3	2	2	2	2	-	-	-	-	-	1		2	1	-	-

UNIT – I

MECHANISMS: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained .

MACHINES: Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains.

UNIT - II

KINEMATICS: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain.

Analysis of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider – Acceleration diagram for a given mechanism, Klein's construction.

UNIT-III

PLANE MOTION OF BODY: Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

Straight Line Motion Mechanisms: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott-Rassul – Grasshopper – Watt T. Chebi-cheff and Robert Mechanisms and straight line motion, Pantograph.

UNIT – IV

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases.

UNIT – V

TOOTHED GEARING: Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact.

UNIT – VI

GEAR TRAINS: Introduction – Train value – Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains.

TEXT BOOKS:

1) Theory of Machines and Mechanisms-S.S.Rattan, Tata McGraw Hill Publishers
2) Theory of Machines by Thomas Bevan/ CBS.

REFERENCE BOOKS:

1) Theory of Machines / R.K Bansal, Lakshmi Publications.
2) Theory of machines by Jagadishlal.
3) Theory of Machines R.S Khurmi & J.K Gupta.
4) Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
5) The theory of Machines /Shiegley/ Oxford.
6) Theory of machines – PL. Balaney/khanna publishers

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (ME)

L	T	C
2	1	3

(A0309204) APPLIED THERMODYNAMICS

(Note: Steam Tables and Mollier Chart are permitted in the examinations)

COURSE OBJECTIVES:

- To learn about IC engines and theory of combustion
- To learn about vapor cycles and their first law and second law efficiencies
- To learn about gas dynamics of steam through nozzles
- To learn the about reciprocating compressors with and without inter cooling

COURSE OUTCOMES:

- They will be able to understand the IC engines and, theory of combustion
- They will be able to Conduct the performance test and estimating the performance of an I.C Engines
- The students will get a good understanding of vapor power cycles.
- They will be able to analyze energy conversion in various thermal devices such as, nozzles, and reciprocating compressors

MAPPING OF COs & POs:

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

UNIT-1

Air Standard Cycles: Air Standard Otto Cycle, Diesel Cycle - Simple problems.

Introduction to IC Engines: Energy conversion, Classification of I.C. Engines, Working principle of two stroke and four stroke engines & application of I.C Engines.

UNIT-2

Combustion in I.C Engines: Stages of combustion in SI & CI Engines - Importance of flame speed and factors influencing the flame speed in SI engines- Importance of ignition delay period and factors affecting the ignition delay period in CI Engines- Abnormal Combustion - pre-ignition- Phenomenon of Knocking SI & CI, Summary of Engine variables affecting the knocking, Comparison of knock in SI & CI Engines. Introduction to MPFI & CRDI.

UNIT-3

Testing and Performance: Engine Performance Parameters - Emissions from Diesel & Petrol Engines, BS-Norms - Simple problems on performance and heat balance sheet.

UNIT-4

Vapor power cycles: Rankine cycle with superheating, reheating and regeneration. Supercritical and ultra super-critical Rankine cycle. Combined gas and vapor power cycles. Simple problems on Rankine Cycle.

UNIT-5

Steam Nozzles: Introduction - types, Steam flow through nozzles- condition for maximum discharge (critical pressure ratio), Nozzle efficiency - Simple problems.

Air Compressors: Introduction, Classification **-** Reciprocating compressors, optimal pressure ratio, effect of inter cooling, minimum work for multistage reciprocating compressors- Introduction to rotary compressors.

UNIT-6

Refrigeration & Air Conditioning: Working principle of vapor compression & Vapor Absorption refrigeration system, – summer and winter air conditioning system.

TEXT BOOKS:

1) Thermal Engineering, R.K. Rajput, 7/e, Lakshmi Publications, 2009.
2) Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand.

REFERENCES:

1) Fundamentals of Thermodynamics, . Sonntag, R. E, Borgnakke, C. and Van Wylen.
2) Thermal Engineering - M.L.Mathur & Mehta, Jain bros.
3) Fundamentals of Engineering Thermodynamics, Moran, M. J. and Shapiro.
3) Thermodynamics and Heat Engines, R.Yadav, Central Book Depot.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (ME)

L	T	C
2	1	3

(A0310204) INDUSTRIAL MANAGEMENT & ACCOUNTANCY

COURSE OBJECTIVES:

- To impart knowledge on work study techniques towards productivity improvement industrial engineering concepts towards manufacturing management quality engineering and reliability tools.
- To impart knowledge on the material management.
- This course will introduce various concepts and methods of economic analysis in engineering, including the time value of the money and its effect on economic decisions, economic equivalence, cash flow analysis and cost accounting.

COURSE OUTCOMES:

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

- Understand where the plant is to be located based on facilities available and plant layout and also plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time.
- Apply various work study techniques towards productivity improvement apply in IE&M concepts in real life environment for goal achievement.
- Understand the importance and function of inventory and apply selected techniques for its control and management under dependent and independent demand circumstances, importance of Inventory control to ensure their availability with minimum capital lock up.
- Apply the basic principles of group dynamics and associated concepts required for HRM in organizations. Design a simple sampling plan, construct its OC curve and evaluate its effectiveness on a given sampling process.
- Perform analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.
- Perform financial accounting and its analysis.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	-	-	3	3	2	2	-	-	-	-	-	-	1	1	-	1
CO3	-	-	-	-	-	1	3	3	-	-	2	2	2	-	-	2
CO4	3	-	-	3	2	-	-	-	-	-	2	-	2	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-	-
CO6	-	-	-	2	-	3	-	2	1	-	1	2	1	2	-	1

UNIT-I

INTRODUCTION: Introduction to Management, Concept of Industrial Management, Functions of Management.

PLANT LOCATION & LAYOUT: Introduction, factors affecting the plant location, comparison of rural and urban sites- methods for selection of plant. Types of production systems; Plant Layout – objectives and types of plant layout.

UNIT-II

WORK STUDY: Introduction, objectives of work study, steps in work study, purpose of method study, procedure of method study, recording techniques. Work measurement-purpose of work measurement, time study procedure-performance rating, standard time calculations (simple problems).

UNIT-III

MATERIALS MANAGEMENT: Objectives, Inventory – functions, types, associated costs, inventory control techniques-ABC and VED analysis. Purchase management, duties of purchase of manager, associated forms, purchase procedure, methods of purchasing**.** Stores Management and Stores Records.

UNIT-IV

QUALITY CONTROL: Meaning, process control, SQC control charts, single, double and sequential sampling,

JOB EVALUATION AND MERIT RATING: Job Evaluation - Objectives, Methods of job evaluation. Merit Rating - Objectives and methods of merit rating.

UNIT-V

ELASTICITY OF DEMAND: Introduction, Types, measurement and significance of elasticity of Demand.

BREAK EVEN ANALYSIS (BEA) - Determination of breakeven point (simple problems) - managerial significance and limitations of BEA.

BUSINESS AND NEW ECONOMIC POLICY: Characteristics of business, features and evaluation of forms of business organization based on ownership, Nature of the economy, structure of the economy, economic policies, new economic policy 1991, economic conditions.

UNIT-VI

Accountancy: Accounting principles, Procedure-Double entry system-journal-ledger, Trail balance –cash book-preparation of trading, profit and loss Account-Balance sheet.

TEXT BOOKS:

1) Dr. Ravi Shankar: Industrial Engineering and management/Galgotia publications pvt. Ltd.
2) Khanna O.P.: Industrial Engineering.

REFERENCE BOOKS:

1) Industrial engineering and operations management by S.K. Sharma and Savita Sharma.
2) T.R. Banga: Industrial Engineering and Management
3) M. Mahajan: Industrial engineering and production management, Dhanpat Rai & Co.
4) Ashwatappa. K “Business Environment”
5) Aryasri “Managerial Economics and Financial Accounting”
6) Agarwal AN, “Indian Economy “Wiley Eastern Ltd, New Delhi
7) Jain and Narang “Accounting part-1” Kalyani publishers
8) Arora, M.N.” Cost Accounting”, Vikas publications

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (ME)

L	T	C
1	2	2

(A0019203) APTITUDE ARITHMETIC REASONING AND COMPREHENSION

(Skill Development Course)

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

COURSE OBJECTIVES:

- To familiarize the students about the concepts of aptitude, arithmetic and reasoning.
- To cope up the students to improve their employable skills.

COURSE OUTCOMES:

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

- Understand number system which helps to become well trained for recruitment drives.
- Analyze permutations and combinations concept.
- Obtain the knowledge of coding and decoding concept.
- Understand the topics related to clock and probability.
- Identify the topics related to Venn diagrams, reasoning and Non-verbal reasoning.

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-			
CO2	3	3	2	-	-	-	-	-	-	-	-	-			
CO3	3	2	2	-	-	-	-	-	-	-	-	-			
CO4	3	2	3	-	-	-	-	-	-	-	-	-			
CO5	3	3	2	-	-	-	-	-	-	-	-	-			

UNIT I

Numbers, Number Systems, Simple Equations, Ratio, Proportion, Variation Quadratic Equations, Progressions, Percentages.

UNIT II

Profit and Loss, Partnerships, Averages, Mixtures & Allegations, Simple Interest, Compound Interest, Time and Work, Pipes, indices, surds, inequalities, Cisterns Time and Distance Geometry and Mensuration.

UNIT III

Permutations and Combinations, Probability, Data Interpretation & Data Sufficiency.

UNIT IV

Number & Letter Series, Analogies, Coding and Decoding, Odd Man Out, Blood Relations.

UNIT V

Direction Sense, Symbols and Notations, Deductions & Connectives, Clocks, Calendars Analytical

UNIT VI

Reasoning (Verbal and Non-Verbal), Venn Diagrams, Analytical Puzzles and Octal number system.

TEXTBOOKS & REFERENCES:

1) R.S.Agarwal, (2016), Quantitative Techniques, S.Chand Publishers.
2) Shankuntala Devi, (2003), Techniques of Reasoning. S.Chand Publishers.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (ME)

L	P	C
0	3	1.5

(A0295204) BASIC ELECTRICAL & ELECTRONICS ENGG. LAB

COURSE OBJECTIVES:

- To experiment and verify the basic electrical and electronic principles.
- To provide practical exposure to test the performance of DC machines.
- It helps to study the characteristics of basic electronics devices

COURSE OUTCOMES:

At the end of the course student is able to

- To know the basic knowledge of electrical circuit parameters and Kirchhoff's laws.
- Understand the principles of dc machines and transformers.
- Analyze the working operations of measuring instruments, electrical machines.
- Determine the efficiency of machines, half wave and full wave rectifiers.
- Able to observe the different tests and calculations of all machines.
- Applications of dc machines, instruments and rectifiers.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		-	-	2	-	-	-	3	-	-	-				
CO2	3	1	2	-	2	-	-	-	3	-	-	-				
CO3	3	3	2	2	1	2	-	-	3	-	2	-				
CO4	3	1	1	1	-	1	-	-	3	-	-	-				
CO5	3	2	1	2	-	2	-	-	3	-	2	-				
CO6	3	2	1	1	2	1	-	-	2	1	-	-				
Avg.	3	2	2	2	2	2	-	-	3	1	2	-				

SECTION – A

Electrical Engineering Lab: **(Any five experiments)**

1) Verification of Kirchhoff's laws
2) Verification of Resistors in Series and Parallel
3) Verification of Ohm's law
4) Speed control of D.C. Shunt motor by Armature Voltage control
5) Speed control of D.C. Shunt motor by Field flux control method
6) Brake test on D.C Shunt Motor

SECTION – B

Electronics Engineering Lab: (Any five experiments)

1) PN-Junction diode characteristics
2) Half-wave Rectifier without filters
3) Full-wave center tapped without filters
4) Transistor Common Emitter Characteristics (Input and Output)
5) Common Emitter Amplifier
6) Study of CRO (Voltage and time measurements)

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (ME)

L	P	C
0	3	1.5

(A0571203) PYTHON PROGRAMMING LAB
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To be able to introduce core programming basics and various Operators and flow control statements of Python programming language through proper practice.
- To demonstrate about various Python fundamental data structures such as int, float, complex, bool and strings.
- To demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries.
- To demonstrate about Functions, Modules and File Input - Output operations in Python programming language.
- To demonstrate about Object Oriented Programming in Python Programming.
- To understand about and Exception handling mechanisms and Regular Expressions in Python Programming.

COURSE OUTCOMES:
- Student should be able to understand the basic concepts of scripting and the contributions of scripting language.
- Student should be able to explore Fundamental data structures in Python.
- Student should be able to explore python data structures like Lists, Tuples ,Sets and dictionaries.
- Student should be able to explore Functions, Modules and File input – Output Operations in Python programming language.
- Student should be able to explore Object Oriented Programming in Python Programming.
- Student should be able to create practical and contemporary applications using Exception handling mechanisms and Regular Expressions.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1			1				1	1		1	2	1	1
CO 2	3	3	2		2				1	1		1	1	1	1
CO 3	3	2	2	1	2				1	1		2	1	2	1
CO 4	3	2	1		2				1	1		1	1	2	
CO 5	3	3	1	1	1				1	1		2	2	2	2
CO 6	3	3	1	1	1				1	1		2	2	2	2

S.No	Name of the Experiment
1	a) Demonstrate about Basics of Python Programming.
	b) Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)
	c) Demonstrate the working of following functions in Python. i) id( ) ii) type( ) iii) range( )
	d) Write a Python program to demonstrate various base conversion functions.
	e) Write a Python program to demonstrate various type conversion functions.
2	a) Demonstrate the following Operators in Python with suitable examples. i) Arithmetic Operators ii) Relational Operators iii) Assignment Operator iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
3	a) Write Python programs to demonstrate the following:

	i) input( ) ii) print( ) iii) 'sep' attribute iv) 'end' attribute v) replacement Operator ({ })
	b) Demonstrate the following Conditional statements in Python with suitable examples. i) if statement ii) if else statement iii) if – elif – else statement
	c) Demonstrate the following Iterative statements in Python with suitable examples. i) while loop ii) for loop
	d) Demonstrate the following control transfer statements in Python with suitable examples. i) break ii) continue iii) pass
4	Write Python programs to print the following Patterns:
	i) A A B A B C A B C D A B C D E ii) * * * * * * * * * * * * * * *
	iii) E E E E E E E E E D D D D D D D C C C C C B B B A iv) 4 4 3 4 3 2 4 3 2 1 4 3 2 1 0 4 3 2 1 4 3 2 4 3 4
	v) 4 3 4 2 3 4 1 2 3 4 0 1 2 3 4 1 2 3 4 2 3 4 3 4 4 vi) * * ** ** *** *** **** **** **********
	vii) ** ** **** **** ****** ****** ******** ******** ********** ********** viii) E D E C D E B C D E A B C D E B C D E C D E D E E
5	a) Write a Python program to demonstrate various ways of accessing the string. i) By using Indexing (Both Positive and Negative) ii) By using Slice Operator

	b) Demonstrate the following functions/methods which operates on strings in Python with suitable examples: i) len( ) ii) strip( ) iii) rstrip( ) iv) lstrip( ) v) find( ) vi) rfind( ) vii) index( ) viii) rindex() ix) count( ) x) replace( ) xi) split( ) xii) join( ) xiii) upper( ) xiv) lower( ) xv) swapcase( ) xvi) title( ) xvii) capitalize( ) xviii) startswith() xix) endswith()
6	a) Demonstrate the different ways of creating list objects with suitable example programs.
	b) Demonstrate the following functions/methods which operates on lists in Python with suitable examples: i) list( ) ii) split( ) iii) len( ) iv) count( ) v) index ( ) vi) append( ) vii) insert( ) viii) extend() ix) remove( ) x) pop( ) xi) reverse( ) xii) sort( ) xiii) copy( ) xiv) clear( )
	c) Demonstrate the following with suitable example programs: i) List slicing ii) List Comprehensions
7	a) Demonstrate the different ways of creating tuple objects with suitable example programs.
	b) Demonstrate the following functions/methods which operates on tuples in Python with suitable examples: i) len( ) ii) count( ) iii) index( ) iv) sorted( ) v) min ( ) vi)max( ) vii) cmp( ) viii) extend() ix) remove( ) x) pop( ) xi) reverse( ) xii) sort( ) xiii) copy( ) xiv) clear( )
8	a) Demonstrate the different ways of creating set objects with suitable example programs.
	b) Demonstrate the following functions/methods which operates on sets in Python with suitable examples: i) add( ) ii) update( ) iii) copy( ) iv) pop( ) v) remove( ) vi)discard( ) vii) clear( ) viii) union() ix) intersection( ) x) difference( )
9	a) Demonstrate the different ways of creating dictionary objects with suitable example programs.
	b) Demonstrate the following functions/methods which operates on dictionary in Python with suitable examples: i) dict( ) ii) len( ) iii) clear( ) iv) get( ) v) pop( ) vi)popitem( ) vii) keys( ) viii) values() ix) items( ) x) copy( ) xi) update( )
10	a) Demonstrate the following kinds of Parameters used while writing functions in Python. i) Positional Parameters ii) Default Parameters iii)Keyword Parameters iv) Variable length Parameters
	b) Write a Python program to return multiple values at a time using a return statement.
	c) Write a Python program to demonstrate Local and Global variables.
	d) Demonstrate lambda functions in Python with suitable example programs.
11	a) Python program to perform read and write operations on a file.
	b) Python program to copy the contents of a file to another file.
	c) Python program to count frequency of characters in a given file.
	d) Python program to print each line of a file in reverse order.
	e) Python program to compute the number of characters, words and lines in a file.
12	Demonstrate various Object Oriented Programming Concepts in Python Programming with illustrative examples.

13	Demonstrate about Exception Handling in Python Programming with illustrative examples.
14	a) Demonstrate the following in-built functions to use Regular Expressions very easily in our applications. i) compile( ) ii) finditer( ) iii) match( ) iv) fullmatch( ) v) search( ) vi) findall( ) vii) sub( ) viii) subn( ) ix) split( )
	b) Write a Regular Expression to represent all RGM language (Your own language) identifiers. **Rules**: 1. The allowed characters are a-z,A-Z,0-9,#. 2. The first character should be a lower case alphabet symbol from a to k. 3. The second character should be a digit divisible by 3. 4. The length of identifier should be at least 2. Write a python program to check whether the given string is RGM language identifier or not?
	c) Write a Regular Expression to represent all 10 digit mobile numbers. **Rules:** 1. Every number should contains exactly 10 digits. 2. The first digit should be 7 or 8 or 9 Write a Python Program to check whether the given number is valid mobile number or not?

TEXT BOOKS

1. Learning Python, Mark Lutz, Orielly, 3 Edition 2007.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson, 2017.

REFERENCE BOOKS

1) Think Python, 2 Edition, 2017 Allen Downey, Green Tea Press
2) Core Python Programming, 2016 W.Chun, Pearson.
3) Introduction to Python, 2015 Kenneth A. Lambert, Cengages
4) https://www.w3schools.com/python/python_reference.asp
5) https://www.python.org/doc/

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

II B.Tech, II-Sem (ME)

L	P	C
0	3	1.5

(A0394204) THERMAL ENGINEERING LAB

COURSE OBJECTIVES:

- Imparting intensive and extensive knowledge of the Lab so that students can understand the role of Thermal Engineering in the field of Engineering.
- Developing theoretical/practical capabilities of students so that they can characterize, transform and use Thermal Engineering in Engineering and Apply knowledge gained in solving related Engineering problems.
- The student should able to know the use of various air compressors.
- The student should able to know the use of refrigeration systems.
- The student should able to know the use of air conditioning systems.

COURSE OUTCOMES:

At the end of the Lab work the student should have knowledge on/off:

- Applying the practical skills in designing and testing the thermal engineering related equipment.
- How to estimate the performance of a boiler.
- How to estimate the performance of an air compressor.
- Conducting and estimating the performance of a refrigerator and air conditioning systems.

MAPPING OF COs & POs:

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

LIST OF EXPERIMENTS:

CYCLE: I

1) Determination of Volumetric & Isothermal Efficiency of Multi Stage Reciprocating Air Compressor Test Rig.
2) Performance test on Centrifugal/axial flow air compressor test rig.
3) Determination of Calorific Value of a liquid/gaseous fuels.
4) Determination of Kinematic & Dynamic Viscosities of liquid fuels by using Redwood & Say Bolt Viscometer.
5) Determination of flash & Fire Points of Liquid Fuels by using Cleveland's & Ables apparatus.

CYCLE: II

1) Draw the Actual Valve & Port timing Timing Diagrams of a four stroke Diesel/ two stroke petrol Engines.
2) Performance Test on 4S Single Cylinder/Multi Cylinder Petrol / Diesel Engine test rigs.
3) Performance Test on VCR Computerized Multifuel Research Engine test rig.
4) Determination of Engine friction Power by Morse, retardation & Willan's line test Methods.
5) To draw the HBS/HBC on 4S Single Cylinder/Multi Cylinder Petrol / Diesel Engine test rigs.

STUDY:

1) Study of I.C Engine Parts.

