Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

SRI KRISHNADEVARAYA UNIVERSITY: ANANTAPUR
College of Engineering & Technology
Academic Regulations 2020 (R20) for
B. Tech (Regular-Full time)

(With effect from the Academic Year 2021-22 for the students admitted into I year I semester)

1. Award of the Degree:

A student will be declared eligible for the award of B. Tech. degree if he/she fulfills the following:

i. Pursues a course of study in not less than four and not more than eight academic years.
ii. After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech. course and their admission stands cancelled.
iii. Registers for 163 credits and must secure all the 163 credits.
iv. A student shall be eligible for the award of B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 163 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

2. Programs offered by the College:

The following programs are offered at present as specializations for the B. Tech. course from 2020-2021.

S. No.	Branch	Program Code
01.	Computer Science & Engineering	01
02.	Electronics and Communication Engineering	02
03.	Mechanical Engineering	03
04.	Electrical and Electronics Engineering	04
05.	Civil Engineering	05

and any other course as approved by the authorities of the University from time to time.
The entire course of study is of four academic years in semester pattern (for regular students)and of three academic years in semester pattern (for lateral entry students).

3. Medium of Instructions:

The medium of instruction is **English** for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

4. Minimum Qualification for Admission:

A candidate seeking admission to the first semester of the eight semester B. Tech. Degree Program should have passed the Intermediate Examination of the Board of Intermediate Education of Andhra Pradesh with Mathematics and Physical Sciences (Physics and Chemistry) as optional courses or any other equivalent examination there to recognized by Govt. of Andhra Pradesh, as per AICTE guidelines. For admissions into the third semester of B. Tech Degree Program under lateral entry scheme a candidate should have passed diploma in the respective branch of study as per AICTE guidelines.

5. Structure of the Program:

Every course of B. Tech. Program shall be placed in one of the nine categories as listed in table below:

Table 2: Category wise distribution of credits

S.No.	Category	Code	Suggested breakup of Credits (APSCHE)	Suggested breakup of Credits (AICTE)
1	Humanities and social science including Management courses	HSMC	13.5*	15
2	Basic Science Courses	BSC	21*	25
3	Engineering science courses	ESC	24*	24
4	Professional Core Courses	PCC	51*	48
5	Open Elective Courses	OEC	12*	18
6	Professional Elective Courses	PEC	15*	18
7	Internship, Project Work Seminar	PROJ	16.5*	15
8	Mandatory courses	NCMC	NC	NC
9	Skill Oriented Courses	SOC	10	-
Total Credits			163	163

Minor variation is allowed as per need of the respective disciplines.

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.

6. Scheme of Instruction

The scheme of instruction shall be for duration of four academic years for regular students and three academic years for lateral entry students. Each academic year consists of two consecutive semesters (one odd + one even). There shall be 90 working days in each semester, excluding the days allotted for internal examinations, preparation holidays and university examinations. Each working day shall be for duration of six hours of instruction and or seminar/ tutorial work.

Note: Under unavoidable circumstances, the 90 working days can be inclusive of internal examinations.

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The details of syllabi and the list of text books and reference books for each branch of study shall be prescribed by the university from time to time on the recommendation of the Board of Studies.

7. Credit Assignment:

Program related terms:

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

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

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

iv. **Massive Open Online Course (MOOC):** The MOOC course is a Discipline Centric Elective Course and the student shall register for the course offered by authorized Institutions/Agencies, through online with the approval of Head of the Department.

v. Each course is assigned certain number of credits based on following criterion:

	Semester	
	Hours / Week	Credits
Theory (Lecture/Tutorial)	02	02
	03	03
	04	04
Practical	02	01
	03	1.5
	04	02
Summer Internship**	2 Months (or 8 weeks)	1.5
Industrial/Research**	2 Months (or 8 weeks)	3
Non-Credit Mandatory Courses	02 / week	00
Project	6 Months (or 24 weeks)	12

Note:

1. Summer Internship for 2 months (Mandatory) after second year (to be evaluated during V semester).
2. The concerned Board of studies can assign tutorial hours to such courses wherever it is necessary, but without change in the total number of credits already assigned for semester.
3. Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester.
4. During Project period the student is supposed to report the Internal Departmental Committee periodically.