EXPERIMENTS BEYOND THE CURRICULUM:

1) Determination of COP of a Vapor Compression Refrigeration Test Rig.
2) Determination of COP of a Summer/winter Air Conditioning Test Rig.
3) Measurement of I.C Engine Exhaust Gas Emissions from Petrol/Diesel Engines.
4) To draw the HBS/HBC on VCR Computerized Multifuel Research Engine test rig.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0311205] HEAT TRANSFER

(Note: The use of Heat transfer data book along with steam tables is permitted in the examinations)

COURSE OBJECTIVES:

- To impart the basic laws of various modes of heat transfer and their applications
- To familiarize the conduction convective heat transfer concepts
- To explain basics of radiation heat transfer
- To make conversant with the heat transfer analysis related to thermal systems like heat exchangers, evaporator, and condenser.
- To understand the phenomenon of boiling and condensation

COURSE OUTCOMES:

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

- Compute temperature distribution in heat conduction
- Understand and analyze heat transfer through extended surfaces
- Analyze forced and free convection heat transfer.
- Design heat exchangers using LMTD and NTU methods.
- Understand the principles of radiation heat transfer.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	2	1	-	-	-	-	1	1	2	2	3	1
CO2	3	3	2	2	2	1	1	-	-	-	1	1	2	2	2	2
CO3	3	3	2	3	2	1	1	-	-	-	1	1	2	3	3	1
CO4	3	2	2	3	1	1	1	-	-	-	1	1	2	1	2	2
CO5	3	2	2	3	1	1	-	-	-	-	1	1	2	1	1	1

UNIT – I

INTRODUCTION: Modes of heat transfer – Basic laws of heat transfer – General applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical coordinates - Heat conduction through plane walls and composite walls - hollow and composite cylinders - hollow and composite spheres - critical thickness of insulation
– Problems.

UNIT - II

FINS: Heat flow through extended surfaces - infinite long fin – fin insulated at the tip- fin losing heat at the tip - Efficiency and effectiveness of the fin.

ONE DIMENSIONAL TRANSIENT HEAT CONDUCTION: Heat conduction in solids having infinite thermal conductivity (negligible internal resistance) – Significance of Biot and Fourier Numbers - Problems.

UNIT – III

CONVECTIVE HEAT TRANSFER: Non-dimensional numbers - Significance of non-dimensional numbers - correlations for convective heat transfer.

FORCED CONVECTION: Introduction to hydrodynamic boundary layer - Concepts and definitions - thermal boundary layer - correlations for forced convection – flow over flat plates and walls - flow inside pipes - turbulent flow over flat plate, cylinders - Problems.

UNIT IV

FREE CONVECTION: Bulk mean temperature and mean film temperature – local and average heat transfer coefficients - correlations for free convection – horizontal plates, cylinders – problems.

Heat Transfer with Phase Change: Boiling – Regimes (Theory only),

Condensation: Film wise and drop wise condensation (Theory only).

UNIT: V

HEAT EXCHANGERS: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor

– Concepts of LMTD and NTU methods – effectiveness - Problems using LMTD and NTU methods.

UNIT VI

RADIATION HEAT TRANSFER:

Introduction - surface emission properties - absorptivity, reflectivity, and transmissivity - concept of black body & grey body - Stefan Boltzmann law - Kirchhoff, Wein&Lambert‟s cosine law .

TEXT BOOKS:

1. Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2007.
2. Fundamentals of Engg. Heat and Mass Transfer, RC.Sachdeva, 3/e, New Age International, 2009.

REFERENCE BOOKS:

1. Heat and Mass Transfer, D.S.Kumar.SK Kataria& Sons, 2015.
2. Heat Transfer, Holman, J. P., Bhattacharyya Souvik, Tata McGraw Hill, New Delhi, 10th edition 2017.
3. Heat Transfer, P.K.Nag, 2/e, TMH, 2010
4. Fundamentals of Heat and Mass Transfer, Kondandaraman, C.P., 3/e, New Age Publ, 2006.
5. Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International, 2011.
6. Heat and Mass Transfer by JP Holman. MH Publications, 2017.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0312205] METAL CUTTING & MACHINE TOOLS

COURSE OBJECTIVES:

- The course provides students with fundamental knowledge and principles in material removal processes.
- In this course, the student should understand the some fundamental aspects of an overview of machine tools & metal cutting theory, including Components of the Engine lathe, Turret and capstan lathes, Grinding machine, Drilling and Boring Machines, Milling machine, shaping slotting and planning machines.
- To demonstrate the fundamentals of machining processes and machine tools.
- To develop knowledge and importance of metal cutting parameters.
- The student should able to apply the knowledge to solve more complicated problems and study the effect of process parameters and able to describe the construction and working of different types machine tools.

COURSE OUTCOMES:

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

- Understand the fundamentals and principles of working of material removal process.
- Apply the knowledge on operations in conventional, automatic, Capstan and turret lathes.
- Analyze the skills on working principles and operations of shaping, slotting and planning.
- Understand the working of drilling, boring and broaching operations.
- Apply the knowledge on indexing the milling machine for gear cutting.
- Analyze the operations of grinding and super finishing process.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	3	1	1	1	2	2	1	2	2	1	2	2	1	1	2
CO 2	3	2	3	1	1	2	1	1	1	1	1	1	1	1	1	1
CO 3	3	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1
CO 4	3	2	1	1	1	2	2	1	1	1	1	2	1	1	2	1
CO 5	3	3	3	3	3	2	2	1	1	2	1	2	2	1	1	2
CO6	3	2	3	2	2	2	2	1	2	1	1	1	1	1	1	1

UNIT – I

Geometry of single point cutting tool and angles-Mechanism of chip formation in machining ductile and brittle materials- types of chips –Built-up-Edge (BUE) formation and its effects, Use of Chip breaker in machining-principles and methods of chip breaking. Mechanics of Orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut.

UNIT – II

Engine lathe – Principle of working, specifications of lathe – types of lathes – work holders, tool holders – Box Tools, Taper turning, thread turning and attachments for Lathes. Turret and capstan lathes – collect chucks –tool holding devices –tool layout.

Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout.

UNIT – III

Shaping, Slotting and planning machines – their Principles of working – Principal parts – specifications, classification, Operations performed-Machining time calculations. Shaper size,

shape mechanism, Crank and slotted link mechanism, Whit worth quick return mechanism, Hydraulic shaper mechanism.

UNIT – IV

Drilling and Boring Machines – Principle of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine-deep hole drilling machine.

UNIT – V

Milling machine – Principle of working – specifications – classifications and principle features of milling machines – machining operations, Types and geometry of milling cutters– methods of indexing –Director Rapid indexing, Plain or simple indexing, Compound indexing, Differential indexing and angular indexing.

UNIT – VI

Introduction to grinding, lapping, honing and broaching machines-classification- comparison of grinding, lapping and honing- Lapping, Honing and Broaching machines- Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel.

TEXT BOOKS:

1. Elements of Workshop Technology: Vol: II By S K HajraChoudhury; A K HajraChoudhury; Nirjhar Roy, Published By Media Promoters & Publisher, 14th Edition,2010.
2. A Course in Workshop Technology Vol II –B.S. Raghuwanshi , Published By DhanpathRai&Co., 2015.

REFERENCE BOOKS:

1. Manufacturing science, by AmitabGhosh and Ashok KumrMallik, published by Tata-McGraw-Hill Publications, second edition, 2010..
2. Metal cutting by Bhattacharya. published by New Central Book Agency ,2012.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0313205] DESIGN OF MACHINE ELEMENTS

(Note: Design Data Books are **Not Permitted** in the examination**)**

COURSE OBJECTIVES:

The course should enable the students to learn:

- To develop an ability to apply the knowledge of materials and mechanics
- To develop an ability to design a system / components to meet desired needs within realistic constrains using suitable design methodology
- To utilize various theories of design and methods of standardization.
- Apply the concept of design and validation by strength analysis.

COURSE OUTCOMES:

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

- Understand and identify the materials for the design of machine elements, selection of preferred sizes and numbers.
- Analyze the stresses and strains induced in a machine element
- Understand component behaviour subjected to loads and identify the failure criteria
- Design of Riveted and welded joints for industrial applications
- Apply knowledge to design bolted joints for industrial application.
- Understand working principles of springs for the industrial application.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	3	3	2	-	1	2	2	1	1	2	3	3	2
CO2	3	3	3	3	3	2	-	1	2	2	1	1	2	3	3	2
CO3	3	3	3	3	3	2	-	1	2	2	1	1	2	3	3	2
CO4	3	3	3	3	3	2	-	1	2	2	1	1	2	3	3	2
CO5	3	3	3	3	3	2	-	1	2	2	1	1	2	3	3	2
CO6	3	3	3	3	3	2	-	1	2	2	1	1	3	2	3	3

UNIT-I

INTRODUCTION: The art and science of machine design - Types of design methods – stages in machine design- Engineering materials and its classification, mechanical properties- Manufacturing considerations in design, Preferred numbers Types of loads ,Factor of safety.

UNIT-II

DESIGN OF MACHINE ELEMENTS AGAINST STATIC LOAD: Simple stresses-Combined stresses–Torsional and bending Stresses–impact stresses–Various theories of failure–Design for strength and rigidity, eccentric loading.

UNIT-III

DESIGN OF MACHINE ELEMENTS AGAINST DYNAMIC LOAD: Stress concentration–notch sensitivity, Fatigue stress concentration factor – Design for fluctuating stresses – Endurance limit, S-N Curve –EstimationofEndurancestrength–Goodman'scriteria–Soderberg'scriteria- Gerber's curve.

UNIT-IV:

DESIGN OF RIVETED AND WELDED JOINTS: Types of riveted joints - Caulking and fullering-modes of failure-strength and efficiency of riveted joints, pitch of the rivets, design stresses - boiler joints, - Riveted joints under eccentric loading.

WELDEDJOINTS: Types of welded joints, strength of welds, Design of simple welded joints- Welded joints under eccentric loads

UNIT-V:

DESIGN OF BOLTED JOINTS: Different Forms of Screw threads- Stresses in Screw fasteners - Design of bolts with pre-stresses–Design of joints under eccentric loading –Bolts of uniform strength.

UNIT-VI

HELICAL SPRINGS: Classification of springs-Stress and deflections of helical Springs-Springs for fatigue loading-Energy storage capacity, Concentric spring, Introduction to laminated spring.

TEXT BOOKS:

1. Design of Machine Elements, Bhandari V.B, Tata McGraw-Hill Book Co, 6th Edition, 2007.
2. Machine Design, Pandya and Shah, Charotar Publishers, Anand, India, 20th Edition, 2015
3. Kanniah, Machine Design, Scitech publishers, Hyderabad, 2nd Edition, 2010,

REFERENCES:

1. Mechanical Engineering Design, Shigley J.E, Mischke C. R., Tata McGraw-Hill, 6th dition, 2003
2. Machine Design, R S Khurmi and J K Gupta, S chand publications, New Delhi, 25th Edition, 2008.
3. Design and Machine Elements, Spotts M.F., Shoup T.E, Pearson Education, 2004.
4. Machine Design, Schaum's outlines,TMH Publishing company Ltd.,New Delhi, 2008.
5. Machine Design, Black and Adams, Mc Graw Hill publishing Co,New Yark, 1968.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0314205] TOOL DESIGN
(Professional Elective-I)

COURSE OBJECTIVES:

- Able to understand various manufacturing methods and to inculcate basic knowledge of tool design and the student should design single point cutting tools for various machining processes.
- To inculcate basic knowledge of tool design and the student should design multi point cutting tools for various machining processes
- The student should gain the Knowledge of designing jigs and fixtures.
- The student should gain the Knowledge of design considerations for blanking dies and piercing dies
- The student should gain the Knowledge of design considerations for progressive dies and drawing dies
- The student should gain the Knowledge for finding tool life of different tools in machining

COURSE OUTCOMES:

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

- Design and assess the tools for quality improvement, and able to design and develop
- Single point cutting tools
- Apply the skills to design and develop multi point cutting tools.
- Design jigs and fixtures for Industrial applications
- Design blanking dies and piercing dies for a particular application.
- Design and development of progressive dies and drawing dies for a particular application.
- Determine the tool life of different tools in machining

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	2	2	1	1	1	1	2	2	1	1	2
CO2	3	3	3	3	2	2	1	1	1	1	1	2	2	1	1	2
CO3	2	2	2	1	1	1	1	1	2	2	1	1	2	1	1	3
CO4	3	3	2	1	1	1	2	1	1	1	1	2	2	1	1	3
CO5	3	2	3	1	1	2	1	1	2	1	1	2	2	1	1	3
CO6	3	3	3	3	2	2	1	1	2	1	1	2	2	1	1	3

UNIT –I

DESIGN OF SINGLE POINT CUTTING TOOLS: Design of single point cutting tools such as solid tools, tipped tools, coated tipped tools, throw away type tools and diamond tools.

THERMAL ASPECTS IN MACHINING: Sources of heat generation in machining and its effects, temperature measurement techniques in machining, types of cutting fluids, Functions of cutting fluid, Characteristics of cutting fluid, Application of cutting fluids.

UNIT - II

DESIGN OF MULTIPOINT TOOLS: Design of plain milling cutter, gear milling cutters, hobs, gear shaping tools, broaches, drills, reamers, taps & dies for thread cutting, boring tools, flat form tools, circular form tools. Standard tool holders & standard tooling and their design for turrets and automates

UNIT -III

DESIGN OF JIGS AND FIXTURES: Basic principles of location and clamping, locating,

methods and devices, jigs, definitions, types, general consideration in the design of jigs, drills bushing, methods of construction, fixtures-vice fixtures milling, boring, and lathe grinding fixtures.

UNIT-IV

DESIGN OF SHEET METAL BLANKING AND PIERCING: Fundamentals of die cutting operating, power press types, General press information, Material handling equipment, cutting action in punch and die operation. Die clearance, and types of Die construction. Die design fundamentals-blanking and piercing die construction, pilots, striper and pressure pads presswork material, strip layout, short run tooling for piercing.

UNIT-V

DESIGN OF SHEET METAL BENDING, FORMING AND DRAWINGS DIE: Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing. Determination of blank size, drawing force, single and double action draw dies.

UNIT -VI

TOOL LIFE AND TOOL WEAR: theories of tool wear-adhesion, abrasive and diffusion wear mechanisms forms of wear, tool life criteria and Mach inability index, tool wear criterion, measurement of tool wear. Introduction to Plastic tooling-commonly used plastic tooling materials.

TEXT BOOKS:

1. Tool Engineering & Design, G.R.Nagpal, Khanna Publishers (1 January 2000).
2. Tool Design, Donaldson, Lecain and Goold, TMH, McGraw Hill Education; Fifth Edition (20 May 2017)
3. Principles of Metal cutting, A Bhattacharya, New Central Book Agency, Calcutta ,New Central Book Agency (1 January 2012).

REFERENCES:

1. Production Engineering Design (Tool Design), SurendraKenav and Umesh Chandra, Satyaprakashan, New Delhi, Satya publishers 2017.
2. Design of Cutting Tools. Use of Metal Cutting Theory, Amitabh Bhattacharya and Inyong Ham, ASTME publication Michigan USA, 2015.
3. Fundamentals of Machining and Machine Tools, RK Singal and Others, I K International Publishing House; 0 Edition (12 February 2008)
4. Metal Cutting Principles, Shaw, Oxford Univ. Press, 2012
5. Production Technology, P.C Sharma, S Chand (1 December 2006).

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0315205] ENGINEERING METROLOGY & MECHANICAL MEASUREMENTS
(Professional Elective-I)

COURSE OBJECTIVES:

- The student should understand the some fundamental aspects of system of limits and fits, measurement of linear, angular dimensions, including limit gauges.
- Emphasis is placed on understanding of surface roughness & described mathematically. The screw thread, gear measurement methods are also considered in some detail..
- The student should able to apply the knowledge to solve more complicated problems and study the effect of problem parameters and able to describe the construction and working of different types of metrology machines and also plot the performance curves.
- The student should be prepared to continue the study and analyze the metrology and surface engineering to solve the complicated practical problems.
- The students should get knowledge of force, pressure and temperature measuring devices and their applications.

COURSE OUTCOMES:

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

- Apply the knowledge of the limits, fits and tolerances for the Design the go and NOGO gauges
- Understand the metrology instruments & use the same for both linear and angular
- measurements
- Explain the basic measurement principles of comparators and transducers.
- Measure the various elements of screw thread and gear using different methods.
- Analyze the geometrical irregularities and use the suitable surface finish measurement instruments.
- Learn the concepts and select the suitable measuring devices to measure force, pressure, temperature

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	-	3	2	1	1	-	1	2	2	-	1	1
CO2	1	1	1	1	1	-	-	-	1	-	1	1	-	1	2	1
CO3	1	1	1	-	-	-	-	-	1	-	1	1	2	1	2	1
CO4	2	1	1	2	1	1	2	-	1	-	1	2	2	1	1	1
CO5	1	2	1	2	1	1	2	-	1	-	1	1	2	1	1	1
CO6	1	2	2	-	-	1	1	-	1	-	1	-	1	-	1	1

UNIT – I

LIMITS, FITS, TOLERANCES AND GAUGES: Introduction, Limits, tolerance, tolerance build-up, compound tolerances, terminology for limits and fits, system of writing tolerance, Unilateral, Bi-lateral systems; Relation between tolerance and cost; types of fits, hole and shaft basis systems, standard limit systems-Indian standard system, interchangeability and selective assembly. Taylor's principle – Design of go and No-go gauges, plug, ring, snap, gap, taper, profile and position gauges.

UNIT – II

STANDARDS OF MEASUREMENTS: Line standards, End standards and Wave length standards.

LINEAR AND ANGULAR MEASUREMENT: Vernier caliper, vernier height gauge, micrometers, telescopic gauge, dial bore gauge, slip gauges, vernier and optical bevel protractor, sine principle and sine bars, angle gauges, sprit level, clinometers, rollers and spheres used to determine the tapers.

UNIT –III

COMPARATORS: Introduction; Need of comparators; Basic Principles of Operation, uses, essential characteristics; classification of comparators- Mechanical, optical, mechanical optical, Electrical and Electronic Comparators, pneumatic comparators, multi check comparators, Eden- Rolt - Millionth comparator and their uses in mass production, linear variable differential transformer (LVDT);

UNIT – IV

SCREW THREAD MEASUREMENT: Screw thread terminology, errors in threads; pitch errors; measurement of various elements of thread; measurement of major, minor and effective diameter; Tool maker's microscope and its uses, optical projector.

GEAR METROLOGY: Terminology of gear tooth, measurement of tooth thickness-chordal thickness method-constant chord method-base tangent method-measurement over pins or balls Parkinson gear tester.

UNIT – V

SURFACE TEXTURE: Introduction, factors affecting the surface roughness, reasons for controlling surface texture, orders of geometrical irregularities, Elements of surface texture, methods of measuring surface finish, analysis of surface traces.

UNIT – VI

MEASUREMENT OF FORCE, PRESSURE, AND TEMPERATURE

Force measurement – Direct, Indirect, Load cells; Measurement of pressure – Bourdon gauge, Diaphragm, Bellows, Piezoelectric sensor; Temperature measurement – Thermocouple, Resistance Temperature Detectors, Thermistor, liquid in glass thermometer, bimetallic strip thermometers, and pyrometers.

TEXT BOOKS:

1. Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2009.
2. A text book of Metrology, M. Mahajan, DanpathRai& Co, 1st edition, 2012.
3. Engineering Metrology and Measurements, N.V. RAGHAVENDRA & L. KRISHNAMURTHY/ Oxford University Press, 1st edition, 2013.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/112104250
2. https://nptel.ac.in/courses/112106179

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0316205] FUEL CELL TECHNOLOGY
(Professional Elective-I)

COURSE OBJECTIVES:
- To present a problem oriented in depth knowledge of fuel cell technology
- To address the underlying concepts, methods and application of fuel cell technology

COURSE OUTCOMES:
At the end of the course, the student will be able to;
- Understand fuel cell fundamentals
- Analyse the performance of PEM fuel cell system
- Understand construction and operation of fuel cells
- Apply the modelling techniques for fuel cell system

MAPPING OF COs & POs:

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

UNIT-I
Overview of Fuel Cells: Description of fuel cell, brief history, classification, working principle, Fuel cell basic chemistry and thermodynamics of fuel cell and performance.
Fuel Cell Thermodynamics: Thermodynamic Potentials, Heat Potential of a Fuel: Enthalpy of reaction, Reaction Enthalpies, Work Potential of a Fuel: Gibbs Free Energy, Relationship between Gibbs Free Energy and Electrical Work, Computing Reversible Voltages, Reversible Voltage Variation with Temperature, Reversible Voltage Variation with pressure, Reversible Voltage Variation with concentration: Nernst Equation, Fuel Cell Efficiency-Ideal and real fuel cell efficiency.

UNIT-II
Fuel cell electrochemistry: electrode kinetics, types of voltage losses, polarization curve, fuel cell efficiency, Tafel equation, exchange currents.
Fuel Cell Modelling: A Basic Fuel Cell Model, 1-D PEM Fuel Cell Model,
Fuels for Fuel Cells: Hydrogen, Hydrocarbon fuels, effect of impurities such as CO, S and others, hydrogen generation and storage; limitations, recent advances.

UNIT-III
Overview of fuel cell types: Phosphoric acid fuel cell (PAFC), Polymer electrolyte membrane fuel cell (PEMFC), Alkaline fuel cell (AFC), Molten carbonate fuel cell (MCFC), Solid-oxide fuel cell (SOFC) and other fuel cells.

UNIT-IV
PEM Fuel cell components: Main PEM fuel cell components, materials, properties and processes: membrane, electrode, gas diffusion layer, bi-polar plates, flow field plate design, Fuel cell operating conditions: pressure, temperature, flow rates, humidity. **Direct methanol fuel cell**, active and passive DMFC, methanol cross over and techniques to reduce, current collectors.

UNIT-VI
Main components of solid-oxide fuel cells, Cell stack and designs, Electrode polarization,

testing of electrodes, cells and short stacks, Cell, stack and system modelling.

UNIT-VI

Fuel processing: Direct and in-direct internal reforming, Reformation of hydrocarbons by steam, CO2 and partial oxidation, Direct electro-catalytic oxidation of hydrocarbons, carbon decomposition, Sulphur tolerance and removal , Using renewable fuels for SOFCs.

TEXT BOOKS:

1. Fuel Cell Fundamentals, Ryan O′Hayre, Suk-Won Cha Whitney Colella, John Wiley & Sons, second edition 2018.
2. PEM Fuel Cells: Theory and Practice, Franno. Barbir, Elsevier/Academic Press, 2nd Ed., 2013.

REFERENCE BOOKS:

1. Fuel Cells and Their Applications, Karl Kordesch& Gunter Simader, VCH Publishers, 2001
2. Fuel Cell Technology Hand Book, Hoogers G., CRC Press, 2010

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0317205] INDUSTRIAL WASTE MANAGEMENT
(Open Elective-II/Job Oriented Course)

COURSE OBJECTIVES:
- To understand the wastewater treatment process.
- To gain knowledge on waste disposal in various ways.
- To know about advances in wastewater treatment.

COURSE OUTCOMES:
At the end of the course, the student will be;
- Understand wastewater treatment methods
- Understand and analyze the waste disposal methods
- Analyze technologies used for chemical and biological methods of effluent treatment
- Analyze advanced wastewater treatment to specific industries.

MAPPING OF COs & POs:

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

UNIT I
Wastewater Treatment an Overview: Terminology – Regulations – Health and Environment Concerns in waste water management – Constituents in waste water inorganic – Organic and metallic constituents. Process Analysis and Selection: Components of waste water flows – Analysis of Data – Reactors used in waste water treatment – Mass Balance Analysis – Modeling of ideal and non ideal flow in Reactors – Process Selection

UNIT II
Waste disposal methods – Physical, Chemical & Biological; Economical aspects of waste treatment and disposal. Treatment methods of solid wastes: Biological composting, drying and incineration; Design of Solid Waste Management System: Landfill Digester, Vermicomposting Pit.

UNIT III
Introduction: Classification and characterization of food industrial wastes from Fruit and Vegetable processing industry, Beverage industry; Fish, Meat & Poultry industry, Sugar industry and Dairy industry.

UNIT IV
Chemical Unit Processes: Role of unit processes in waste water treatment chemical coagulation – Chemical precipitation for improved plant performance chemical oxidation – Neutralization – Chemical Storage

UNIT V
Biological Treatment: Overview of biological Treatment – Microbial metabolism – Bacterial growth and energetics – Aerobic biological oxidation – Anaerobic fermentation and oxidation – Trickling filters – Rotating biological contractors – Combined aerobic processes – Activated sludge film packing.

UNIT VI
Advanced Wastewater Treatment: Technologies used in advanced treatment – Classification

of technologies. Removal of Colloids and suspended particles – Depth Filtration – Surface Filtration – Membrane Filtration- Absorption – Ion Exchange – Advanced oxidation process.

TEXT BOOKS:

1. Herzka A & Booth RG; "Food Industry Wastes: Disposal and Recovery"; Applied Science Pub Ltd. 1981.
2. Fair GM, Geyer JC &Okun DA; "Water & Wastewater Engineering"; John Wiley & Sons, Inc. 1986,

REFERENCES:

1. GE; "Symposium: Processing Agricultural & Municipal Wastes"; AVI. 1973,
2. "Food Processing Waste Management"; Inglett Green JH & Kramer A; AVI. 1979,
3. "Environmental Biotechnology: Principles and Applications"; Rittmann BE & McCarty PL; Mc-Grow-Hill International editions2001,.
4. "Environmental Biotechnology"; Bhattacharyya B C & Banerjee R; Oxford University Press
5. "Wastewater Treatment; Applied Science", Bartlett RE; Pub Ltd.
6. "Waste water Engineering Treatment and Reuse": G. Tchobanoglous, FI Biston, McGraw Hill, 2002.
7. "Industrial Waste Water Management Treatment and Disposal by Waste Water" 3rd Edition McGraw Hill 2008

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0318205] ELECTRIC VEHICLE TECHNOLOGY
(Open Elective-II/Job Oriented Course)

COURSE OBJECTIVES:

- To develop and understand the principles of conversion in design, construction and working of mechanical systems and electronic systems in automobiles.
- To solve multi-disciplinary problems and will be part of future developments in industries.

COURSE OUTCOMES:

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

- Understand the functionality of different parts of an automobile
- Analyze the fuel supply system used in petrol/ diesel engines
- Acquaintance of Micro-processor and microcomputers used in automobiles
- Analyze the role of sensors and actuators used in the management of vehicle control.
- Understand the functions of electronic fuel injection system and Ignition system
- Analyze the working of electric and hybrid vehicles.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	1	1	2	1	-	-	-	-	1	1	1	1	1
CO2	1	1	1	1	1	2	1	-	-	-	-	1	2	2	2	1
CO3	1	1	1	1	1	2	2	-	-	-	-	1	1	2	1	1
CO4	1	1	1	1	1	2	2	-	-	-	-	1	2	2	2	1
CO5	1	1	1	1	1	2	2	-	-	-	-	1	1	1	1	1
CO6	2	2	2	1	1	2	2	-	-	-	-	1	2	2	2	1

UNIT- I

Introduction to Automobile : Components of an automobile – chassis and body – power unit – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, oil filters, oil pumps – crank case ventilation-Fuel gauge – oil pressure gauge, Engine temperature indicator.

UNIT-II

Introduction to Electric Vehicles:
Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT-III

Fundamentals of Automotive Electronics: Microprocessor and micro Computer applications in automobiles; components for engine management System; electronic management of chassis system; vehicle motion control.

UNIT-IV

Sensors & Actuators: Introduction; Basic sensor arrangement; Types of Sensors such as oxygen sensors, Crank angle position sensors, fuel metering/vehicle speed sensors and detonation sensors, altitude sensors, flow Sensors, throttle position sensors, solenoids, stepper motors, relays.

UNIT-V

Electronic Fuel Injection & Ignition System: Introduction; feedback carburetor system;, throttle body injection and multi point fuel injection System, injection system controls-

advantage of electronic ignition systems, types of solid state system and their principle of operation, electronic spark timing

UNIT-VI

Automotive Electricals: Batteries; starter motor & drive mechanism; D.C. generator and alternator; regulation for charging; lighting design; dashboard instruments; horn, warning system and safety devices.

TEXT BOOKS:

1. Automobile Engineering, – Vol.1 & Vol.2, Kirpal Singh. Standard publishers-Distributors- Delhi, 13th edition, 2018,
2. Tom Denton, Automobile Electrical and Electronic Systems, Butterworth-Heinemann, 4th edition, 2014.
3. Automotive Electrical Equipment, P. L. Kohli, Tata McGraw Hill, 27th reprint., 2006.

REFERENCE:

1. Automotive Electronics Handbook, Ronald K. Jurgen, McGraw Hill Publishing Co., ISBN 0-07- 034453-1.
2. Automotive Electricity and Electronics, Al Santini, Delmar Publishers, NY, ISBN 0-8273-6743-0.
3. Automobile Electrical & Electronic Equipments, Young, Griffitns, Butterworth Publication, London.
4. Understanding Automotive Electronics, Bechfold, SAE 1998.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/103/108103009/

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0514205] DATA ANALYTICS USING R
(Open Elective-II/Job Oriented Course)

COURSE OBJECTIVES:

- Facilitate students to understand R programming
- Help students to gain a basic understanding of Data Analytics
- Inculcate working knowledge of plotting

COURSE OUTCOMES:

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

- Identify and execute basic syntax and programs in R
- Perform the Matrix operations using R built in functions
- Apply nonnumeric values in vectors
- Create the list and data frames
- Exploit the graph using ggplot2.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	1	2	2	1	-	-	-	-	1	1	1	1	2
CO2	1	1	1	2	2	2	1	-	-	-	-	1	2	2	2	2
CO3	1	1	1	2	2	2	2	-	-	-	-	1	1	2	1	2
CO4	1	1	1	2	2	2	2	-	-	-	-	1	2	2	2	2
CO5	1	1	1	1	2	2	2	-	-	-	-	1	1	1	1	2

UNIT I INTRODUCTION TO R PROGRAMMING

History and Overview of R- Basic Features of R-Design of the R System- Installation of R-Console and Editor Panes- Comments- Installing and Loading R Packages- Help Files and Function Documentation-Saving Work and Exiting R- Conventions.

UNIT-II

R for Basic Math Arithmetic - Logarithms and Exponentials - E-Notation - Assigning Objects – Vectors - Creating a Vector-Sequences, Repetition, Sorting and Lengths – Sub setting and Element Extraction -Vector – Oriented Behavior.

UNIT III MATRICES AND ARRAYS

Defining a Matrix – Defining a Matrix- Filling Direction- Row and Column Bindings- Matrix Dimensions-Sub setting- Row, Column, and Diagonal Extractions- Omitting and Overwriting-Matrix Operations and Algebra- Matrix Transpose- Identity Matrix- Matrix Addition and Subtraction- Matrix Multiplication-Matrix Inversion-Multidimensional Arrays-Subsets, Extractions and Replacements.

UNIT IV NON-NUMERIC VALUES

Logical Values- Relational Operators- Characters- Creating a String- Concatenation- Escape Sequences-Substrings and Matching- Factors- Identifying Categories- Defining and Ordering Levels- Combining and Cutting.

UNIT V LISTS AND DATA FRAMES

List of Objects - Component Access – Naming – Nesting - Data Frames - Adding Data Columns and Combining Data Frames – Logical Record Subsets – Some Special Values – Infinity – NaN – NA -NULL – Attributes – Object - Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions

UNIT VI BASIC PLOTTING

Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis Labels-Color-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an ExistingPlot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms—Reading and Writing Files- R-Ready Data Sets- Contributed Data Sets- Reading in External Data Files- Writing Out Data Files and Plots-AdHoc Object Read/Write Operations

TEXT BOOKS:

1. "The Book of R-A First Programming, Statistics", Tilman M. Davies, Library of Congress Cataloging-in-Publication Data, 2016.

REFERENCE BOOKS:

1. Hadley Wickham, Garrett Grolemund,"R for Data Science",Oreilly Publication,2017.
2. Roger D. Peng, "R Programming for Data Science" Lean Publishing, 2016.
3. Steven Keller, "R Programming for Beginners", Create Space Independent Publishing Platform2016.

ONLINE LEARNING RESOURCES:

- https://www.coursera.org/learn/data-analysis-r

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
1	2	2

[A0319205] COMPUTER AIDED MACHINE DRAWING
(Skill Development Course)

COURSE OBJECTIVES:

- To create the awareness among the students of making use of computers for drafting purpose.
- To train the student to make use of CAD software package.
- To improve the quality of the machine drawings.

COURSE OUTCOMES:

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

- Understand the national and international standards pertaining to machine drawing.
- Apply drawing primitives and editing / Modify commands to draw part modeling
- Understand and apply the importance of the linking functional and visualization aspects in the preparation of the part drawings.
- Design and drawing of drawings in mechanical components with codes, standards and symbols.

MAPPING OF COs & POs:

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

UNIT – I:

Introduction to Auto CAD: The Auto CAD screen - the X-Y co-ordinate system - angular measurement
- entering points in Auto CAD - functional keys. Code of practice for Engineering Drawing.

UNIT – II:

Introduction to machine drawing & modeling – commands – Accurate Input – O snaps – learn about line, circle, offset, undo, erase, print – drawing lines to exact points.

UNIT – III:

Object Properties & selection sets – and dimensioning – know about crossing selection – window selection – crossing polygon – crossing window – fence – quick select – changing the object Properties – colour – line type – line weight.

UNIT – IV:

Inquiry tools & layers – isometric views – measure distances – mass properties – area & information of selected objects – how to lock, hide and freeze the layers.

UNIT – V:

Advanced drawing and modifying commands – isometric views and dimensioning: rectangle – trim – extend – offset – scale – text etc. Sketchers – Shear plate – Friction plate – latch plate – Gear arm - Gasket of vacuum pump – C washer – special Cam

UNIT: VI

Modelling and editing of solids – extrude – revolve – sweep – copy faces – offset – loft – imprint etc., Modelling of machine part: cut of holder – Socket bearing – Truck Wheel – Index Guide – Anchor Clip

TEXT BOOKS:

1. Working Auto-CAD, Singh, TMH 2000.
2. Introduction to Auto-CAD 2D & 3D Design, Alf Yarwood , Edition 2017.

LIST OF EXERCISES:

1. Draw a simple entity using absolute co-ordinate method.
2. Draw a simple entity using relative co-ordinate method.
3. Draw a simple entity using direct distance method.
4. Using offset command & draw the given sketch.
5. By using Array command compute the drawing.
6. Draw simple machine element using fillet and chamfer command.
7. Exercise on mirror command.
8. Compute the drawing and specify dimensions.
9. Using copy commands compute the isometric views.
10. Exercise on isometric views.
11. Using revolve command complete the model.
12. Using extrude, sweep & loft command complete the model.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0395205] HEAT TRANSFER LAB

(Note: Heat Transfer Data Books are permitted in the Examinations)

COURSE OBJECTIVES:

- To analyze various modes of heat transfer experimentally
- To measure the heat transferred by conduction
- To measure the heat transferred by convection
- To measure the heat transferred by radiation

COURSE OUTCOMES:

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

- Analyze the different mode of heat transfer
- Evaluate the thermal conductivity through composite wall, lagged pipe, insulting sphere and metal rod.
- Determine the efficiency and effectiveness of fin by convection process
- Determine the overall heat transfer coefficient of the heat exchanger.
- Evaluating the emissivity of the test plate
- Understanding the boiling and condensation process, and estimating the overall heat transfer coefficient.

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	1	-	-	-	-	-	2	2	3	3	1
CO2	3	3	3	2	1	1	-	-	-	-	-	2	2	3	3	1
C03	3	3	3	3	1	1	-	-	-	-	-	2	2	3	3	1
CO4	3	3	3	3	1	1	-	-	-	-	-	2	2	3	3	1
CO5	3	3	3	3	1	1	-	-	-	-	-	2	2	3	3	1
CO6	1	1	1	1	1	1	-	-	-	-	-	2	2	3	3	1

LIST OF EXPERIMENTS:

1. Thermal conductivity of insulating powder through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus.
3. Overall heat transfer co-efficient through Composite Slab Apparatus.
4. Thermal Conductivity of Metal Rod (conductor).
5. Heat transfer coefficient in natural convection.
6. Effectiveness of Pin-Fin by forced convection.
7. Experiment on Parallel and counter flow heat exchanger.
8. Emissivity of a given test plate by Emissivity apparatus.
9. Experiment on Stefan Boltzmann Apparatus.
10. Experiment on Critical Heat flux apparatus.

EXPERIMENTS BEYOND THE CURRICULUM:

1. Study of heat pipe and its demonstration.
2. Heat transfer in drop and film wise condensation.
3. Effectiveness of Pin-Fin by Natural Convection Process.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

L	T	C
2	1	3

[A0396205] MACHINE TOOLS LAB

COURSE OBJECTIVES:

- This course "metrology and machine tools" lab imparts intensive and extensive practical knowledge of the lab so that students can understand the importance of concepts of "metrology and machine tools" in the field of engineering.
- The student should able to develop theoretical / practical capabilities so that they can characterize, transform, use and apply in engineering from the knowledge gained in solving related engineering problem.

COURSEOUTCOMES:

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

- Apply the knowledge of metrology and machine tools
- Understand the working function of various devices used in metrology
- Understand the working functions of sine bar, bevel protractor, gear teeth caliper and profile projector
- Understand the working functions of lathe machines
- Understand the working functions of drilling and milling machines
- Understand the working functions of shaping and slotting machines

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	1	2	2	2	1	1	1	2	2	1	1	2
CO2	3	3	2	1	2	3	1	1	1	1	2	2	1	1	1	1
CO3	3	2	2	3	2	2	2	2	2	2	1	2	1	1	1	1
CO4	3	3	2	2	3	1	2	1	1	1	1	2	1	1	2	1
CO5	3	3	2	3	3	2	1	1	1	1	1	2	2	1	1	2
CO6	3	3	2	3	3	1	2	2	1	1	2	2	1	1	1	1

LIST OF EXPERIMENTS:

1. Measurement of angle by sine bar and bevel protractor.
2. Measurement of length, height, depth diameters by vernier calipers, vernier height guage and micrometers.
3. Measurement of pitch, major diameter, minor diameter, pitch, threads angle, effective diameter and depth of thread of a given threaded component.
4. Perform Thread cutting and knurling operation on a cylindrical work piece using lathe machine.
5. Perform Drilling and tapping operation on a given work piece using radial drilling machine.
6. Produce maximum size of the square on a given cylindrical work piece using Shaping machine.
7. Machine slots on a given hollow work piece using slotting machine
8. Machine a keyway on a given work piece using a milling machine.
9. Perform Machine tool alignment tests on lathe.
10. Perform Step turning and taper turning operation on a cylindrical work piece using lathe machine

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME) | L | T | C
2 | 1 | 3

[A0320206] DESIGN OF TRANSMISSION ELEMENTS

(N**ote: The use of Design Data book is permitted in the examinations**)

COURSE OBJECTIVES:
The course should enable the students to learn:
- To develop the ability to execute original designs of machine elements.
- To analyse different mechanical systems and select the proper machine elements (Shafts, keys, couplings, bearings, belts & gears) from commercial catalogues for a required application.
- To implement design procedures to design and complete the projects individually or in a team.
- To communicate design ideas by producing the CAD drawings, writing technical reports and making oral presentations.

COURSE OUTCOMES:
At the end of the course, the student will be able to:
- Design the shafts, key and couplings for the given applications.
- Analyze the design and selection process of bearings.
- Design the IC engine parts.
- Design Belt, Rope and Chain drives for various industrial applications.
- Design of Spur and helical gears.
- Design of power screws for different engineering applications.

MAPPING OC COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	1	-	1	2	2	2	2	3	3	2	2
CO2	3	3	3	3	2	1	-	1	2	2	2	2	3	3	2	2
CO3	3	3	3	3	2	1	-	1	2	2	2	2	3	3	2	2
CO4	3	3	3	3	2	1	-	1	2	2	2	2	3	3	2	2
CO5	3	3	3	3	2	1	-	1	2	2	2	2	3	3	2	2
CO6	3	3	3	3	2	1	-	1	2	2	2	2	3	3	2	2

UNIT – I
DESIGN OF SHAFTS, KEYS AND COUPLINGS
Design of solid and hollow shafts for strength and rigidity–Design of Shafts for combined bending, Torsional and axial loads.
Types of Keys, stresses in Keys, design of rectangular and square Keys,
Design of Rigid couplings: Muff, Split muff and Flange couplings.

UNIT – II
BEARINGS: Types of Journal bearings – Lubrication – Bearing Modulus–Bearing materials – Journal bearing design – Ball and roller bearings – Static & dynamic load capacity of ball & roller bearings, bearing life and reliability.

UNIT – III
DESIGN OF I.C ENGINE PARTS: Design connecting rod-stress due to whipping action on Connecting rod –design of trunk type piston for I C engine – Design of crank and crankshafts-overhang crank shaft, Centre crank shaft.

UNIT – IV
DESIGN OF FLEXIBLE ELEMENTS: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes- Design procedure for chain drives.

UNIT-V

SPUR & HELICAL GEARS: Classification of gears, design of spur gears, Lewis equation – bending strength, dynamic load and fatigue of gear tooth- Design of Helical gears.

NIT-VI

DESIGN OF POWER SCREWS: Design of Power screws- Square, ACME, Buttress screws- Efficiency of the screw. Design of nut, compound screw, differential screw, ball screw- possible failures.

TEXT BOOKS

1. Design of Machine Elements, Bhandari V.B, Tata McGraw-Hill Book Co, 6th Edition, 2007
2. Pandya and Shah Machine Design, Charotar Publishers, Anand, India,20th Edition, 2015.
3. Machine Design, Kanniah, Scitech publishers, Hyderabad, 2nd Edition, 2010.