8. Weights for Course Evaluation:

8.1 **Course Pattern:**

i. The entire course of study is for four academic years. Semester pattern shall be followed in all the academic years.
ii. A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.
iii. When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

8.2 **Evaluation Process:**

The performance of a student in each semester for academic year I,II,III,IV shall be evaluated subject wise with a maximum of 100 marks for theory and 75 marks for practical subject. Project stage-I, Socially relevant project and Internship shall be evaluated for 50 marks each & Project stage-II shall be evaluated for 200 marks whereas mandatory courses with no credits shall be evaluated for 30 internal marks.

1. For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
2. For practical subjects the distribution shall be 25 marks for Internal Evaluation and 50 marks for the End-Examination.

8.3 **Internal Examination Evaluation:**

For theory subjects, during the semester there shall be 2 midterm examinations. Each midterm examination consists of subjective paper for 25 marks with duration of 1hour 30 minutes.

First midterm examination shall be conducted for the first half of the syllabus in the middle of the semester and second midterm examination shall be conducted for the second half of the syllabus towards the end of the semester. A weightage of 0.75 for better score and 0.25 for the other score will be considered for awarding the sessional marks in both the midterm examinations. There shall be two assignments in each semester for award of 05marks so that midterm component will be 30marks (25 for midterm examinations + 05 marks for assignments).

***Note 1:** The subjective paper shall contain Section A with 2 questions of equal weightage of 10 marks and student shall answer any one.Section B shall contain 4 questions equal weightage of 5 marks and student shall answer any three .Any fraction (0.5 & above) shall be rounded off to the next higher mark.
***Note 2:** The assignment shall contains 5 questions of equal weightage of 1 mark each. Which are essay type questions/numerical problems/software development.

If the student is absent for the internal examination, no re-exam shall be conducted and internal marks for that examination shall be considered as zero.
Final Internal marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 75% weightage given to the better mid exam and 25% to the other.
For Example:

Marks obtained in first mid : 24
Marks obtained in second mid : 20
Final Internal Marks: (24x0.75) + (20x0.25) = 23

If the student is absent for any one midterm examination, the final internal marks shall be arrived at by considering 75% weightage to the marks secured by the student in the appeared examination and zero to the

other. For Example:

Marks obtained in first mid : Absent
Marks obtained in second mid : 24
Final Internal Marks: (24x0.75)+ (0x0.25) =18

8.4 **End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

a. There shall be 8 questions and each question carries 14 marks and Student shall answer any five of them.

8.5 For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and 50 end examination marks. Day-to-day work in the laboratory shall be evaluated for 25 marks by the concerned laboratory teacher based on the regularity/record/viva/Internal test. The end examination shall be conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

8.6 There shall be mandatory courses with zero credits. There shall be no external examination. However, attendance in the audit course shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates every six months/semester at a mutually convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.

8.7 The Engineering Drawing/Graphics course, offered is to be treated as a Theory Course. Evaluation method adopted shall be same as for any other Theory Course. The Internal evaluation for sessionals will be 15 marks for day-to-day work in the class that shall be evaluated by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm exams in a semester for a duration of 2 hrs each, evenly distributed over the syllabi, for 15 marks giving a weightage of 0.75 for the better score and 0.25 for the other score will be considered. The sum of day to day evaluation and the internal tests will be the final sessionals for the subject
.

8.8 The laboratory records and internal test papers shall be preserved for a minimum of 2 years in the respective departments as per the Institution norms and shall be produced to the Committees as and when the same are asked for.

8.9. There shall be 05 Professional Elective courses and 04 Open Elective courses. All the Professional & Open Elective courses shall be offered for 03 credits, wherever lab component is involved it shall be (2-0-2) and without lab component it shall be (3-0- 0). 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.