REFERENCES:

1. Mechanical Engineering Design, Shigley J.E, Mischke C. R, Tata McGraw-Hill, 6thdition, 2003.
2. Black and Adams, Machine Design, McGraw Hill and Co, New Delhi, 2002
3. Machine Design, R S Khurmi and J K Gupta, S chand publications, New Delhi, 25th Edition, 2008.
4. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi, 2005.
5. "Machine Design, Sundararajamoorthy T.V, Shanmugam. N, Anuradha publications, Chennai, 2003.
6. Design and Machine Elements, S Spotts M.F., Shoup T.E, Pearson Education, 2004.

DESIGN DATA HANDBOOK:

1. Mahadevan and Balaveera Reddy, Machine Design Data Hand Book, CBS Publishers

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0321206] DYNAMICS OF MACHINERY

COURSE OBJECTIVES:

- The study of dynamics of machinery is an applied field of mechanical engineering that is concerned with understanding the relationship between the power and motions of the machine parts.
- The overall objective of this course is to learn how to analyse mechanisms and to design machine/mechanisms.
- Apply basic principles and knowledge for the analysis and design of a system
- Application of mechanisms and machines, and new fields of research in motion control.

COURSE OUTCOMES:

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

- Understand the physical significance of Gyroscope, Gyroscopic couple etc.
- Design clutches and brakes of engine parts.
- Understand the working principals of different types of Governors.
- Analyse the turning moment diagrams and design of flywheel.
- Analyse balancing problems in rotary and reciprocating machines.
- Understand free and forced vibrations of single degree freedom system.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1	-	-	1	-	-	-	-	1	2	1	1	-
CO2	2	3	2	2	1	1	-	2	2	-	1	1	2	2	2	1
CO3	2	2	1	1	-	1	3	-	3	-	-	1	1	1	1	-
CO4	3	2	2	2	1	1	-	-	-	-	-	1	2	3	2	1
CO5	3	3	2	2	2	-	3	-	-	-	1	1	2	2	2	1
CO6	2	3	1	1	-	1	-	2	2	-	1	1	2	1	1	-

UNIT – I

Precession: Gyroscopes, effect of precession motion on the stability of aero planes and ships, moving vehicles such as motor car, motor cycle.

UNIT – II

Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

Brakes: Introduction, type of brakes, Simple block brakes, internal expanding brake, band and block brake, braking of vehicle.

UNIT – III

Turning Moment Diagrams and Flywheel: Introduction to flywheel, turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine. Fluctuation of energy, Coefficient of Fluctuation of energy, Coefficient of Fluctuation of speed. Energy stored in fly wheels and their design.

UNIT-IV

Governors: Introduction, type of governors, Centrifugal governor, Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Characteristics of governor.

UNIT – V

Balancing: Introduction, Static balancing, dynamic balancing, balancing of several masses rotating in the same plane, balancing of several masses rotating in different planes. Balancing

of reciprocating masses, partial balancing of locomotives.

UNIT – VI

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping, Vibration isolation & Transmissibility, resonance, critical speeds of shafts.

TEXT BOOKS:

1. Theory of Machines, S.S Ratan, MGH, 2014.
2. Theory of Machines, R.S Khurmi& Gupta, S.Chandpubl, 2005.

REFERENCES:

1. Mechanism and Machine Theory, JS Rao and RV Dukkipati, New Age Publ.1989
2. Theory of Machinery, Ballaney, Khanna Publishers,1965
3. Mechanical Vibrations by G.K. Groover.2009
4. Theory of Machines, Thomas Bevan, CBS Publishers.3/e,2005
5. Theory of Machines, JagadishLal&J.M.Shah, 1987

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0322206] REFRIGERATION AND AIR-CONDITIONING

(Use of Standard Refrigeration and Air Conditioning Data Book along with Steam Tables are Permitted in End Examinations**)**

COURSE OBJECTIVES:

- Introduce the students how real systems used in commercial, industrial refrigeration and air conditioning industries.
- Expose the students on various refrigeration methods like vapour compression refrigeration, vapour absorption refrigeration and latest developments.
- Know the various air conditioning methods like summer, winter and year round air conditioning
- Make the student to understand the practical applications of refrigeration and air conditioning systems.

COURSE OUTCOMES:

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

- Analyze various refrigerating cycles.
- Evaluate the performance of vapour compression refrigeration and vapour absorption refrigeration systems
- Illustrate the working of various components of the steam jet refrigeration system
- Perform the cooling load calculations and select the appropriate process and equipment for the required comfort and industrial air conditioning

MAPPING OF COs & POs:

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

UNIT–I

INTRODUCTION TO REFRIGERATION: Necessity and Applications, Carnot Refrigerator, Unit of Refrigeration, COP, EER, Different Refrigeration Methods.

AIR REFRIGERATION: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Numerical Problems - Boot Strap Air Evaporative Cooling System.

UNIT–II

VAPOUR COMPRESSION REFRIGERATION (VCR) SYSTEM: Basic Cycle - Working Principle and Essential Components of The Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Construction and Use of Ph Charts - Numerical Problems. Refrigerants - Desirable Properties - Classification of Refrigerants Used - Nomenclature- Secondary Refrigerants- Lubricants - Ozone Depletion - Global Warming- Newer Refrigerants.

UNIT–III

VAPOR ABSORPTION REFRIGERATION (VAR) SYSTEM: Description and Working of NH3 - Water System and LiBr -Water System -Calculation of Max COP, - advantages and disadvantages of VAR over VCR- Principle of Operation of domestic Electrolux system.

UNIT–IV

STEAM JET REFRIGERATION SYSTEM: Working Principle and Basic Components –

Principle and operation of: (i) Thermo-Electric Refrigerator (ii) Vortex tube or Hilsch tube (iii) Acoustic refrigeration system.

UNIT–V

INTRODUCTION TO AIR CONDITIONING: Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads - Need for Ventilation - Infiltrated air - Heat Load concepts - RSHF, GSHF-Problems.

Air Conditioning equipment: Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.

UNIT–VI

COMFORT AIR CONDITIONING: Requirements of human comfort and concept of Effective Temperature- Comfort chart -Comfort Air Conditioning - summer, winter & year round air conditioning - Simple Problems.

Heat Pump: Heat sources - different heat pump circuits

TEXT BOOKS:

1. Refrigeration and Air Conditioning, CP Arora, TMH, 4/e, 2020
2. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar, Dhanpatrai, 2018.

REFERENCES:

1. Refrigeration and Air Conditioning, Manohar Prasad, New Age. 3/e, 2021.
3. A text book of Refrigeration and Air Conditioning, R.S.Khurmi & J.K.Gupta, S.Chand & Co. 2019.
4. Principles of Refrigeration, Dossat, Pearson Edu. 4/e, 2002.
5. Refrigeration and Air Conditioning, P.L.Ballaney, Khanna Publ. 1972.
6. Refrigeration and Air Conditioning, R.C.Arora, PHI. 2010.
7. Basic Refrigeration and Air-Conditioning – Ananthanarayanan, TMH, 2013.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0323206] MECHANICAL VIBRATIONS
(Professional Elective-II)

COURSE OBJECTIVE:

- Demonstrate basic concepts and definitions of mechanical vibrations.
- To train the students about basic concepts of forced vibrations, vibration transmissibility and isolation and seismic instruments. Further to understand about various vibration control methods.
- To familiarize the students about two degree freedom system and various types of vibration absorbers.
- To analyze the two degree and multi degree of freedom systems.

COURSE OUTCOMES:

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

- Formulate governing equations of motion for the analysis of free single degree of freedom system.
- Analyze system with forced vibration, analysis of rotating and reciprocating unbalance systems.
- Analyze and design machine supporting structures, vibration isolators.
- Understanding the whirling of shaft and analysis of critical speeds.
- Determine the frequencies and mode shapes of free and forced vibration responses of Two degree freedom system
- Analyze the free and forced vibration responses of multi degree freedom systems using modal analysis.
- Understand and apply the principles of vibration measuring instruments.

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	1	1	-	-	-	1	1	1	2	2	1	2
CO2	3	3	2	2	2	1	-	-	-	1	1	1	2	2	2	1
CO3	3	3	2	3	2	1	-	-	-	1	1	1	2	2	1	2
CO4	3	3	2	2	2	1	-	-	-	1	1	1	2	2	2	2
CO5	3	3	2	2	1	1	-	-	-	1	1	1	2	2	1	2
CO5	3	2	2	2	1	1	-	-	-	1	1	1	2	2	1	1

UNIT-I

Introduction: Causes and effects of vibration, Classification of vibrating system, Modes of Vibrations, Degree of freedom, physical and mathematical formulation of undamped free SDF Spring –mass system and damped free SDF Spring-mass system.

UNIT –II

Forced vibration of SDF system: Response to harmonic excitations, solution of differential equation of motion, Magnification factor, Resonance, Rotating/reciprocating unbalances, Force Transmissibility, Motion Transmissibility.

UNIT-III

Critical Speed of Shaft: Whirling of rotors, Computation of critical speeds, influence of bearings, Critical speeds of Multi rotor systems.

UNIT-IV

Two degree of freedom systems: Introduction, Formulation of equation of motion, Free vibration response, Eigen values and Eigen vectors, Normal modes and mode superposition,

Coordinate coupling, decoupling of equations of motion, Natural coordinates, Response to initial conditions, free vibration response case studies, Forced vibration response, undamped vibration absorbers, Case studies on undamped vibration absorbers.

UNIT-V

NUMERICAL METHODS FOR MULTI DEGREE FREEDOM SYSTEMS:

Introduction, Influence coefficients, Maxwell reciprocal theorem, Dunkerley's equation. Method of determination of all the natural frequencies using Matrix iteration, Rayleigh's, and stodola's, method.

UNIT-VI

Vibration Measurement: Basics of Vibration Pickup, Vibrometer, Velocity pickup, accelerometer, Phase distortion and frequency measurement.

TEXT BOOK:

1. Theory of Vibration with Applications, W.T. Thomson and Marie Dillon Dahleh, Pearson Education 5th edition, 2007
2. Mechanical Vibrations by G.K. Groover, Pearson Education 6th edition, 2018
3. Mechanical Vibrations, V P Singh, DhanpatRai& Company Pvt. Ltd, 3rd edition, 2006.

REFERENCES:

1. Mechanical Vibrations, Singiresu S Rao, Pearson education, 4th Ed., 2011
2. Vibration: Fundamentals and Practice, Clarence W. de Silva , CRC Press LLC, 2000
3. Mechanical Vibrations – Schaum series

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0531206] FUNDAMENTALS OF JAVA PROGRAMMING
(Professional Elective-II)

COURSE OBJECTIVES:

After taking this course, the student should be able to:

- Describe the Windows event-driven programming model
- Build simple JAVA applications according to the model
- Write fluent JAVA code for creating classes
- Use JAVA variables, data, expressions and arrays
- Design and create forms, menus and controls
- Write clear, elementary Java programs(applets and applications)
- Use a Java-enabled browser and/or the applet viewer to execute Java applets
- Use the Java interpreter to run Java applications
- Design and construct effective graphic user interfaces for application software.
- Use Java Beans, RMI to build complex business applications

COURSE OUTCOMES:

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

- Understand the syntax and concepts of JAVA
- Write JAVA programs to implementing Object Oriented Concepts
- Able to build directories and manage applications within interfaces
- Write JAVA programs that used at a from flat files and databases
- Develop programs with error free and Multi-tasking.
- Program assignment utilizing Java GUI components, event listeners and event-handlers.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3	1	2				1		2	2	2	2	1	2
CO2	2	1	3	2	2			1				3	1	2	1	2
CO3	1	2	2	1	1							2	1	1	1	2
CO4	1	1	2	1	2			1			2	2	1	2	1	2
CO5	2	2	2	1	2			1			1	2	2	2	1	2
CO6	1	1	1	2	2							1	1	1	1	2

UNIT-I

Introduction To Java – Introduction to OOP, OOP Concepts, The History and Evolution of Java, Differences from C, C++ and JAVA, The Java Buzzwords, Simple Program , Compiling the Program, Structure of Java Program, data types, variables, constants, type conversion and casting, enumerated types, scope and life time of variables, operators, expressions , control statements, arrays.

Introductions to Class and Objects: overview of classes, creations of objects, instant variables and methods, constructors, access controls, usage of this, Garbage Collection and finalize().

UNIT-II

More on Classes and Methods: objects as arguments, returning objects, Recursion, overloading methods and constructors, Understanding static, Introducing Nested and Inner Classes, Using Command-Line Arguments.

Inheritance – overview, Super and Sub classes, Member access rules, types of Inheritance, super uses, method overriding, Dynamic method dispatch, abstract classes and methods, use of

final, the Object class and its methods.

UNIT-III

Packages- Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, access protection.

Interfaces – Interfaces vs. Abstract classes, defining interfaces, implementing interfaces, Nested Interfaces, Interfaces Can Be Extended, Default Interface Methods, and Use static Methods in an Interface.

UNIT-IV

String Handling: Strings, String Constructors, string functions: Special String Operations, string functions**,** String Comparison**,** Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Joining Strings, StringBuffer, StringBuilder.

Primitive Type Wrappers, **some java.util package classes:** String Tokenizer, Date, Calendar, Random, and Scanner.

UNIT-V

Input /Output exploring of java.io: I/O Basics, Streams, Byte Streams and Character Streams, The Predefined Streams, Reading Console Input, Writing Console Output, PrintWriter Class, Reading and Writing Files, File class, The Auto Closeable, Closeable, and Flushable Interfaces, File zipping and unzipping, Serialization, Static Import.

UNIT-VI

Exception handling – fundamentals, exception types, usage of try, catch, multiple catch Clauses, Nested try Statements, Usage of throw, throws and finally, built in exceptions, creating your own exceptions subclasses.

Multithreading – overview, difference between process and thread, Main thread, creating threads, thread life cycle, creating multiple threads, use of isAlive() & join(), thread priorities, thread synchronization, interthread communication, deadlock.

TEXT BOOKS:

1. Java; the complete reference, Herbert schildt, Oracle Press, MGHE ,Legit Books Store ,9th Editon,2016.
2. Understanding OOP with Java, updated Edition, T. Budd, pearsoneduction, 1st Edition 2000.

REFERENCES:

1. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John Wiley & Sons; 3rdEdition (15 August 2008)
2. Programming in Java, Sachin Malhotra, SaurabhChoudhary, 2nd Edition,2018.
3. An Introduction to OOP, second Edition, T. Budd, pearson education. 1st Edition 2000.
4. Introduction to Java programming, Y. Daniel Liang, pearson education, 6th Edition,2016.
5. An introduction to Java programming and object oriented application development, R.A. Johnson- Thomson, New Edition 2006.
6. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Pearson Education, 7thEdition, 2004.
7. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Pearson Education, 7th Edition, 2004.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0324206] GAS TURBINES
(Professional Elective-II)

COURSE OBJECTIVE:
- Student gets acquitted with Principle of operation of a gas turbine.
- Student gets acquitted with Principle of operation of Jet propulsion

COURSE OUTCOMES:
At the end of the course, the student will be able to
- Understand the gas turbine working principle and analyse the cycles of gas turbine plant
- Understand and analyze working principal of centrifugal compressors and turbines
- Analyze the combustion phenomenal of gas turbine
- Understand the basic concepts and working of different types of Jet propulsion engines

MAPPING OF COs & POs:

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

UNIT I
Introduction: Prime Movers-Simple Gas Turbine – Review of basic principles: Definitions and laws –Energy equation- basic fluid dynamics definition-stream tube area –velocity reaction- normal shock waves- equations of motion for a normal shock wave

UNIT-II
Ideal cycles and their analysis: Assumptions in Ideal cycle analysis- simple gas turbine cycle-heat exchange cycle- reheat cycle- reheat and heat exchange cycle- intercooled cycle-intercooled cycle with heat exchanger- inter cooled and reheat cycle- Simple problems.

UNIT-III
Centrifugal compressors: Essential parts of a centrifugal compressor- principle of operation-ideal energy transfer- blade shapes and velocity triangles- analysis of flow through the compressor- compressor characteristics-surging and choking-Simple problems.

UNIT-IV
Combustion systems: Combustion theory applied to gas turbine combustor- factors affecting combustion chamber design- factors affecting combustion chamber performance-requirements of combustion chamber –process of combustion in a gas turbine- combustion chamber geometry- mixing and dilution- combustion chamber arrangements.

UNIT-V
Gas turbines: Axial flow gas turbines- impulse and reaction turbines, single impulse stage, single reaction stage

UNIT-VI
Jet propulsion: Introduction- thrust, propulsive power and propulsive efficiency, classification of gas turbine engines – turbo jet engine, turbo prop engine, ram jet engine, pulse jet engine, comparison of various propulsive devices.

TEXT BOOKS:

1. Gas turbines, V.Ganesan, TMH
2. Gas turbines and propulsive systems, P.Khajuria and S.P.Dubey, Dhanapathrai publications

REFERENCES:

1. Gas turbine and jet rocket propulsion, V.M.Domkundwar, Dhanapathrai&Co
2. Gas turbine theory, Saravanmuttoo, H.I.H.,Rogers,G.F.C. and Cohen H., 6/e Pearson prentice Education,2008.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0325206] INDUSTRIAL IOT
(Open Elective-II/Job Oriented Course)

COURSE OBJECTIVES:
- Acquire theoretical knowledge on Industrial Internet of Things.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms for sensors and data transmission.

COURSE OUTCOMES:
At the end of the course, the student will be able to:
- Understand the characteristics of Internet of Things and its industry strategies.
- Apply various Internet of Things models to appropriate problems.
- Identify and integrate more than one technology to enhance the performance.
- Understand the sensors and data transmission used in Internet of Things.
- Analyse the co-occurrence of data to find interesting frequent patterns.
- Pre-process the data before applying to any real-world problem and can evaluate its performance.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3	1	2				1		2	2	2	2	1	2
CO2	2	1	3	2	2			1				3	1	2	1	2
CO3	1	2	2	1	1							2	1	1	1	2
CO4	1	1	2	1	2			1			2	2	1	2	1	2
CO5	2	2	2	1	2			1			1	2	2	2	1	2
CO6	1	1	1	2	2							1	1	1	1	2

UNIT I OVERVIEW OF INTERNET OF THINGS
Introduction, IOT Architecture, Application –based IOT protocols, Cloud Computing, Fog Computing, Sensor Cloud, Big Data.
Overview of Industry 4.0 and Industrial Internet of Things: IIoT- Prerequisites of IIOT, Basics of CPS, CPS and IIOT, Applications of IIoT.

UNIT II INDUSTRIAL INTERNET OF THINGS
Introduction, Industrial Internet Systems, Industrial sensing, Industrial sensing, Industrial Processes.
Business Models and Reference Architecture of IIoT: Definition of a business model, Business models of IOT, Business models of IIOT.

UNIT III KEY AND ON-SITE TECHNOLOGIES
Key Technologies: Off-site Technologies- Introduction, Cloud Computing- Necessity, Cloud Computing and IIot, Industrial Cloud Platform Providers, SLA, Requirements of Industry 4.0, Fog Computing.
On-site Technologies- Introduction, Augmented Reality- History, Categorization, Applications, Virtual Reality- History, Categorization, Applications.

UNIT IV SENSORS AND DATA TRANSMISSION
Sensors: Introduction to Sensors, Characteristics-Sensor calibration, Sensor profile, Operating voltage, Sensor Categories.
Actuators: Introduction, Thermal Actuators, Hydraulic Actuators, Pneumatic Actuators, Electromechanical Actuators.

Industrial Data Transmission: Foundation fieldbus, Profibus, HART, Interbus, Bitbus.

UNIT V MACHINE LEARNING AND DATA SCIENCE,

Machine Learning and Data Science in Industries: Introduction, Machine Learning, Categorization on ML, Applications and Data Science of ML in industries, Deep Learning, Applications of Deep Learning in industries.

UNIT-VI APPLICATIONS IN HEALTHCARE

Applications of Healthcare in Industries: Smart Devices, Advanced Technologies using in Healthcare, Open Research Issues to be Addressed.

TEXT BOOKS:

1. Introduction to Industrial Internet of Things and Industry 4.0, S. Misra, C. Roy, and A. Mukherjee, CRC Press, 2020.

REFERENCE BOOKS:

1. Industrial IoT. Available online: https://medium.com/iotforall/whatproduct-managers-need-to-know-about-industrial-iot-8c92eec1d9d2
2. IIoT Cloud Platforms. Available online: https://fr.farnell.com/willthere-be-a-dominant-iiot-cloud-platform.
3. Development of a high-speed solenoid valve: Investigation of solenoids, Kajima, T. and Kawamura, Y, IEEE Transactions on industrial electronics, 42(1), pp.1-8, 1995.

ONLINE LEARNING RESOURCES:

1. https://www.coursera.org/learn/industrial-internet-of-things
2. https://www.coursera.org/specializations/developing-industrial-iot

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0326206] POWER PLANT ENGINEERING
(Open Elective-II/Job Oriented Course)

COURSE OBJECTIVES:

The student is able to know that:

- This subject gives wide knowledge about different types of generating plants and their operation
- The course is designed to give fundamental knowledge of construction and working of various types of thermal power plants i.e. steam turbine, gas turbine, nuclear etc.
- To understand the power plant economics and power distribution.
- To develop an ability to identify, formulate, and solve engineering problems.