8.10 All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme.

8.11 A student shall be permitted to pursue up to a maximum of TWO Open Elective courses under MOOCs during the Programme. (See the possibility of Min 1 and Max under MOOCs; avoid paid courses; Coursera, NPTEL, TCS ION to be explored). Each of the courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOCs. Student has to pursue and acquire a certificate for a MOOC only from the

organizations/agencies approved by the BoS in order to earn the 3 credits. The Head of the Department shall notify the list of such courses at the beginning of the semester.

8.12 The college shall invite registration forms from the students at the beginning of the semester for offering professional and open elective courses. There shall be a limit on the minimum and maximum number of registrations based on class/section strength.

8.13 **Internships:**

Students shall undergo mandatory summer internships for a minimum of 2 months duration at the end of second and third year of the Programme. There shall also be mandatory full internship for 6 months in the final semester of the Programme along with the project work.

8.14 S**kill Oriented Courses:**

There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain courses and the remaining one shall be a soft skills course.

8.15.**Honors/Minors:**

Under graduate Degree with Honors/Minor shall be issued by the University to the students who fulfill all the academic eligibility requirements for the B. Tech program and Honors/Minor program. The objective is to provide additional learning opportunities to academically motivated students.

9. Attendance Requirements in Academics:

i. A student shall be eligible to appear for University examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
ii. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
iii. Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
iv. A stipulated fee shall be payable towards condonation of shortage of attendance to the Institution.
v. 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.
vi. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.
vii. The aggregate percentage of attendance can be rounded to next integer for the purpose of considering for condonation/detention.

For example:

A candidate getting ≥64.5 may be condoned, may be rounded to 65. No attendance shall be added but for condoning purpose can only be considered.

10. Minimum Academic Requirements and Award of the Degree:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in section 9.

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

10.2 A student shall be promoted from II Year 2nd to III Year I Semester only if he/she fulfils the academic

requirement of securing **24 credits** in the subjects that have been studied up to II Year I Semester.
10.3 A student shall be promoted from III Year II Semester to IV Year 1st semester only if he/she fulfils the academic requirements of securing **42 credits** in the subjects that have been studied up to III Year I Semester And in case a student is detained for want of credits for particular academic year by sections 10.2 and 10.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the III Year I Semester or IV Year 1st semester as the case may be.

10.4 A student shall register and put up minimum attendance in all 160 credits and earn all the 160 credits.
105 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

11. With–holding of Results:
If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him/her or candidate or student, the result of the candidate shall be withheld and the candidate will not be allowed/promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

12. Award of Grades:

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 fall.

Structure of Grading of Academic Performance

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

i. A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.
ii. For mandatory courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

12.1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

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

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

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

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

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

where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits upto that semester.

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

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

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D, E and F.

13. Award of Class:

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

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.5 < 5.5

14. Gap Year Concept:

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

15. Transitory Regulations:

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of

attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted. Candidates who are permitted to avail Gap Year shall be eligible for rejoining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section **2** and they will follow the academic regulations into which they are readmitted.

16. Curricular Framework for Mandatory Internships

i. It is mandatory to undergo Community Service Project during II Year Summer Vacation with a minimum of 2 months duration.

ii. It is mandatory to undergo Internship during III Year Summer Vacation with a minimum of 2 months duration. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs.

iii. Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightages respectively.

iv. In the final semester, the student should mandatorily undergo internship for 6 Months and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

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

17. 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

viii requirements upon producing a valid certificate as approved by the concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.

ix A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks are to be approved by the University/Academic Council.

18.Curricular Framework for Honors Programme

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

i A student shall be permitted to register for Honors program at the beginning of 4th

ii semester provided that the student must have acquired a minimum of 8.0 SGPA upto 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 8/12weeks 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 MOOCs 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. MOOCs must be of minimum 8 weeks in duration.

Attendance will not be monitored for MOOCs. 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 MOOCs is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.

ix 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.

x 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 Minors will be shown in the transcript. Courses which are dropped under the Minor will not be shown in the transcript.

xi 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.

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

19. Curricular Framework for Minor Programme:

i 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.

ii 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.

iii 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.

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

v 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.

vi 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 MOOCs as approved by the concerned Head of the department in consultation with BoS.

vii 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 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA up to 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

viii 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).

ix 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.

x 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.

xi 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.

xii 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.

xiii 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.

xiv 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.

20. General Instructions:

a. The academic regulations should be read as a whole for purpose of any interpretation.
b. Malpractices rules-nature and punishments are appended.

c. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
e. The Principal may change or amend the academic regulations of common B.o.S or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Principal.
f. The above rules and regulations are to be approved/ratified by the College Academic Council as and when any modifications are to be done.

21.MOOCs through SWAYAM Platform:

There shall be five professional elective courses and four open elective courses, which are Choice Based Credit Courses (CBCC), offered from V semester onwards. Among them, one elective course shall be pursued through MOOCs. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's assignment submissions given by SWAYAM. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.
A Student must complete the SWAYAM MOOC course in all respects on or before 5 / 6 / 7 semester. Students' MOOC course score in terms of marks/grade/credits will be counted in their 5/6/7 semester marks sheet as the case may be. Students who have qualified in the proctored examinations conducted by the SWAYAM and apply for credit transfer as specified are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the university.
Necessary amendments in rules and regulations regarding adoption of SWAYAM MOOCS courses would be proposed from time to time.
Credit Equivalence for SWAYAM MOOCs Courses: Courses of 04 weeks duration: 01 Credit Courses of 08 weeks duration: 02 Credits Courses of 12 weeks duration: 03 Credits Courses of 16 weeks duration: 04 Credits.

22.Credit Transfer Policy

Adoption of MOOCs is mandatory for all students, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 40% of the total courses being offered in a particular Programme in a semester through the Online Learning courses through SWAYAM platform (www.swayam.gov.in).

i. The University shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform.
ii. The online learning courses available on the SWAYAM platform will be considered for credit transfer. SWAYAM course credits are as specified in the platform.
iii. Student registration for the MOOCs shall be only through the institution, it is mandatory for the student to share necessary information with the institution
iv. Credit transfer policy will be applicable to the Professional & Open Elective courses offered by the university under Choice Based Credit System (CBCS).
v. The institution shall select the courses to be permitted for credit transfer through SWAYAM. However, while selecting courses in the online platform institution would essentially avoid the courses offered through the curriculums it may otherwise lead to duplication and repetition of the same course

vi. The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer in the forthcoming Semester.

vii. The institution shall also ensure that the student must complete the course and produce the course completion certificate as per the academic schedule given for the regular courses in that semester

viii. The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

ix. The university shall ensure no overlap of SWAYAM MOOC exams with that of the university examination schedule. In case of delay in SWAYAM results, the university will re-issue the marks sheet for such students.

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

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

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

Note: Students shall also be permitted to register for MOOCs offered through online platforms other than SWAYAM / NPTEL. In such cases, credit transfer shall be permitted only after seeking approval of the University at least three months prior to the commencement of the semester.

ACADEMIC REGULATIONS FOR B. TECH.(R20)
(LATERAL ENTRY SCHEME)

(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year 2022-2023 and onwards)

1. Award of B.Tech. Degree

A student admitted in Lateral Entry Scheme (LES) will be declared eligible for the award of the B.Tech degree if the student fulfills the following academic regulations:

a)Pursues a course of study for not less than three academic years and not more than six academic years.

b) Registers for *124* credits and secures all *124*credits from II to IV year of Regular B. Tech. program.

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

3. All The regulations except 8.1 are to be adopted as that of B. Tech. (Regular).

4. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.9

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

ii A student shall be promoted from III Year II Semester to IV year 1st Semester only if the student fulfills the academic requirements of securing **25 credits** of the subjects that have been studied up to III Year I Semester**.**

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

5. Course Pattern

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

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

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

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Mechanical Engineering

RULES FOR DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

S. No.	Nature of Malpractices/Improper conduct	Punishment
	If the Candidate:	
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1 (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all examinations, if his involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all 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	Expulsion from the examination hall and

	or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	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 examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject only.
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 means or 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. If the candidate physically assaults the invigilator/ officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. 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 there of 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 the examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee**.**
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institution for further action to award suitable punishment.	