COURSE OUTCOMES:

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

- Understand the generation of power by using various sources like coal, water, liquid/gas fuel and nuclear fuels.
- Analyse the performance of various components present in the different power plants.
- Understand the concept of fixing the tariff.
- Analyse the methods of disposal of waste material from various power plants.
- Understand the environmental impact by using various power plants.
- Analysis and modify small components in different power plants.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	-	1	-	1	1	1	2	1	3	1	2	1
CO2	3	2	2	2	1	1	-	1	1	2	2	2	2	2	1	2
CO3	3	3	1	2	-	1	-	1	1	2	1	1	2	1	2	1
CO4	3	1	2	1	1	1	-	-	1	1	1	1	2	2	2	2
CO5	3	1	1	-	-	1	-	-	-	1	1	2	-	1	1	1
CO6	3	3	2	1	1	1	-	1	2	2	1	2	3	2	2	2

UNIT – I

Introduction on different Sources of Energy (Conventional and Non-conventional)

STEAM POWER PLANT: Layout & Selection of site for Modern Steam Power Plant, working of different circuits- Coal Storage- Classification of coal handling, pulverizing fuel system and its components, simple problems on steam generation to power.

UNIT II

STEAM POWER PLANT: Overfeed and Underfeed fuel beds, Traveling grate, spreader grate and retort grate stoker firing systems – different types of burners – cyclone furnace- Ash handling systems, Dust collectors-Cooling Towers.

UNIT – III

HYDRO ELECTRIC POWER PLANT: Hydrological cycle – Hydrographs – flow duration curve – mass curve – Classification of Dams, Spill ways and SurgeTanks.

HYDRO PROJECTS AND PLANT: Classification of Hydro Electric Power Plants – Typical Layout & Selection of Site for Hydro Electric Power Plant – plant auxiliaries – plant operation.

UNIT – IV

NUCLEAR POWER PLANT: Nuclear fuel, Fissile and Fertile materials– Breeding – Nuclear reactor & operation.

TYPES OF REACTORS: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast Breeder Reactor, Homogeneous Reactor and Gas Cooled Reactor – Radiation hazards and shielding – radioactive & wastedisposal.

UNIT V

GAS TURBINE POWER PLANT: Introduction – Plant Layout – Classification – Working of Simple Gas Turbine Power Plant– Constant pressure and constant volume Gas Turbine Power Plants –Combination of Gas Turbine Cycles.

UNIT – VI

POWER PLANT ECONOMICS: Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor, utilization factor, Plant capacity factor and plant use factor – Types of loads **–**Load curve and load duration curve **–**general arrangement of power distribution –Different types of tariff for Electrical energy – Simple problems .

TEXT BOOK:

1. A Text Book of Power Plant Engineering, Rajput. R.K. LaxmiPublications, 5th Edition, 2016.
2. A Course in Power Plant Engineering, Arora and S.Domkundwar, 8th Edition ,2016.

REFERENCES:

1. Power Plant Engineering, P.K.Nag, TMH, 2nd Edition, 2016.
2. Power Plant Engineering, Nagpal, new Edition, 2002.
3. Power plant Engineering, Ramalingam, Scietech Publication new Edition 2015.
4. Power Plant Engineering, C. Elanchezian and others, I.K.International, new Edition 2013.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0327206] INDUSTRIAL SAFETY ENGINEERING
(Open Elective-II/Job Oriented Course)

COURSE OBJECTIVE:
The objective of this course is to
- To impart knowledge on different facets and aspects of engineering systems safety,
- To focusing on tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings.

COURSE OUTCOMES:
At the end of the course, the student will be able to:
- Perform the Hazard analysis and determine system risk
- Determine the root causes and probability of occurrence of a specified undesired event and identify and evaluate the sequence of events in a potential accident scenario. Also perform qualitative analysis.
- Find the quantification of basic events to decrease the failure rate of events.
- Apply the quantitative aspects of system analysis find the quantification of basic events to decrease the failure rate of events.
- Apply different controls for safer production system
- Conduct the Accident/incident analysis with different techniques

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1	1	2	3	1	2	1	-	2	1	2	1	1
CO2	3	3	1	-	1	1	-	1	1	1	-	2	2	2	1	1
CO3	3	3	3	-	-	1	-	1	1	1	-	2	2	2	1	-
CO4	3	1	3	-	-		-	1	1	1	1	2	2	-	1	-
CO5	1	1	2	-	2	2	3	1		1	-	2	2	-	1	1
CO6	1	2	1	2	2	2	3	1	3	-	-	2	2	3	1	1

UNIT-I:
Introduction to industrial safety engineering; Key Concepts and Terminologies-Hazards, Mishap and Risk; Risk Assessment and Control, Hazard analysis techniques-Hazard and Operability Study (HAZOP)- Failure Mode and Effect Analysis.

UNIT-II:
Fault Tree Analysis (FTA) – Construction-Gate by Gate Method-Cut- Set Method; Fault Tree Analysis Importance Measures; Event Tree Analysis (ETA); Bow – Tie concept; Common Cause Cut Sets; Cut Sets for Accident Scenarios.

UNIT-III:
Risk Assessment; Consequence Assessment; Energy Control Model and Hazard Control Hierarchy; Safety Function Deployment.
Quantification of Basic Events for Non – repairable Components– Hazard Rate- Exponential Distribution-Weibull Distribution.

UNIT-IV:
Quantification of Basic Events for Failure to Repair Process- Repairable Components-failure and repair intensities-Computation of combined process parameters: Laplace transform analysis; Quantification of Systems Safety and Reliability Block Diagram-Truth Table Approach-Structure Function-Minimal Cut and Minimal Path representation using Structure Function.

UNIT-V:
Human Error, Classification and Causes-Human Error Identification-Human Reliability Assessment-Human Error Quantification from Expert's opinions - Fuzzy Set Approach.

UNIT-VI:
Accident Investigation; Accident Investigation & Analysis: Descriptive Analytics-Control Chart Analysis; Predictive Analytics-Regression, Classification Tree. Safety Performance Indicators; Energy Isolations.

TEXT BOOKS:

1) Probabilistic Risk Assessment and management for Engineering and Scientists, Hiromitsu Kumamoto, Ernest. J. Henley, IEEE Press, 2nd Edition, 1995.
2) Hazard Analysis Techniques for system safety, Clifton A. Ericson, Wiley-Inter science, 1st edition, 2005

REFERENCES:

1) Industrial Accident Prevention, H. W.Heinrich, Dan Petersen and Nestor Roos, McGraw Hill, 5th edition, 1980.
2) Techniques for safety management - A systems approach, Dan Petersen, Amer Society of Safety Engineers, 4th edition, 2003.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0328206] PARAMETRIC MODELLING – I
(Skill Development Course)

COURSE OBJECTIVES:
- To train the student to make use of Pro-E software package
- To improve the quality of the Engineering Drawing.

COURSE OUTCOMEES:
After Completion of the Course students will able to:
- Understand 2D drawings and 3D drawings and can be drawn using CATIA Software package.
- Understand and apply the importance of the linking functional and visualization aspects in the preparation of the part drawings.
- Create 3D assemble drawings.
- Understand the national and international standards pertaining to machine drawing.

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	1	-	-	-	-	2	-	1	2	2	2	1
CO2	3	2	2	1	2	-	-	-	-	2	-	1	1	2	2	2
CO3	3	3	2	1	2	1	-	-	-	2	2	1	1	2	1	2
CO4	3	2	2	1	1	-	-	-	-	3	-	1	2	2	2	1

UNIT – I:
Introduction to Pro/E & sketching: What is parametric modeling – setting up working directory – different file extensions in Pro/E – sketch tools – create and edit dimensions – constraints.

UNIT – II:
Part Modeling: Feature creations – protrusion & cut – solid and thin features – shell – dressup features – pattern chamfer – fillet.

UNIT – III:
Assembly: Introduction to top-down & bottom-up assembly – assembly constraints –Skelton model – exploded views.

UNIT – IV:
Drafting: Introduction to drafting with / without templates – placing views – placingdimensions – bill of materials.

UNIT – V:
Surface modeling: Datum curves – points – plans – co-ordinate systems – sketch basedfeatures – extrude – trim – offset – merge.

UNIT – VI:
Sheet metal – flat walls – extrude walls – creating walls – punches – notches – forms – dies – bending the sheet.

TEXT BOOKS:
1. Parametric Modeling, Randy H Shih.2006
2. Pro/Engineer Wildfire, Dr. Zuomin Dong, Department of Mechanical Engineering, University of Victoria,2013

LIST OF EXERCISES:
1. Draw the sketch with given dimensions.

2. Draw the sketch and specify dimensions.
3. Create a part using extrude and revolve features.
4. Create a part using chamfer and filletsfeatures.
5. Create a part using sweep, blend tools & patternfeatures.
6. Complete the part using revolves and rib toolsfeatures.
7. Modify the dimensions and regenerate the existing part.
8. Draw the simple parts and assemble.
9. Draw all parts of machine component and complete the assembly.
10. Generate views for specified part.
11. Create views, dimensions and bill of materials for specified assembly modeling.
12. Draw the surface and convert it into solid.

Soft Ware Required: Pro-Engineer.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0014203] INDIAN HERITAGE & CULTURE

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

COURSE OBJECTIVES:

- To enable the students to have an insight into and understanding of the great heritage and culture of India.
- To sensitize them towards preservation and progression of the composite culture of India
- To make students learn soft skills and life skills from ancient treatise
- Relevance of architecture & ancient principle to the current engineering scenario

COURSE OUTCOMES:

After Completion of the Course students will able to:

- Equip learners with knowledge of the heritage and culture of India.
- Acquire Leadership & Soft skills from great leaders of India
- Apply the ancient wisdom to become successful professionals
- To make them understand diversity of culture and national integrity

MAPPING OF COS & POS:

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

UNIT-I:

Origin of Indian Culture & Heritage –Indus valley Civilization - Time line of Indian empires - Cultural & social conditions of India under Mauryas, Guptas& the Sathavahanas

UNIT-II:

Influence of Islam on Indian Culture - Leadership skills from Akbar the Great &Krishnadeva Raya - World Heritage Sites in India

UNIT-III:

Great Indian Epics – Life skills from Ramayana and Mahabharata – Ethics from Upanishads &- Vedas - Pathanjali Yoga -Principles of Jainism, Buddhism & Sufism

UNIT-IV:

Indian Art Forms –Literature - Rabindranath Tagore - RK.Narayan - Sri Sri - Jashuva – Music - Saint Tyagaraja, Annamayya -Purandhara Das - Kabir Das- Dance Forms of India

UNIT-V:

Social awakening and Social reform movements -Theosophical Society - Emancipation of Women in pre-independent era

UNIT-VI:

Mahatma Gandhi - Non-violence and Satyagraha - Great leaders of Freedom struggle – Subhash Chandra Bose – Bhagath Singh –Moulana AbulKalam Azad – B.R.Ambedkar - Post Independent Era.

TEXT BOOK

1. Indian Heritage and Culture, Madanlal Malpani & Shamsunder Malpani, Kalyani Publishers, New Delhi, 2009.

REFERENCE BOOKS

1. Indian Cultures as Heritage: Contemporary Pasts, Romila Thapar, 2018, India.
2. Indian Culture &Heritage, Anurag Mathur, Create space independent publishing Platform, 2017.
3. Indian Heritage and culture, P.R.Rao & P. Raghavendra, Sterling Publication Pvt. Ltd.
4. Indian Heritage and culture, Madhukarkumar Bhagat, Access Publications.
5. Indian Heritage and culture, Dhirendra Singh, APH Publications.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0397206] NUMERICAL SIMULATION LAB

COURSE OBJECTIVES:

- To train the student to make use of MatLab software package
- To solve engineering problem involving Matrix algebra
- To improve the quality of the engineering learning through simulation of problem

COURSE OUTCOMES:

At the end of the lab sessions, the student will be able to:

- Apply built-in functions in MATLAB to solve numerical problems.
- Develop code for solving problems involving different types of mathematical models and equations (ODE, Linear and nonlinear equations).
- Solve simulation problems encountered in mechanical design, vibration analysis and CAD
- Writing codes with functions and scripts
- Curve fitting and interpolation of experimental data
- Model a system and Develop a simulation code

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PS01	PS02	PS03	PS04
CO1	2	2	3	2	1	2	1	1	1	1	1	2	2	2	3	2
CO2	3	2	3	3	2	2	1	1	1	1	1	2	2	3	3	2
CO3	3	2	3	3	3	2	1	1	1	1	1	2	2	3	3	2
CO4	3	2	3	3	3	2	1	1	1	1	1	2	2	3	3	2
CO5	3	2	3	3	3	2	1	1	1	1	1	2	2	3	3	2
CO6	2	2	3	3	3	2	1	1	1	1	1	2	2	3	3	2

Detailed Syllabus: List of Experiments conducted in this lab:

1. Introduction to MATLAB and practice
2. Practice session on handling basic arithmetic etc.
3. Writing codes with control loops, functions and scripts
4. Developing codes for visualization and plotting
5. Solving problems involving linear equations
6. Solving problems involving curve fitting and interpolations
7. Solving problems involving ordinary differential equations
8. Solving problems related to optimization
9. Solving problems involving numerical differentiation and integrations
10. Solving Problem using simulink

TEXTBOOK:

1. Getting started with Mat Lab by Rudra Pratap Singh, 2010

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0398206] DYNAMICS & MEASUREMENTS LAB

COURSE OBJECTIVE:

- To understand the concepts of different modes and types of vibrations and vibrating systems.
- To analyse different types of governors.
- To understand the principles of a Gyroscope.
- To know the calibration of instruments used for measuring different physical quantities.

COURSE OUTCOMES:

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

- Apply the fundamental concepts to find the natural frequency of a spring-mass system.
- Determine the Gyroscopic Couple from its principles.
- Understand and apply the cam jump phenomena in industrial applications.
- Evaluate the sensitivity of different governors.
- Calibrate the different types of instruments for measuring the physical quantities (Load, displacement. Temp, speed etc.)
- Evaluate the Static and Dynamic balancing of rotary masses.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	2	1	1	1	1	1	1	2	2	2	2	1
CO2	3	3	2	3	2	1	1	1	1	1	1	2	2	2	2	1
CO3	3	3	2	3	2	1	1	1	1	1	1	2	2	2	2	1
CO4	3	3	2	3	2	1	1	1	1	1	1	2	2	2	2	1
CO5	3	3	2	3	2	1	1	1	1	1	1	2	2	2	2	1
CO6	2	2	3	3	2	1	1	1	1	1	1	2	2	2	2	1

Note: Conduct any FIVE experiments form each cycle

Cycle-I [Dynamics Lab]

1. Longitudinal vibrations of a spring-mass system.
2. To Measure the Amplitude and Frequency of Simple Harmonic Motion.
3. To study the damping effect on Vibration with Oil Damper
4. Motorized Gyroscope- study of gyroscopic effect and couple.
5. Critical speed or whirling speed of a shaft.
6. Experiments on Governors- Determination of range sensitivity, effort etc.,

(Watt, Porter, Proell and Hartnell)

Experiments beyond the Curriculum:

1. Determination of Mass moment of inertia using Bi-filer suspension.
2. To measure Natural Frequency and Modal Shape of simply supported by the Method of Hammer Impact.
3. Cam Jump Analysis: Cam profile drawing and study of jump phenomenon.
4. Static and Dynamic balancing of rotary masses

Cycle-II [Measurements Lab]

1. Study and calibration of LVDT transducer for displacement measurement.
2. Calibration of Pressure Gauges.
3. Calibration of strain gauge for strain measurement.

4. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
5. Study and calibration of load cell for load measurement.

Experiments beyond the Curriculum:

1. Calibration of thermistor for temperature measurement.
2. Calibration of thermocouple for temperature measurement.
3. Calibration of resistance temperature detector for temperature measurement.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

L	T	C
2	1	3

[A0584206] FUNDAMENTALS OF JAVA PROGRAMMING LAB

COURSE OBJECTIVES:

- To make the student operating systems.
- Learn object oriented way of solving problems.
- To teach the student to write programs in Java to solve the problems

COURSE OUTCOMES:

After Completion of the Lab Course students will able to:

- Write programs using classes and objects.
- Develop the polymorphic behaviour of objects.
- Design software using object oriented approach.
- Implement the programs handling built in exceptions and creating custom exceptions.
- Develop the Multithread programming.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3	1	2				1		2	2	3	2	1	1
CO2	2	1	3	2	1						1	3	2	-	-	1
CO3	1	2	2	1	1						1	2	3	2	-	1
CO4	1	2	1	1	2				2		2	2	-	2	1	1
CO5	2	2	2	1	2						1	2	-	2	-	1

RECOMMENDED SYSTEMS/SOFTWARE REQUIREMENTS:

- Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and100 MB free disk space.
- JDK Kit. Recommended

1. a) Write a Java program that prints all real solutions to the quadratic equation ax2 + bx + c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2 -4ac is negative, display amessage stating that there are no real solutions.

   b) The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non- recursive functions to print the nth value in the Fibonacci sequence.

2. a) Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer.

   b) Write a Java program to multiply two given matrices.

3. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all theintegers (Use String Tokenizer class of java. until)
4. Write a Java program to find both the largest and smallest number in a list of integers.
5. Write a Java program to illustrate method overloading.
6. Write a Java program that implements the Sieve of Eratosthenes to find prime numbers.
7. Write a Java program to sort a list of names in ascending order.
8. Write a Java program to implement the matrix ADT using a class. The operations supported by this ADT are:

a) Reading a matrix. b) Printing a matrix. c) Addition of matrices.

d) Subtraction of matrices. e) Multiplication of matrices.

9. Write a Java Program to solve Tower's of Hanoi problem.
10. Write a Java Program that uses a recursive function to compute ncr. (Note: n and r values are given)
11. Write a Java program to perform the following operations:

    a) Concatenation of two strings.

    b) Comparison of two strings.
12. Implement the complex number ADT in Java using a class. The complex ADT is used to represent complexnumbers of the form c=a+ib, where a and b are real numbers. The operations supported by this ADT are:

    a) Reading a complex number. d) Subtraction of complex numbers.

    b) Writing a complex number. e) Multiplication of complex numbers.

    c) Addition of Complex numbers. f) Division of complex numbers.
13. Write a Java program that makes frequency count of letters in a given text.
14. Write a Java program that uses functions to perform the following operations:

    a) Inserting a sub-string in to the given main string from a given position.

    b) Deleting n characters from a given position in a given string.
15. a) Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAMis a palindrome.

    b) Write a Java program to make frequency count of words in a given text.
16. a) Write a Java program that reads a file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of fileand the length of the file in bytes.

    b) Write a Java program that reads a file and displays the file on the screen, with a line number before each line.

    c) Write a Java program that displays the number of characters, lines and words in atext file.

    d) Write a Java program to change a specific character in a file.

    Note: Filename, number of the byte in the file to be changed and the new character arespecified on the command line.
17. Write a Java program that:
    i) Implements stack ADT.
    ii) Converts infix expression into Postfix form
    iii) Evaluates the postfix expression.
18. a) Write a Java program that creates three threads. First thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third threaddisplays Welcome" every three seconds.

b) Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.

REFERENCES:

1. Java; the complete reference, Herbert schildt, 7th editon, TMH.
2. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley &sons.
3. Programming in Java, Sachin Malhotra, Saurabh Choudhary, Second Edition.
4. An Introduction to OOP, second edition, T. Budd, pearson education.
5. Introduction to Java programming 6th edition, Y. Daniel Liang, pearson education.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0330207) FINITE ELEMENT METHODS
(Professional Elective-III)

COURSE OBJECTIVES:

- To equip the students with the Finite Element formulation Techniques.
- To characterize the different types of elements used in FEM technology
- To formulate Equilibrium equation, Stress-strain relation for isotropic and orthotropic materials.
- To apply different boundary conditions to solve structural problems and heat transfer problems using Finite Element Techniques.

COURSE OUTCOMES:

At the end of the course, the students are able to:

- Understand the fundamental structural concepts of equilibrium equations, stress-strain relations and strain displacements for solving 2D and 3D elastic problems.
- Understand the local and Global coordinate system, formulation of shape functions and finite element equation.
- Apply finite element techniques to analyse the 1-D dimensional Bar Element and 2D-Truss structures.
- Apply FEM techniques to solve Beam structures.
- Apply FEM techniques to solve two dimensional problems using CST and Axi-symmetric finite element formulation.
- Apply FEM techniques to solve heat transfer problems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	3	-	-	-	2	2	1	2	3	3	2	2
CO2	3	3	2	2	3	-	-	-	1	3	1	2	3	3	2	3
CO3	3	3	2	3	3	2	-	-	3	3	3	2	3	3	2	3
CO4	3	3	2	3	3	2	-	-	3	3	3	2	3	3	2	3
CO5	3	3	2	3	3	2	-	-	3	3	3	2	3	3	2	3
CO6	3	3	2	3	3	2	-	-	3	3	3	2	3	3	2	3

UNIT-I

Introduction: Fundamental concepts in finite element methods, advantages and applications of FEM, steps followed in FEM- Stress and Equilibrium. Strain – Displacement relations. Stress – strain relations. Plane stress, plane strain conditions. Variational and weighted residual methods- the Rayleigh Ritz method, Galerkin's method.