Note: -

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfill all the norms required for the award of Degree.

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Mechanical Engineering

SKUCET Curriculum
B. Tech Course Structure – R20
MECHANICAL ENGINEERING

Semester – 0 Common for All Branches of Engineering				
S.No	**Course No**	**Course Name**	**Category**	**L-T-P-C**
1		Physical Activities – Sports, Yoga and Meditation, Plantation	MC	0-0-12-0
2		Career Counseling	MC	4-0-4-0
3		Orientation to all branches – career options, tools, etc.	MC	6-0-0-0
4		Orientation on admitted Branch – corresponding labs, tools and platforms	EC	4-0-6-0
5		Proficiency Modules & Productivity Tools	ES	4-2-4-0
6		Assessment on basic aptitude and mathematical skills	MC	4-0-6-0
7		Remedial Training in Foundation Courses	MC	4-2-4-0
8		Human Values & Professional Ethics	MC	6-0-0-0
9		Communication Skills – focus on Listening, Speaking, Reading, Writing skills	BS	4-2-4-0
10		Concepts of Programming	ES	4-0-4-0
Total				40-6-44-0

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
I Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Linear Algebra & Calculus	BS	3-0-0	3
2.		Engineering Chemistry	BS	3-0-0	3
3.		Basic Electrical and Electronics Engineering	ES	3-0-0	3
4.		Problem Solving & Programming	ES	3-0-0	3
5.		Basic Engineering Workshop	ES	0-0-3	1.5
6.		IT Workshop	ES	0-0-3	1.5
7.		Basic Electrical & Electronics Engineering Lab	ES	0-0-3	1.5
8.		Engineering Chemistry Lab	BS	0-0-3	1.5
9		Problem Solving & Programming Lab	ES	0-0-3	1.5
				Total	**19.5**

Category	**CREDITS**
Basic Science course	7.5
Engineering Science Courses	12
TOTAL CREDITS	**19.5**

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
I Year II Semester					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Differential Equations & Vector Calculus	BS	3-0-0	3
2.		Engineering Physics	BS	3-0-0	3
3.		Engineering Mechanics	ES	3-0-0	3
4.		Communicative English	HS	3-0-0	3
5.		Engineering Graphics	ES	1-0-4	3
6.		Basic Civil and Mechanical Engineering Lab	ES	0-0-3	1.5
7.		Engineering Physics Lab	BS	0-0-3	1.5
8.		Communicative English Lab	HS	0-0-3	1.5
9.		Environmental Studies	MC	2-0-0	0
				Total	**19.5**

Category	**CREDITS**
Basic Science course	7.5
Engineering Science Courses	7.5
Humanities and social science	4.5
TOTAL CREDITS	**19.5**

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
II Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Complex Variables, Transforms & Application of PDE	BS	3-0-0	3
2.		Thermodynamics	PC	3-0-0	3
3.		Manufacturing Processes	PC	3-0-0	3
4.		Fluid Mechanics & Hydraulic Machinery	PC	3-0-0	3
5.		Mechanics of Materials	ES	3-0-0	3
6		UHV-II: Universal Human Values – Understanding harmony and Ethical Human Conduct	HS	2-1-0	3
7.		Fluid Mechanics & Hydraulic Machinery Lab	PC	0-0-3	1.5
8.		Manufacturing Processes Lab	PC	0-0-3	1.5
9.		Mechanics of Materials Lab	ES	0-0-3	1.5
10.		**Skill oriented course – I** Application Development with Python	SC	1-0-2	2
11		**NCC/NSS ACTIVITIES**			
			Total	**24.5**	

Category	**CREDITS**
Basic Science course	3
Humanities and Social Sciences	3
Professional Core Courses	12
Engineering Science Courses	4.5
Skill Oriented Course	2
TOTAL CREDITS	**24.5**