UNIT-II

Finite element technique: Finite element modeling, coordinates-Local and Global coordinates and shapes functions- Principle of minimum Potential Energy- Assembly of Global stiffness matrix and load vector, Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT-III

Analysis of Bar And Truss Structures: One-dimensional Bar element- derivation of element stiffness matrix, simple problems on bar element and Thermal stresses in 1-D bar element. Two-dimensional truss bar element, stiffness matrix for two-dimensional truss bar element, simple problems on two-dimensional truss structures.

UNIT-IV

Analysis of Beam Structures: Beam elements, stiffness matrix for beam element, simple problems on beam structures – stresses and deflection of beams – cantilever and simply supported beams.

UNIT-V

Two Dimensional Stress Analyses: Finite element modeling for two-dimensional stress analysis, element stiffness matrix for constant strain triangle (CST) and treatment of boundary conditions, Finite element modeling of axisymmetric solids.

UNIT-VI

Steady State Heat Transfer Analysis: Steady state heat transfer analysis: 1-D heat conduction of slab and composite wall, One-dimensional heat transfer through a fin. Introduction 2-D Heat transfer- Simple Problems.

TEXT BOOKS

1. Introduction to Finite Element in Engineering, Tirupati Chandrapatla and Bellagundu Pearson Education, New Delhi, 2011.
2. An Introduction to Finite Element Method, J. N. Reddy, McGraw Hill, International Edition, 2005.

REFERENCE BOOKS:

1. Finite Element Analysis, C.S. Krishna Moorthy, McGraw Hill Publishers, New Delhi, 1987.
2. Finite Element Methods, S. S. Rao, Pergamom Press, New York, 6th edition, 2017.
3. Introduction of finite element Analysis, S. Md. Jalaluddin, Anuradha Publishers, Chennai, 2016.
4. Fundamentals of Finite Element Analysis, V. David Hutton, McGraw Hill Publishers, New Delhi, 2010.
5. Introduction to the Finite Element Methods, Desai and Abel, CBS Publishers, New Delhi, 2005.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0334207) NON DESTRUCTIVE TESTING
(Professional Elective-III)

COURSE OBJECTIVE
- To introduce the basic principles, techniques, equipment, applications and limitations of NDT methods such as Visual, Penetrant Testing, Magnetic Particle Testing, Ultrasonic Testing, Radiography, Eddy Current.
- To enable selection of appropriate NDT methods.
- To identify advantages and limitations of nondestructive testing methods
- To make aware the developments and future trends in NDT.

COURSE OUTCOME
At the end of the course the students are able to:
- Identify the requirements of testing criteria as per material composition.
- Understand the theory of non-destructive testing methods is used.
- Determine the type of requirement of non-destructive test.
- Distinguish between the various NDT test as Ultrasonic and Eddy current methods.
- Understand the properties of radiation used in engineering.
- Describe the various types of non-destructive test used to determine the surface cracks.

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	-	-	1	-	2	1
CO2	3	2	-	1	3	-	-	-	-	2	-	-	1	-	2	1
CO3	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-
CO4	2	2	-	2	-	-	-	-	-	3	-	1	-	-	2	1
CO5	3	2	-	2	2	-	-	-	-	2	-	-	1	-	2	1
CO5	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-

UNIT – I:
Introduction to NDT, Comparison between destructive and NDT,Importance of NDT, Scope of NDT, difficulties of NDT, future progress in NDT, economics aspects of NDT.
Visual Inspection-tools, applications and limitations-Fundamentals of visual testing: vision, lighting, material attributes, environmental factors. visual perception, direct and indirect methods mirrors, magnifiers, boroscopes, fibro scopes, closed circuit television, light sources special lighting, a systems, computer enhanced system.

UNIT – II:
Liquid Penetrant Inspection: principles, properties required for a good penetrants and developers - Types of penetrants and developers and advantages and limitations of various methods of LPI - LPItechnique/ test procedure interpretation and evaluation of penetrant test indications, false Indication and safety precaution required in LPI, applications, advantagesand limitations.

UNIT – III:
Magnetic Particle Inspection (MPI)- Principles of MPI, basic physics of magnetism, permeability, flux density, cohesive force,magnetizing force, rentivity, residual magnetism Methods of magnetization, magnetization techniques such as head shot technique, cold shot technique, central conductor testing, magnetization using products using yokes direct and indirect method of magnetization, continuous testing of MPI, residual technique of MPI, system sensitivity, checkingdevices in MPI. Interpretation of MPI, indications, advantage and limitation ofMPI.

UNIT– IV

Ultrasonic Testing (UT): principle, types of waves, frequency,velocity, wavelength, reflection, divergence, attenuation, mode conversion in ultrasonic UT testing methods contact testing and immersion testing, normal beam and straightbeam testing, angle beam testing, dual crystal probe, ultrasonic testing techniques resonance testing, through transmission technique, pulse echo testing technique, instruments used UT, accessories such as transducers, types, frequencies, and sizes commonly used Reference blocks with artificially created defects, calibration ofequipment, Applications, advantages, limitations, A, B and C scan - Time of Flight Diffraction (TOFD).

UNIT – V

Radiography Testing (RT): Principle, electromagnetic radiationsources: X-ray source, production of X-rays, high energy X-ray source, gamma ray source - Properties of X-rays and gamma rays. Inspection techniques like SWSI, DWSI, DWDI, panoramicexposure, real time radiography, films used in industrial radiography, types of film, speed of films, qualities of film screens used in radiography, quality of a good radiograph, film processing, interpretation, evaluation of test results, safety aspectsrequired in radiography applications, advantages and limitations of RT

UNIT –VI

Eddy Current Testing (ECT) - Principle, physics aspects of ECT like conductivity, permeability, resistivity, inductance, inductive reactance, impedance Field factor and lift of effect, edge effect, end effect, impedance plane diagram in brief, depth of penetration of ECT, relation between frequency and depth of penetration in ECT equipment's and accessories, various application of ECT such as conductivity measurement, hardness measurement, defect detection coating thickness measurement, advantages and limitations of eddy current testing

TEXT BOOK:

1. Practical Non – Destructive Testing Baldev Raj, , Narosa Publishing House ,1997
2. Non-Destructive Testing by P. Halmshaw, 2nd ed, London : E. Arnold, 1991.

REFERENCE BOOKS:

1. Ultrasonic Testing of Materials Krautkramer, Josef and Hebert Krautkramer, , Springer-Verlag, 1990
2. Non-Destructive Testing, Hull B. and V.John, , Macmillan,1988
3. Non-destructive Testing Techniques by Ravi Prakash January 2010.
4. Non Destructive Test and Evaluation of Materials, 2 Edition, by J Prasad and C. G. Krishna das Nair , July 2017.
5. Non-Destructive Testing of Structures, by Magdalena Rucka , February 2021.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0335207) MECHANICS OF COMPOSITE MATERIALS
(Professional Elective-III)

COURSE OBJECTIVES:

- To enlighten the students about modern lightweight composite materials which are being used extensively in this modern scenario.
- To enlighten behavior of constituents in the composite materials and different types of reinforcement materials used in processing of the composite materials.
- To understand the macro & Micro mechanics of composite materials.

COURSE OUTCOMES:

At the end of the course, the student are able to:

- Understand the various types of composite materials used for different engineering applications.
- Understand the different types of reinforcing materials used in making of composite materials.
- Understand different types of manufacturing processes used for making of composite materials.
- Analyse stress-strain tensors of isotropic and orthotropic materials through macro-scopic analysis.
- Analyse the stress-strains of 2-D Uni-directional lamina and angle lamina and also apply failure theories.
- Apply the concepts of Micro-mechanical analysis to determine the physical and mechanical properties of the composite material based on matrix and reinforcement material properties.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	3	3	3	3	-	1	-		2	1	1	-	-
CO2	1	1	1	3	3	3	3	-	3	-	-	2	3	3	1	2
CO3	1	2	3	3	3	2	2	2	3	-	-	2	3	3	2	3
CO4	3	3	3	3	3	2	-	-	3	3	2	2	3	3	2	2
CO5	3	3	3	3	3	2	-	-	3	3	2	2	3	3	2	2
CO6	3	3	3	3	3	2	-	-	3	3	2	2	3	3	2	2

UNIT-I

Introduction to Composite Materials: Introduction, Classification: Polymer Matrix Composites. Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber. Reinforced Composites and nature-made composites, and applications.

UNIT-II

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide. fibres. Particulate composites, Polymer composites- Thermoplastics, Thermosets, Metal matrix and ceramic composites.

UNIT-III

Manufacturing Processes: Hand lay-up, Spray lay-up, Vacuum bagging, Pultrusion, Resin Transfer Molding (RTM), Filament winding processes.

UNIT-IV

Macro-Mechanical Analysis of a Lamina: Introduction, Definitions: Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials – Anisotropic

material, monoclinic material and orthotropic material, Hooke's Law for a Two Dimensional Unidirectional Lamina - Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina, Angle Lamina.

UNIT-V

Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina, Strength Failure theories of an angle lamina- Maximum stress Failure Theory, Tsai–Hill Failure Theory, Tsai–Wu Failure Theory.

UNIT-VI

Micro-Mechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli – Longitudinal young's modulus, Transverse young's modulus, Major Poisson's ratio and In-plane shear modulus by Strength of Materials Approach, Semi Empirical Models, Ultimate Strengths of a Unidirectional Lamina- Longitudinal tensile strength, Transverse tensile strength, Longitudinal compressive strength, Transverse compressive strength, In-Plane shear strength.

TEXT BOOKS:

1. Mechanics of Composite Materials, (Second Edition), by Autar K. Kaw, CRC, 2010.
2. Analysis and performance of fibre Composites, B. D. Agarwal and L.J. Broutman Wiley- Inter science, 4/E, 2017.

REFERENCE BOOKS:

1. Mechanics of Composite Materials, (3ed edition), by R. M. Jones, Mc Graw Hill Company, New York, 2006.
2. Mechanics of Composite Materials, R. M. Jones, McGraw Hill Company, New York, 2/E, 1999.
3. Composite Materials Science and Engineering, Kishan K. Chawla, Springer, 2015.
4. Analysis of Laminated Composite Structures, L.R. Calcote, Van Nostrand Rainfold, New York, 1968.
5. Mechanics of Composite Materials and Structures, Madhujit Mukhpadhyay, New York, 2004.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0329207) CAD/CAM
(Professional Elective-IV)

COURSE OBJECTIVES:

- To impart the knowledge on current advances in Computer-aided design/Computer aided manufacturing (CAD/CAM) and also about Numerical control machines and the process planning.
- It is to introduce geometric modelling techniques, data structure design and algorithms for solid modelling.
- It also covers the machining theory, automated CNC machining, and process control.
- It gives the information of quality control.

COURSE OUTCOMES:

At the end of the course, the students are able to:

- Understand the impact of CAD/CAM in modern manufacturing industries.
- Apply the concept of Transformations in Computer Graphics & Drafting.
- Apply the concept of geometric modelling.
- Prepare the CNC part programme for any type of geometry given.
- Apply the concept of part classification and coding for CNC machines.
- Apply the concept of inspection techniques.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	-	-	2	-	-	-	2	-	2	2	-	1
CO2	3	2	2	-	-	-	-	-	2	-	1	-	2	2	1	1
CO3	2	2	-	1	-	1	-	-	-	-	-	1	2	1	-	2
CO4	3	2	-	-	-	-	1	-	-	3	2	-	2	1	-	2
CO5	2	3	1	-	-	-	-	-	-	-	1	-	2	2	-	1
CO6	3	2	-	-	-	-	1	-	-	-	2	-	2	1	-	2

UNIT – I

Product cycle, Basic structure, CPU, input devices, output devices, Memory types, Application of computers for design, benefits of CAD, storage devices hard copy devices. Reasons for implementing CAD, benefits of computer aided design.

UNIT – II

Computer Graphics & Drafting: Raster scan graphics coordinate system, DDA Algorithm, database structure for graphics modeling, transformation of geometry, 2D, 3D transformations, Geometric commands, layers, display control commands, editing, dimensioning.

UNIT – III

Geometric modeling: Wire frame models, Surface frame models, Solid models, Wire frame entities, Surface frame entities, Solid entities, curve representation, parametric representation of synthetic curves.

UNIT –IV

Numerical control: Basic components of an NC, Classifications- CNC, DNC, classification of several output devices used in NC systems, feedback devices, NC coordinate systems, NC motion control systems, application of NC, Machining center, turning center, NC Part Programming, A.P.T- language.

UNIT – V

Group Technology: Part family, coding and classification, production flow analysis,

Advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

UNIT – VI

Computer Aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, non-contact inspection methods-optical non-contact inspection methods-non-optical computer aided testing, integration of CAQC with CAD/CAM.

TEXT BOOKS:

1. CAD/CAM, A Zimmers & P.Groover, PE, PHI, 2019.
2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 2017.
3. Mastering CAD/CAM, Ibrahim Zeid, TMH, 2005.

REFERENCE BOOKS:

1. Automation, Production systems & Computer integrated Manufacturing, Groover, P.E, 2016.
2. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age, 2018.
3. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson, 2004.
4. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH, 2009.
5. Computer Aided Design and Manufacturing, Lalit Narayan, PHI, 2008.
6. Computer Aided Manufacturing, T.C. Chang, Pearson, 2005.
7. A text book of CAD/CAM, CSP Rao, Hitech Publ, 2017.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0332207) MICRO AND NANO MANUFACTURING
(Professional Elective-IV)

COUSE OBJECTIVES:

- To equip students with the knowledge and skills required to work in the rapidly advancing field of micro and nano manufacturing and to contribute to cutting edge research and development.

COURSE OUTCOME:

At the end of the course, the students are able to:

- Understanding of various traditional/non- traditional micro and Nano machining methods.
- Apply the various micro forming/welding techniques.
- Illustrate the details of various Micro Forming and Welding techniques.
- Demonstrate various Nano Finishing Techniques used in industries.
- Apply the knowledge of Metrology for micro machined components

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	3	-	-	-	-	1	2	2	2	1
CO2	2	3	1	2	1	2	-	2	2	-	1	1	2	2	2	-
CO3	2	2	1	2	2	-	1	-	1	-	-	1	2	2	1	-
CO4	3	2	1	2	2	-	1	-	-	-	-	1	2	2	2	1
CO5	2	3	2	1	1	-	-	-	-	-	-	1	2	1	-	1
CO6	2	3	2	1	2	-	1	-	-	-	-	1	2	2	2	-

UNIT- I

Overview of Micro and Nano Manufacturing Introduction, Micro-Products And Design Considerations For Manufacturing, Material Factors, Considerations On Manufacturing Methods, Manufacturing Methods And Processes, Process Chains And Hybrid Processes, Transition from Nanotechnology to Nano manufacturing.

UNIT-II

Non-traditional Micro Machining Ultra Sonic Micro Machining, Chemical and Electro Chemical Micro Machining, Electric Discharge Micro Machining, Electron Beam Micro Machining, Laser Beam Micro Machining, Ion Beam Micro Machining.

UNIT-III

Micro Forming and Welding, Micro Blanking and Punching, Micro Embossing, Micro Extrusion, LASER Micro Welding, Electron Beam Micro Welding.

UNIT-IV

Nano polishing

Abrasive Flow finishing – Magnetic Abrasive Finishing – Magneto rheological finishing – Magneto Rheological abrasive flow finishing - Magnetic Float polishing – Elastic Emission Machining – chemo-mechanical Polishing.

UNIT-V

Micro Extrusion

Micro extrusion – Micro and Nano structured surface development by Nano plastic forming and Roller Imprinting – Micro bending with LASER – LASER micro welding – Electron beam for micro welding.

UNIT-VI

Recent Trends and Applications:

Metrology for micro machined components – Ductile regime machining– AE based tool wear compensation– Machining of Micro gear, micro nozzle, micro pins – Applications.

TEXT BOOKS:

1. Nano Materials, Bandyopadhyay. A.K., New age international publishers, New Delhi, 2008, ISBN: 8122422578.
2. Handbook of nanotechnology, Bharat Bhushan, springer, Germany, 2010.
3. Introduction to Micro machining' Jain V.K., Narosa Publishing House, 2011
4. Advanced Machining Processes Jain V.K, Allied Publishers, Delhi, 2002

REFERENCE BOOKS:

1. Jain V. K., Micro Manufacturing Processes, CRC Press, Taylor & Francis Group, 2012
2. Janocha H., Actuators – Basics and applications, Springer publishers – 2012
3. Mcgeoug.J.A., Micromachining of Engineering Materials, CRC press 2001, ISBN-10:0824706447.
4. www.cmxr.com/industrial/ 9. www.sciencemag.org.handboo

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0333207) ENERGY AUDIT AND MANAGEMENT
(Professional Elective-IV)

COURSE OBJECTIVES
- To understand Energy Audit procedure along with relevant technologies/ tools
- To understand Energy Conservation measures undertaken across different user segments using case studies
- To develop Energy Audit Report writing skill

COURSE OUTCOMES;
At the end of the course, the students are able to:
- Identify the energy conservation opportunities in various industrial processes.
- Gain knowledge on tools and techniques employed in energy auditing
- Comprehend an Energy Audit report, including economic parameters

MAPPING OF COs & POs:

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

UNIT I
Introduction: Energy Scenario, various forms of energy, energy management and its importance, recent trends in energy conservation.

UNIT-II
Monitoring and Targeting: Defining monitoring and targeting, elements of monitoring and targeting, data and information, analysis techniques, energy consumption, production, cumulative sum of difference.

UNIT III
Energy Efficiency in Thermal Utilities: Boilers, steam systems, furnaces insulation and refractories, FBC boilers, cogeneration, waste heat recovery, Case study

UNIT IV
Energy Efficiency in Electrical Utilities: Electrical systems, electric motors, compressed air system, HVAC and refrigeration systems, fans and blowers, pumps and pumping systems, cooling towers, lighting system, diesel generating system, case study

UNIT V
Energy Economics: Simple payback period, time value of money, IRR NPV, life cycle costing, cost of saved energy, cost of energy generated, Case Studies.

UNIT VI
Energy Auditing and Instrumentation: Definition, methodology, analysis of past trends (plan data), closing the energy balance, laws of thermodynamics, measuring instruments, portable and online instruments, role of Instrumentation in Energy Conservation.

TEXT BOOKS:
1. Industrial Energy Management and Utilization Witte L.C., Schmidt P.S., Brown D.R., Hemisphere, Publishing Corp., New York 1988
2. Industrial Energy Conservation Manuals, Gyftopoulos E.P., MIT Press, 1982.
3. The Efficient Use of Energy Dryden IGC, , 2nd Ed., Butterworth Heinemann, 2013.

REFERENCE BOOKS

1. Economics of Solar Energy & Conservation Systems F. Krieth & RE West, Vol. I & II, CRC Press, 1980.
2. Energy Management Handbook Capehart B.L, Turner, W.C., Kennedy W.J.,The Fairmont Press, Atlanta, GA, 2000.
3. Energy Audit and Management For Mumbai University B.E. Mechanical Engineering,by B. L. Singhal and Amit L. Nehete | 8 June 2023.
4. Energy Audit and Management For SPPU B.E. Mechanical Engineering by B. L. Singhal and Amit L. Nehete March 2023

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0336207) MODERN MACHINING METHODS
(Professional Elective-V)

COURSE OBJECTIVE:
- To create the awareness among the students about newer manufacturing methods and Ultrasonic machining.
- Student can learn about AJM, WJM and AWJM.
- Manufacturing process using Electro Chemical Machining.
- Manufacturing process using Thermal metal removal Process.
- Machining Process using EBM and LBM.
- To impart the knowledge of machining Plasma and Chemical Machining.

COURSE OUTCOMES: At the end of the course, the students are able to:
- Understand the fragile manufacturing techniques and USM.
- Understand the different manufacturing processes for industrial applications (AJM, WJM and AWJM).
- Apply the Electro Chemical Process for suitable applications.
- Apply the Thermal metal removal process for specific applications.
- Apply the EBM and LBM for industrial applications.
- Apply the PAM and CHM for suitable applications.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	3	-	-	-	-	1	2	2	2	1
CO2	2	3	1	2	1	2	-	2	2	-	1	1	2	2	2	-
CO3	2	2	1	2	2	-	1	-	1	-	-	1	2	2	1	-
CO4	3	2	1	2	2	-	1	-	-	-	-	1	2	2	2	1
CO5	2	3	2	1	1	-	-	-	-	-	-	1	2	1	-	1
CO6	2	3	2	1	2	-	1	-	-	-	-	1	2	2	2	-

UNIT I
Need for non-traditional machining Processes -Classification of modern machining processes. Ultrasonic Machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT II
Abrasive jet machining, Water jet machining and abrasive water jet machine: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.

UNIT – III
Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tools, Surface finish and accuracy economic aspects of ECM.

UNIT – IV
Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes –Process parameters, selection of tool electrode and dielectric fluids, methods of surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT – V
Electron Beam Machining: Generation and control of electron beam for machining, theory

of electron beam machining, comparison of thermal and non-thermal processes.
Laser Beam Machining: General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT-VI
Plasma Machining: Principle, metal removal mechanism, process parameters, accuracy and surface finish, applications.
Chemical Machining: Fundamentals of chemical machining- Principle- maskants –etchants- advantages and applications.

TEXT BOOKS:
1. Advanced Machining Processes, VK Jain, Allied publishers. Indersecience Enterprises, 2011
2. Manufacturing Science by Amitabha Ghosh, east-west press pvt ltd, 2010.
3. Textbook of Production Engineering by P. C. Pandey, - Standard Publishers Distributors, 2017.

REFERENCE BOOKS:
1. Modern Machining Process, Pandey, P.C. and Shah H.S., TMH, 1980.
2. New Technology, Bhattacharya A, the Institution of Engineers, India 1984.
3. Manufacturing Engineering & Technology, Kalpakzian, Pearson, 2013.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0337207) RENEWABLE ENERGY SOURCES
(Professional Elective-V)

COURSE OBJECTIVES:
Upon successful completion of this course, the student will understand
- ❖ The potential of the different renewable energy resources
- ❖ The methodologies for energy conversion processes and utilization
- ❖ The economics of energy production and consumption.

COURSE OUTCOMES:
At the end of the course, the students are able to:
- ❖ Understanding different types of renewable energy sources and their utilization.
- ❖ Ensures the effective employment of energy sources for their corresponding applications
- ❖ Identify problems and develop data-driven solutions related to energy systems from an economic point of view.
- ❖ Applying knowledge to assess alternative methods for minimizing waste without affecting production & quality

MAPPING OF COs & POs:

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

UNIT-I
PRINCIPLES OF SOLAR RADIATION: Introduction - solar constant - Role and potential of new and renewable source, instruments for measuring solar radiation, Introduction – type - Flat plate, ETC and concentrating (Parabolic) collectors - Merits & Demerits.

UNIT-II
SOLAR ENERGY STORAGE AND APPLICATIONS: Introduction - Different methods - Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion- photovoltaic Cells.

UNIT-III
WIND ENERGY: Introduction – Potential in India - Basic Principle of wind energy conversion - Basic components **–** classification – Horizontal & Vertical Axis wind mill **–** Merit & demerits.

UNIT-IV
BIO-MASS: Principles of Bio-Conversion – Bio gas generation-Anaerobic/Aerobic Digestion – Factors affecting Biogas generation-classification of biomass gasifiers -thermal gasification of Bio mass- up draught, down draught & cross draught gasifies- advantages and disadvantages- utilization for cooking and IC Engine operation.

UNIT-V
Fuel cells: Introduction, Key components, Physical and Chemical phenomena in fuel cells, advantages and disadvantages, types fuel cells and applications, characteristics
Hydrogen Energy – production, storage, transportation, storage, safety.

UNIT-VI

Energy Economics: Financial Analysis Techniques – Simple payback, Time value of money, Net Present Value (NPV), Return on Investment (ROI), Internal Rate of Return (IRR), Risk and Sensitivity analysis.

TEXT BOOKS:

1. Sustainable Energy with MindTap, by Richard A. Dunlap, Cengage India Private Limited1 August 2017**.**
2. Renewable energy resources/ Tiwari and Ghosal/ Narosa,2005.
3. Solar Energy /Sukhame, 2017.
4. Non-Conventional Energy Sources /G.D. Rai,2017.

REFERENCE BOOKS:

1. Renewable Energy Sources / Twidell & Weir, 2015.
2. Energy Management: W. R. Murphy, G. McKay (Butterworth), 2016.
3. Handbook of Energy Audit, Albert Thumann P.E. CEM, William J. Younger CEM, The Fairmont Press Inc., 7th Edition, 2003.
4. Energy management Handbook, Wayne C. Turner, The Fairmont Press Inc., 5th Edition, Georgia, 2013.
5. Energy Performance assessment for equipment and Utility Systems, Vol. 2, 3, 4, BEE, Govt. of India, 2006.
6. Boiler Operator's Guide Fourth Edition, Anthony L Kohan, McGraw Hill, 2016.
7. Efficient Use of Energy: I. G. C. Dryden (Butterworth Scientific), 2015.
8. www.energymanagertraining.com
9. www.bee-india.nic.in

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0338207) NANOTECHNOLOGY
(Professional Elective -V)

COURSE OBJECTIVES

- To enable the students to understand the science of Nanomaterials
- To enable students to understand properties of bulk and Nanomaterials
- To enable students to understand the different methods of synthesis of nonmaterial.
- To enable students to understand the instrumental techniques for characterization of Nanomaterial's

COURSE OUTCOMES: After completing this course students are able to;

- Understand the mechanical properties of Nanomaterials.
- Analyze the various Nanostructured materials.
- synthesize and characterize the Nanomaterials
- Apply the usage of Nanomaterials for various industrial applications

MAPPING OF COS & POS:

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

UNIT-I

Types of Nanomaterials: Nano-clusters, Solid solutions, Thin film, Nano-composites (Metal Oxide and Polymer based), Core Shell Nanostructure, Bucky balls, Carbon nano tubes and, Zeolites minerals, Dendrimers, Micelles, Liposomes, Block Copolymers, Porous Materials, ,Metal Nanocrystals .

UNIT-II

Mechanical Properties of Nanomaterials: Stress- Strain curve, True Stress True strain, Hardness, compressive & tensile strengths, Fracture toughness Fatigue, Creep and other elastic properties of materials, Deformation behaviour of Nanomaterials.

UNIT-III

Clean Room Technology: Introduction, needs and Types, Basics of clean room standards, design of clean room & clean air devices, High efficiency air filtration, Clean room disciplines, Cleaning of clean room, Quality control, Industrial and Scientific application of clean room

UNIT-IV

Synthesis of Nanomaterials: Physical Methods- Physcal Vapour Deposition (PVD), Inert gas condensation, Arc discharge, DC sputtering, Ion sputtering, RF & Magnetron sputtering ,Pulse Laser Deposition (PLD), Ball Milling, Molecular beam epitaxy, Electro-deposition.

UNIT-V

Characterization Techniques: Structural characterization techniques X-ray diffraction (XRD) technique, particle size determination using XRD, Applications of XRD, Electron diffraction and its application, neutron diffraction and its applications, Scanning Electron Microscopy, Transmission Electron Microscopy.

UNIT-VI

Applications of Nanomaterials: Solar energy, Hydrogen energy and Nano-materials, Carbon

nanotube fuel cells, Hydrogen storage, Thermoelectricity, Re-chargeable batteries, Energy savings, Nano-lubricants, Nano-composites and Nano-catalysts.

TEXT BOOKS

1. Introduction to Nanotechnology by Charles P. Poole, Jr., Frank J. Owens, John Wiley & Sons, 30-May-2003
2. Nanostructure and Nanomaterials: Synthesis, Properties and Application by G. Cao, Imperial College Press, 2004.
3. Clean Room Technology:Fundamental of Design, testing & operation by William Whyte; John – Wiley & Sons 2002.
4. Willard, Merritt, Dean, Settle - Instrumental Methods of Analysis, 7th edition. 1989
5. Mick Wilson: Nanotechnology: Basic Science and Emerging Technologies, Chapman and hall/CRC Press. 2002.

REFERENCE BOOKS

1. Nanoscale Materials- Liz Marzan & Kamat
2. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al. Wiley VCH Verlag Gmbh & Co, Weinheim.
3. Handbook of nanoscience, Eng. & Technology by W. Gaddand, D. Bernner, S.L. Solnki & G.J. Infrate (Eds) , CRC press 2002

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0331207) INDUSTRIAL AUTOMATION & ROBOTICS
(Open Elective-III)

COURSE OBJECTIVES:

- The objective of this subject is to impart basic knowledge on automation in Industries.
- To know about anatomy, different configuration and motion of robots.
- To learn about basic component of robots such as sensor, actuators, and feedback devices

COURSE OUTCOMES:

At the end of the course, the student are able to:

- Understand fundamental aspects of automation in industries.
- Identify various workstations, system support equipments and components in FMS
- Understand fundamental of automatic assembly line and production line
- Learn robot anatomy of robot, configuration of different robots, and Describe construction and working of different types robots
- Represent Position and orientation of body, transformation of rigid body, Homogenous Transformation, The Manipulator Kinematics, D-H parameters, forward and inverse kinematics.
- Understand Robot actuator and feedback components such as stepper motor, encoder, resolver.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	-	1	-	-	1	1	3	2	1	1	1
CO2	2	2	1	2	3	1	-	-	-	-	-	2	2	3	1	1
CO3	3	2	2	2	3	-	-	-	-	-	1	2	3	1	1	1
CO4	3	2	3	2	3	1	-	-	-	-	-	2	3	2	1	1
CO5	3	2	2	2	3	1	1	-	-	1	1	1	3	1	1	1
CO6	3	3	2	2	3	1	1	-	-	1	1	2	3	1	1	1

UNIT – I

INTRODUCTION TO AUTOMATION: Automation - need-types, Basic elements of an automated system, levels of automation- computer process control, Forms of computer process control, input/output devices for discrete data, overview of material handling equipment.

UNIT – II

FMS: Definition, Types of FMS, FMS Components-Work stations, Material handling and storage system, Computer control system , Human resources, FMS applications and benefits, FMS planning and implementation issues, Quantitative analysis of Flexible Manufacturing Systems-Bottleneck model, Extended Bottleneck model ,Sizing the FMS.

UNIT – III

MANUAL ASSEMBLY LINES AND TRANSFER LINES: Fundamentals of Manual Assembly lines and automated production lines, Alternative assembly systems, Design for Assembly, Applications of Automated production lines, Analysis of Transfer lines with NO Internal storage, Analysis of Transfer lines with storage Buffers.

UNIT – IV

INTRODUCTION TO INDUSTRIAL ROBOTS: Robotics Definition - robot configurations, Robot Anatomy, joint system, types of joints, Work volume, Robot Drive systems, Precision of Movement, Robotic sensors and actuators, End effectors, Grippers, different types of grippers.

UNIT – V

MANIPULATOR KINEMATICS: Representation of Position and orientation of body, transformation of rigid body, Homogenous Transformation, The Manipulator Kinematics, D-H parameters, 2R and 3R Mechanism D-H analysis, forward and inverse kinematics.

UNIT – VI

ROBOT ACTUATORS AND FEED BACK COMPONENTS: Actuators- pneumatic-hydraulic actuators, Electric & stepper motors, comparison, Position sensors – potentiometers-resolvers- encoders – velocity sensors-tactile sensors-proximity sensors, Robot applications in Manufacturing.

TEXT BOOKS:

1. Automation, Production Systems and CIM, Mikell P. Groover, Prentice-Hall of India Pvt. Ltd, 2016.
2. Industrial Robotics -Technology, Programming and Applications (SIE), Nicholas Odrey, Mitchell Weiss, Mikell Groover, Roger Nagel, Ashish Dutta, McGraw-Hill 2nd Edition, 2017.
3. Introduction to robotics: analysis, control, applications. Niku, S. B, John Wiley & Sons, 2020.

REFERENCE BOOKS:

1. Robotics: Control Sensing, K.S.Fu., R.C.Gonzalez, C.S.G. Lee, Vision and Intelligence Indian Edition, McGraw Hill Book Co., 2008.
2. An introduction to robot technology. Coiffet, P., & Chirouze, M., Springer Science & Business Media, 2012.
3. Robotics: fundamental concepts and analysis, Ghosal, A, Oxford university press, 2006
4. Robotics and Control, Mittal R.K & Nagrath IJ, McGraw-Hill, 2017.
5. Introduction to Robotics, Craig, John J, 2005.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0339207) CRYOGENICS
(Open Elective -III)

COURSE OBJECTIVES:
- To provide the knowledge of production of low temperature
- To give the knowledge on the properties of materials at low temperature
- To deliver the design aspects of cryogenic storage and transfer lines
- To provide the knowledge of cryogenic insulation and applications

COURSE OUTCOMES:
Upon the successful completion of the course, students are able to:
- Understand gas liquefaction system and gas cycle cryogenic refrigeration system
- Comprehend gas separation and gas purification system
- Understand the behavioural changes in materials at low temperature
- Apply the detailed knowledge of cryogenic insulation
- Analyse the storage and transfer systems of cryogenic liquids
- Apply the knowledge of cryogenics and to embark on cryogenic fluid.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	2	1	-	-	-	-	1	3	3	2	2
CO2	3	3	3	3	1	2	1	-	-	-	-	1	2	2	2	2
CO3	3	2	2	2	2	2	1	-	-	-	-	1	2	2	1	1
CO4	3	2	3	2	2	2	2	-	-	-	-	1	3	2	1	2
CO5	3	2	3	3	1	2	1	-	-	-	-	1	2	2	2	2
CO6	3	2	2	2	1	2	1	-	-	-	-	1	2	2	1	2

UNIT-I:
Introduction to cryogenic refrigeration systems: Review of basic thermodynamics, liquefaction systems, ideal, Cascade, Linde - Hampson and Claude cycles and their derivatives; Refrigerators: Stirling, Gifford- McMahon cycles and their derivatives.

UNIT-II:
Gas separation and gas purification systems: Thermodynamic ideal separation system, Properties of mixtures, principles of gas separation, Linde single column air separation, Linde double column air separation, Argon and Neon separation systems.

UNIT-III:
Properties of materials at low temperature: Specific heat, thermal conductivity, electrical conductivity, magnetic and mechanical properties of materials at low temperature

UNIT-IV:
Cryogenic Insulations: Heat Transfer due to conduction, evacuated porous insulation Powder & Fibers Opacified powder insulation, Gas filled powders & Fibrous materials Multilayer super-insulation, Composite insulation.

UNIT-V:
Cryogenic fluid storage and transfer systems: Design of cryogenic fluid storage vessels, Inner vessel, Outer Insulation, Suspension system, Fill and drain lines. Cryogenic fluid transfer, External pressurization, Self-pressurization, Transfer pump.

UNIT-VI:
Applications of cryogenic systems: Cryogenic application for food preservation – Instant Quick-Freezing Techniques, Super conductive devices, Cryogenic applications for space

technology. Application of cryogenic systems, super conducting devices, space technology, nuclear technology, cryogenics in biology and medicine.

TEXT BOOKS:

1. Cryogenic Process Engineering, K. D. Timmerhaus and T. M. Flynn, 1st Edition, Springer, New York, US. 1989.
2. Cryogenics Systems, Randall F. Barron, 2nd Edition, Oxford University Press, New York, US. 1985.

REFERENCE BOOKS:

1. Cryocooler- Part 1: Fundamentals, Graham Walker, Springer, New York, US, 1983,
2. Cryogenics: research and applications Marshall Sittig & Stephen Kidd, Van Nostrand Reinhold Inc., U.S., 1963.
3. Cryogenic Process Engineering (International Cryogenics Monograph Series) by Klaus D. Timmerhaus (Author), Thomas M. Flynn (Author), 12 January 2013.
4. Cryogenic Engineering and Technologies Principles and Applications of cryogen free systems, by Dr. Zuyu Zhao and Dr. Chao Wang | 11 November 2019.
5. Fundamentals of Cryogenic Engineering by Mamata Mukhopadhyay, October 2010.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0340207) PRODUCTION AND OPERATIONS MANAGEMENT
(Open Elective-III)

COURSE OBJECTIVES:

- The objective of production operation management is to produce the quality product at the right time and the right manufacturing cost.

COURSE OUTCOMES:

At the end of the course the students are able to:

- Understand Quality products production with minimum cost
- Apply the MRP knowledge to estimate the components required for final assembly.
- Design the routing sheet and scheduling of jobs.
- Evaluate the project completion time using PERT-CPM techniques.
- Analyse the demand for various products

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	-	-	1	2	-	3	-	-	1	2	1	1	2
CO2	2	2	1	1	-	1	2	-	3	-	-	1	2	1	2	2
CO3	2	2	2	1	-	1	2	-	3	-	-	1	2	1	2	2
CO4	2	2	2	1	-	1	2	-	3	-	-	1	2	1	2	1
CO5	2	2	2	1	-	1	2	-	3	-	-	1	1	1	2	1

UNIT – I

Forecasting – Importance of forecasting – Types of forecasting, their uses – Demand patterns-methods of forecasting: qualitative methods and quantitative methods (simple moving average, weighted moving average, Exponential smoothing, adjusted exponential smoothing, linear trend line, seasonal and adjustments)-Forecast accuracy and control (mean absolute deviation, cumulative error, mean sum of squares, bias and tracking signal).

UNIT – II

Introduction to Materials requirement Planning [MRP] - terms used in materials requirement planning [MRP] -dependent and independent, continuous and lumpy demand-lead time-structure of MRP system-working principle of MRP-benefits and drawbacks of MRP, JIT inventory: JIT philosophy-push pull and KANBAN systems, contrasts between MRP and JIT-Benefits and evaluation of JIT.

UNIT – III

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading.

Scheduling: introduction- scheduling rules for ‘n’ jobs on one machine – Types of scheduling (forward and backward).

UNIT –IV

Introduction to PERT / CPM : Project management, network modeling-probabilistic model, various types of activity times estimation-programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method (CPM)-critical path calculation-crashing of simple of networks.

UNIT-V

Line Balancing: Introduction-terminology in line balancing-methods of line balancing (Ranked positional weight method).

Aggregate planning: concept of aggregate planning-kinds of costs involved in aggregate planning--strategies of aggregate planning-methods to handle aggregate planning (graphical and Linear programming method).

UNIT – VI

Dispatching – Activities of dispatcher – Dispatching procedure – follow up – definition – Reason for existence of functions – types of follow up, applications of computer in production planning and control.

TEXT BOOKS:

1. Industrial Engineering and Management by DR. Ravi Shankar/Galgotia publications pvt. Ltd. 2000.
2. Industrial Engineering and Operations management by S.K. Sharma and Savita Sharma/ Kataria & sons. 2013.

REFERENCE BOOKS:

1. Operations management by Russel / Taylar, 7/E, 2011.
2. Operations Management – S.N. Chary, 6/E, 2019.
3. Production and operations management by Panner Selvam, PHI, 3/E, 2012.
4. Elements of Production Planning and Control / Samuel Eilon, 2015.
5. Modern Production/ operation managements / Baffa & RakeshSarin, 1987.
6. Production Control A Quantitative Approach / John E. Biegel, 1963.
7. Production Control / Moore, 1959.
8. Operations Management / Joseph Monks, 1987.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112102106
2. https://nptel.ac.in/courses/112107238
3. https://nptel.ac.in/courses/110107141

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0542207) FUNDAMENTALS OF AI & ML
(Open Elective-IV)

COURSE OBJECTIVES:

The course should enable the students to learn:

- About History and Foundation of AI.
- Understand types of agents and the activities of agents.
- Problem-solving using searching techniques, Problem characteristics and their implementations.
- To apply knowledge representation using pre-positional logic and First Order logic.
- Basics of Machine learning.
- Various application of AI in Mechanical Engineering.

COURSE OUTCOMES:

At the end of the course, the students are be able to:

- Know about foundations of artificial intelligence and Intelligent agents.
- Analyze the problems using informed and uninformed techniques.
- Interpret the knowledge using first-order logic and the process of inference.
- Handle uncertainty using probability notations.
- Design the different learning techniques.
- Analyze the Mechanical Engineering problems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	2	1	1	2	-	-	-	-	1	-	1	1	1	1	-
CO2	3	3	2	2	2	-	-	-	1	1	-	2	2	1	1	-
CO3	3	3	2	2	3	1		-	1	1	-	2	2	1	1	-
CO4	3	2	2	1	3	-	-	-	1	1	-	2	2	2	1	-
CO5	3	3	2	1	3	1	1	-	1	1	-	2	2	2	1	-
CO6	3	2	2	1	3	1	1	-	1	1	-	1	3	2	1	-

UNIT I:

Introduction to AI: What is AI, Foundations of AI, History of AI.

Intelligent Agents: Agents and Environments, The Concept of Rationality, The Nature of Environments: PEAS, properties of Task Environment, The Structure of Agents.

UNIT – II:

Solving Problems by Searching: Problem Solving Agents, Example problems, Search algorithm, Uninformed Search Strategies, Informed search strategies, Heuristic Search Strategies, Heuristic Functions, Genetic Algorithms, Constraint Satisfaction Problems.

UNIT – III:

Knowledge Representation, Reasoning and Inference: Knowledge based Agents, The Wumpus World Problem,

Logic: Propositional Logic, First-Order Logic Knowledge and Reasoning: Inference in First-Order Logic: Propositional vs First Order inference. First-Order Logic: Syntax and Symantics of First order Logic, Using First Order Logic, Unification and Lifting, Forward Chaining.

Planning: The planning problem formulation, The Language of Planning Problems.

UNIT IV:

Uncertainty Handling: Acting under Uncertainty, Basic Probability Notation, Axioms of Probability, Inference using Full Joint Distribution, Bayes Rule and its Use, Probabilistic

Reasoning Representing Knowledge in an Uncertain Domain, The semantics of Bayesian Networks.

UNIT V:

Fundamentals of Machine Learning: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, the Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines, Ensemble Learning, And Practical Machine Learning.

UNIT VI:

Applications: Human Machine Interaction, Predictive Maintenance and Health Management, Fault Detection, Dynamic System Order Reduction, Image based part classification, Process Optimization, Material Inspection, Tuning of control algorithms.

TEXT BOOKS:

1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Ed, Pearson Education/ Prentice Hall 2019.
2. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, 3/e, McGraw Hill Education, 2008.
3. B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020.
4. Parag Kulkarni and Prachi Joshi, "Artificial Intelligence – Building Intelligent Systems", PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015.
5. Kumar, Zindani, Davim, Artificial Intelligence in Mechanical and Industrial Engineering, CRC Press, 2021.

REFERENCE BOOKS:

1. Artificial intelligence: a new synthesis Nilsson, Nils J., and Nils Johan Nilsson., Morgan Kaufmann, 1998.
2. Introduction to Artificial Intelligence and Expert Systems, Dan W. Patterson, PHI Learning, 2012.
3. Emerging Trends and Applications of Machine Learning Solanki, Kumar, Nayyar, IGI Global, 2018.
4. Foundations of Machine Learning, Mohri, Rostamizdeh, Talwalkar, MIT Press, 2018.
5. Mathematics for Machine Learning Deisenroth, Faisal, Ong, Cambridge University Press, 2020.

E-Resources and Digital Material:

1. https://onlinecourses.nptel.ac.in/noc22_cs56.
2. https://onlinecourses.nptel.ac.in/noc23_ge40.
3. https://onlinecourses.nptel.ac.in/noc23_cs92.
4. https://onlinecourses.nptel.ac.in/noc23_cs87.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0549207) ADVANCED PYTHON PROGRAMMING FOR DATA SCIENCE
(Open Elective-IV)

COURSE OBJECTIVES:

- The main objective of this course is to help students learn, understand, and practice data analytics using python, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are conceptualization and summarization of data

COURSE OUTCOMES:

After completion of the course, students will be able to;

- Write relatively advanced, well structured, computer programs in Python
- Gain familiarity with principles and techniques for optimizing the performance of numeric applications
- Understand parallel computing and how parallel applications can be written in Python
- Experiment with developing GPU accelerated Python applications
- Learn the fundamentals of the most widely used Python packages; including NumPy, Pandas and Matplotlib
- Apply programming concepts in Data Analysis and Data Visualization projects

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	2	2	2	-	-	2	1	-	1	1	1	1	1
CO2	3	3	3	3	3	1	-	-	2	1	-	1	3	3	2	1
CO3	3	3	3	3	3	1	1	-	2	1	1	1	3	3	2	1
CO4	1	1	1	2	2	2	-	-	2	1	-	1	1	1	1	1
CO5	2	3	3	3	3	1	-	1	2	1	-	2	3	3	2	1
CO6	2	3	3	3	3	1	-	-	2	1	-	2	3	3	2	1

UNIT-I THE ROLE OF PYTHON IN DATA SCIENCE

Introduction- Creating the Data Science Pipeline, Understanding Python's Role in Data Science, Learning to Use Python Fast, Setting Up Python for Data Science, Reviewing Basic Python

UNIT-II CONDITIONING AND WORKING WITH REAL DATA

Uploading, Streaming, and Sampling Data, Accessing Data in Structured Flat-File Form, Sending Data in Unstructured File Form, Managing Data from Relational Databases, Interacting with Data from NoSQL Databases, Accessing Data from the Web,NumPy and pandas, Validating Your Data, Manipulating Categorical Variables, Dealing with Dates in Your Data, Slicing and Dicing: Filtering and Selecting Data, Aggregating Data at Any Level

UNIT-III SHAPING AND PERFORMING ACTION ON DATA

Working with HTML Pages, Working with Raw Text, Using the Bag of Words Model and Beyond, Working with Graph Data, Contextualizing Problems and Data, Considering the Art of Feature Creation, Performing Operations on Arrays

UNIT-IV MATPLOTLIB AND VISUALIZATION OF DATA

Starting with a Graph, Setting the Axis, Ticks, Grids, Defining the Line Appearance, Using Labels, Annotations, and Legends, Choosing the Right Graph, Creating Advanced Scatterplots, Plotting Time Series, Plotting Geographical Data, Visualizing Graphs

UNIT-V WRANGLING DATA

Playing with Scikit-learn, Performing the Hashing Trick, Considering Timing and Performance, Running in Parallel, Counting for Categorical Data, Understanding Correlation, Modifying Data Distributions, Reducing Dimensionality, Clustering, Detecting Outliers in Data.

UNIT-VI EXPLORATORY DATA ANALYSIS (EDA) AND STATISTICAL ANALYSIS:

Analyse datasets using descriptive statistics, data summarization techniques, and visualization tools beyond Matplotlib. Understand the importance of EDA in uncovering insights, identifying patterns, and making data-driven decisions. Seaborn and Pandas for advanced data visualization and statistical analysis tasks- correlation analysis, distribution plotting, and hypothesis testing.

TEXT BOOK:

1. Python for Data Science for Dummies, 2ed, Luca Massaron John Paul Mueller, by ISBN: 978-1-118-84418-2.

REFERENCE BOOKS:

1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Pearson; 2 edition (January 26, 2003), ISBN 978-0201648652
2. Big Data: Principles and best practices of scalable realtime data systems, 1st Edition, Nathan Marz, James Warren, ISBN 978-1617290343

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	1	3

(A0550207) FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEM
(Open Elective-IV)

COURSE OBJECTIVES:

The course should enable the students to learn:

- The concepts of Database Management Systems and
- The Entity Relationship Modelling.
- The SQL commands to create, retrieve, update, and delete data from the Data base.
- To comprehend the concepts of Normalization techniques
- The properties of Transactions in a Database System.
- Concurrency Control techniques and Recovery System.

COURSE OUTCOMES:

At the end of the course, the students are able to:

- Understand the basic concepts of Database Management Systems
- Comprehend Entity Relationship Modelling.
- Use SQL commands to create, retrieve, update, and delete data from the Data base.
- Comprehend the concepts of Normalization techniques
- Analyse the Transactions in a Database System.
- To develop the Concurrency Control techniques and Recovery Systems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	2	-	-	-	-	1	-	1	1	2	2	-
CO2	2	2	2	1	2	1		-	-	1	-	1	1	2	2	-
CO3	3	2	2	1	2	1		-	-	1	-	1	1	2	1	-
CO4	3	2	3	1	2	1	-	-	-	1	-	1	2	1	2	-
CO5	2	2	2	2	2	1	-			1	-	1	1	1	1	-
CO6	2	2	2	1	1	1				1	-	1	1	2	2	-

UNIT – I

Introduction: Introduction to DBMS, Purpose of Database Systems, Database System Applications, View of Data, Data Models, Database Users, Database Architecture.

UNIT – II

Entity-Relationship Model: Basic Concepts, Cardinality of Relationship, ER Diagram Notations, Entity-Relationship Diagrams, Modeling using ER Diagrams, Reduction of an E-R Schema to Tables

UNIT – III

Relational Query Languages: SQL, Data Definition Language Commands, Data Manipulation Language Commands and Data Control Language Commands, Candidate Key, Primary key, Foreign key, Select Clause, Where Clause, Logical Connectivity's – AND, OR, Range Search, Pattern Matching, Order By, Group By, Set Operations – Union, Intersect and Minus, Aggregate Functions, Join Operations.

UNIT – IV

Relational Database Design: Features of Good Relational Database Designs, Decomposition, Normalization, Functional Dependency, Types of Normal Forms - First Normal Form, Second Normal Form, Third Normal Form, Boyce Codd Normal Form (BCNF)

UNIT – V

Transactions: ACID properties, Transaction States, Implementation of Atomicity and

Durability, Concurrent Executions.
Serializability: Conflict Serializability, View Serializability

UNIT – VI
Concurrency Control: Lock-Based Protocols – Locks, Granting of Locks, The Two-Phase Locking Protocol.
Recovery System: Failure Classification, Log-Based Recovery, Shadow Paging Technique

TEXT BOOKS:
1. Database System Concepts, Abraham Silbers chatz, Henry F. Korth and S. Sudarshan, McGraw Hill, 7 th Edition, 2019.
2. Database System Concepts" by Abraham Silberschatz and S Sudarshan, Pearson, 2017

REFERENCE BOOKS:
1. Principles of Database and Knowledge – Base Systems, J. D. Ullman, Vol. 1, 2016.
2. Fundamentals of Database Systems. R. Elmasri and S. Navathe, 7th Edition, 2017.
3. Data Base Management Systems, Raghu Ramakrishna and Johnannes Gehrke, McGraw Hill, 3rd Edition, 2014.

E-RESOURCES AND DIGITAL MATERIAL:
1. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
1	2	2

(A0342207) MODELING & ANALYSIS
(Skill Development Course)

COURSE OBJECTIVES:
- To train the student to make use of Solid Edge/CATIA software package
- To improve the quality of the engineering drawing
- To train the student to make use of ANSYS software package.
- To make students understand and learn about the analysis and simulation of simple mechanical parts through software and the solving techniques of various engineering problems.

COURSE OUTCOMES:
At the end of the course the students are able to;
- Draw the 2D and 3D drawings using Solid Edge/CATIA.
- Apply the importance of the linking functional and visualization aspects in the preparation of the part drawings thus increase the productivity of an industry.
- To Analyse the Structural, thermal, Model and Dynamic analysis.
- To apply the various engineering tools that can be effectively used to improve the output of a product.
- To provide the solutions for Industrial 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	-	-	1	-	2	1
CO2	3	2	-	1	3	-	-	-	-	2	-	-	1	-	2	1
CO3	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-
CO4	2	2	-	2	-	-	-	-	-	3	-	1	-	-	2	1
CO5	3	2	-	2	2	-	-	-	-	2	-	-	1	-	2	1
CO5	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-

UNIT- I:
Introduction to Solid Edge/CATIA: Solid Edge/CATIA Environment-Assembly Environment-Drafting environment-Interface basics-The solid application window-Quick Access tool bar-Command bars.
Sketches for solid model: Induction to SOLID EDGE/CATIA-drawing 2D elements-drawing command and tools-sketching tools-lines, tangents and normal's, circles, Ellipses, Arc etc.

UNIT-II:
Profile based features: Profile-based ordered feature work flow-Profile validation-creating cutout features-using the edge of existing features-Projecting edges.
Modeling Tools:
Creating holes-round work flow-Blend work flow-Chamfer command-Pattern features-circular patterns command-mirror copy paste command

UNIT-III:
Advance modeling tools: Adding drafts to model-Adding a lip to the model-creating web networks-creating vents-constructing swept features-comparing swept, lofted and bluesurf feature.
Assembly: Top down and bottom up design in solid edge-Placing additional parts in an assembly-using part reference planes to position parts-Maintaining assembly relationships

UNIT-IV

FEA and ANSYS: What is FEA? Introduction about ANSYS – ANSYS basics & environment.General analysis procedure: Overview – preprocessing – applying element type – material properties – solution – applying loads – boundary conditions.

UNIT-V

Introduction to modeling in ANSYS: Direct generation – solid modeling – creating nodes – elements – fill between nodes – setting element attributes.

Advanced solid modeling: Using key points – lines – splines – arcs – using areas and volumes – concepts of line fillets – and area fillets – Boolean option.

UNIT-VI

Meshing in ANSYS: Introduction to elements – 1D, 2D & 3D, quadrilateral elements – brick elements –tetrahedral elements – introduction to meshing – mapped and free mesh – control the mesh size. Post processing – results – graphs – deflection – deformation – animation.

TEXT BOOKS:

1. Solid Edge 2020 Black Book By Gaurav Verma and Matt Weber, CADCAMCAE Works (September 16, 2020)
2. Fundaments of FEM by Hutton- McGraw Hill, 2004
3. Finite Element Analysis by George R. Buchanan, Schaum Series,2008

REFERENCE BOOKS:

1. CATIA for Designers, Sham Tickoo, CAD / CIM Technologies.
2. A first course in the Finite element method by Daryl L Logan, Thomason, Third Edition,2015
3. Engineering and Technical Drawing Using Solid Edge Version 20,By Jerry W. Craig, SDC Publications, 2008.
4. Finite Element Analysis, SDC Publications, 2010.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	0	2

(A0341207) OPERATIONS RESEARCH
(Humanities and Social Sciences)

COURSE OBJECTIVES:

Upon completion of this course, the student should be able to,

- Understand the formulation and solution of linear programming problem.
- Develop formulation skills in transportation models and finding optimal solutions.
- Apply the knowledge of assignment algorithms to make the decisions on available resources.
- Make the decisions on replacement of various assets of organization/industry.
- Choose the appropriate queuing model for a given practical application
- Understand the need of inventory management

COURSE OUTCOMES:

At the end of the course the students are able to:

- Appropriately formulate and solve the practical problems using Linear Programming models in service and manufacturing systems.
- Interpret the transportation models' solutions and infer solutions to the real-world problems.
- Make the informed decisions on Assignment of the available resources in service and manufacturing systems effectively.
- Optimize decision-making regarding the replacement or maintenance of assets such as machinery, equipment, or infrastructure.
- Make informed decisions and optimize the efficiency and effectiveness of queuing systems
- Solve deterministic and Probabilistic inventory control models for known and unknown demand of the items.

MAPPING OF COs & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	1	-	1	1	2	1	2	2	-	1
CO2	3	2	2	1	2	-	1	-	1	1	1	1	2	2	1	1
CO3	2	2	2	1	2	-	1	-	1	1	-	1	2	1	1	2
CO4	3	2	2	1	1	-	1	-	1	1	2	1	2	1	1	2
CO5	2	3	2	1	1	-	1	-	1	1	1	1	2	2	1	1

UNIT – I

Linear Programming: Introduction-structure of linear programming model- Formulation– Graphical solution – Simplex method, Big-M method, two phase method, Special cases-Duality, dual simplex method.

UNIT-II

Transportation: Introduction-methods of finding initial basic feasible solution (North-west corner rule, least cost method and Vogel's Approximation method), optimal solution (Modi Method), variations in transportation problem-maximization.

UNIT-III

Assignment problems: Hungarian method of Assignment problem- variations of the assignment problem-Traveling salesman problem.

Job sequencing: n jobs - two machines, n jobs - three machines, two jobs - n machines.

UNIT-IV

Replacement and maintenance models: Introduction-types of failure-replacement of items whose efficiency deteriorates with time- replacement of items that fail completely-staffing problem.

UNIT-V

Queuing theory: Introduction-characteristics of queuing system-probability distributions in queuing system-single server queuing models, multi-server queuing models.

UNIT-VI

Inventory: Introduction-functional role of inventory-reasons for carrying inventory, inventory control models without shortages and with shortages-EOQ models with quantity discounts-instantaneous probabilistic demand without set-up cost, P-system and Q-system.

TEXT BOOKS:

1. Operations Research- theory and applications, second edition, J.K. Sharma/MacMillian publications, 2020.
2. Introduction to operations research, Hamdy A. Taha /PHI publications, 2006.

REFERENCE BOOKS:

1. Introduction to Operations Research, F.S Hillier. and G.J Lieberman, TMH, 2009, 7th Edition.
2. Operations research for management-M.P. Gupta and J. K.Sharma, National publishers

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110106062
2. https://archive.nptel.ac.in/courses/112/106/112106134/
3. https://nptel.ac.in/courses/111107128

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
2	0	2

(A0015203) UNIVERSAL HUMAN VALUES

(Mandatory Learning Course)

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

COURSE OBJECTIVES:

- This course is developed to design a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- The main objective of this course is to help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

COURSE OUTCOMES:

- To create a holistic perspective based on self-exploration
- The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
- The students are able to see that they can enlist their desires and the desires are not vague.
- To strengthen the self-reflection.
- To develop the commitment and courage to act.
- The students become aware of their activities of 'I' and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	1	-	2	-	2	-	-	-	1	3	-	-
CO2	2	3	2	3	-	3	-	1	-	--	-	3	3	-	-
CO3	2	2	3	1	-	1	-	3	-	-	-	2	3	-	-
CO4	3	2	3	2	-	2	-	2	-	-	-	2	3	-	-
CO5	2	2	2	1	-	2	-	1	-	-	-	3	3	-	-
CO6	1	1	1	2	-	1	-	3	-	-	-	2	3	-	-

UNIT 1:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements forfulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations

UNIT II:

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer),

Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correctappraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health (Practice Exercises and Case Studies will be taken up in Practice Sessions)

UNIT III:

Understanding Harmony in the Family and Society-Harmony in Human-Human Relationship (Part-I)

Understanding Harmony in the family–the basic unit of human interaction , Understanding values in human-human relationship; meaning of Justice (*Nyaya)* (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness (*Ubhay-tripti)*; Trust *(Vishwas)* and Respect *(Samman)* as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence.

UNIT IV:

Understanding Harmony in the Family and Society-Harmony in Human-Human Relationship (Part-I)

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals (Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals), Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha), Practice Exercises and Case Studies will be taken up in Practice Sessions

UNIT V:

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence *(Sah-astitva)* of mutually interacting units in all- pervasive space, Holistic perception of harmony at all levels of existence, Practice Exercises and Case Studies will be taken up in Practice Sessions

UNIT VI:

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order

b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

TEXT BOOK

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-

93- 87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

REFERENCE BOOKS

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. F Schumacher. "Small is Beautiful"
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Dharampal, "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
3. Sussan George, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, *Energy & Equity, T*he Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

Relevant websites, movies and documentaries

1. Story of Stuff, http://www.storyofstuff.com
2. Al Gore, An Inconvenient Truth, Paramount Classics, USA
3. Charlie Chaplin, Modern Times, United Artists, USA
4. IIT Delhi, Modern Technology – the Untold Story
5. Gandhi A., Right Here Right Now, Cyclewala Productions

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
0	0	1

(A0094207) COMPREHENSIVE VIVA-VOCE

There shall be comprehensive Viva-Voce examination at the end of 7th semester. 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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

L	T	C
0	0	3

(A0095207) INDUSTRIAL / RESEARCH INTERNSHIP

COURSE OBJECTIVE:

- To develop competency of applying engineering knowledge to real life problems

COURSE OUTCOMES:

At the end of the project work the students are able to:

- Formulate prototype/models and/or experimental set-up and/or simulation and other systems capable of meeting the objectives.
- Identify methods and materials to carry out experiments/develop code
- Analyse the results to come out with concrete solutions.
- Write a technical report citing relevant information of the project apart from developing a presentation.

MAPPING OF COs & POs:

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

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. Certificate from the organization has to be submitted to this effect attested by HoD and Internship in charge to the academic section.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, II-Sem (ME)

L	T	C
0	0	1

TECHNICAL SEMINAR

COURSE OBJECTIVES:

- To understand the basic concepts of technical and practical issues of course specialization
- To import a well-organized report writing skill of technical writing

COURSE OUTCOMES:

At the end of the Seminar the students are able to:

- Identify and compare technical and practical issues related to the area of course specialization
- Outline annotated bibliography of research demonstrating scholarly skills
- Prepare a well-organized report employing elements of technical writing and critical thinking.
- Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

MAPPING OF COs & POs:

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

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, II-Sem (ME)

L	T	C
0	0	5

INTERNSHIP IN INDUSTRY

COURSE OBJECTIVE:

- To develop competency of applying engineering knowledge to real life problems

COURSE OUTCOMES:

At the end of the project work the students are able to:

- Formulate prototype/models and/or experimental set-up and/or simulation and other systems capable of meeting the objectives.
- Identify methods and materials to carry out experiments/develop code
- Analyse the results to come out with concrete solutions.
- Write a technical report citing relevant information of the project apart from developing a presentation.

MAPPING OF COs & POs:

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

The student has to undergo 6 months internship in IV year – II Semester for a complete period of 06 months in a reputed industry/organization. The finalization of the summer internship industry/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 industry internship will be evaluated during 8th semester which carries 05 credits. Certificate from the organization has to be submitted to this effect attested by HoD and Internship in charge to the academic section.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

IV B.Tech, II-Sem (ME)

L	T	C
0	0	6

PROJECT WORK

COURSE OBJECTIVE:

- To develop competency of applying engineering knowledge to real life problems

COURSE OUTCOMES:

At the end of the project work the students are able to:

- Formulate prototype/models and/or experimental set-up and/or simulation and other systems capable of meeting the objectives.
- Identify methods and materials to carry out experiments/develop code
- Analyse the results to come out with concrete solutions.
- Write a technical report citing relevant information of the project apart from developing a presentation.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-
CO2	3	2	-	2	2	-	-	-	-	2	-	-	1	-	2	1
CO3	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-
CO4	2	2	-	2	-	-	-	-	-	3	-	1	-	-	2	1
CO5	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-
CO6	3	2	-	2	2	-	-	-	-	2	-	-	1	-	2	1

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.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct *If the candidate:*	Punishment
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject onlyof all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection withthe examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has beenimpersonated, shall be cancelled in all the subjects of the examination (including practicals and projectwork) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additionalsheet, during or After the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language inthe answer paper or in letters to the Examiners or writes to the Examiner requesting	Cancellation of the performance in that subject.

	him to award pass marks.	
6.	Refuses to obey the orders of the Chief Superintendent/Assistant–Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair meansor misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not The candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned inclause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examinationhall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the

		remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of Internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal or College Academic committee for furtheraction to award suitable punishment.	