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
II Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Numerical Methods & Probability Theory	BS	3-0-0	3
2.		Theory of Machines	PC	3-0-0	3
3.		Thermal Engineering - I	PC	3-0-0	3
4.		Material Science & Engineering	PC	3-0-0	3
5.		Managerial Economics & Financial Analysis	HS	3-0-0	3
6.		Thermal Engineering – I Lab	PC	0-0-3	1.5
7.		Material Science & Engineering Lab	PC	0-0-3	1.5
8.		Machine Drawing Lab	PC	0-0-3	1.5
9.		**Skill Oriented Course –II -** Soft Skills	SC	1-0-2	2
				Total	**21.5**
Community Service Project (Mandatory) for 2 months duration during summer vacation					

Category	**CREDITS**
Basic Science course	3
Professional Core Courses	12
Engineering Science Courses	4.5
Skill Oriented Course	2
TOTAL CREDITS	**21.5**

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
III Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Machine Tools	PC	3-0-0	3
2.		Thermal Engineering - II	PC	3-0-0	3
3.		Metrology & Measurements	PC	3-0-0	3
4.		**Professional Elective-I**	PE	3-0-0	3
5.		**Open Elective-I**	OE	3-0-0	3
6.		Thermal Engineering-II Lab	PC	0-0-3	1.5
7.		Metrology & Measurements Lab	PC	0-0-3	1.5
8.		**Skill oriented course-III** Innovation through IOT/ MS Project	SC	1-0-2	2
9.		Evaluation of Community Service Project	PR		1.5
				Total	**21.5**

List of Professional Electives-I	**List of Open Electives-I**
1. Design of Machine Elements- 2. Power Plant Engineering 3.Optimization Techniques	Candidate should select the subject from list of subjects offered by other departments.

Category	**CREDITS**
Professional Core Courses	12
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill oriented course	2
Summer Internship	1.5
TOTAL CREDITS	**21.5**

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
III Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Design of Machine Elements - II	PC	3-0-0	3
2.		CAD / CAM	PC	3-0-0	3
3.		Heat Transfer	PC	3-0-0	3
4.		**Professional Elective-II**	PE	3-0-0	3
5.		**Open Elective-II**	OE	3-0-0	3
6.		CAD / CAM Lab	PC	0-0-3	1.5
7.		Machine Tools Lab	PC	0-0-3	1.5
8.		Heat Transfer Lab	ES	0-0-3	1.5
9.		**Skill oriented course-IV MAT LAB/CFD**	SC	1-0-2	2
				Total	**21.5**
Industrial/Research Internship (Mandatory) for 2 months duration during summer vacation					

List of Professional Electives-II	List of Open Electives-II
1.Finite Element Analysis 2.Non-conventional sources of Energy 3.Nano Technology.	Candidate should select the subject from list of subjects offered by other departments.

Category	CREDITS
Professional Core Courses	13.5
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill oriented course	2
TOTAL CREDITS	**21.5**

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
IV Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		**Professional Elective-III**	PE	3-0-0	3
2.		**Professional Elective-IV**	PE	3-0-0	3
3.		**Professional Elective-V**	PE	3-0-0	3
4.		**Open Elective-III**	OE	3-0-0	3
5.		**Open Elective-IV**	OE	3-0-0	3
6.		**Humanities Elective-I**	OE	3-0-0	3
7.		**Skill oriented course V**	SC	1-0-2	2
8.		Evaluation of Industrial Internship	PR	0-0-0	3
				Total	**23**

List of Professional Electives-III	**List of Professional Electives-V**
1. Operation Research 2. Robotics Composite Materials	1. Automobile Engineering 2. Tool Design Industrial Management
List of Professional Electives-IV	**Humanities Elective-I**
1. Non-Destructive Evaluation (NDE) 2. Solar Energy Systems 3. Mechanical Behavior of Materials	1)Entrepreneurship and Design Thinking 2)Management Science 3)Organizational Behavior
List of Open Electives-III & IV Candidate should select the subject from list of subjects offered by other departments.	

Category	**CREDITS**
Professional Elective Courses	9
Open Elective Course/Job Oriented Elective	6
Humanities and Social Science Elective	3
Skill oriented course	2
Industrial Internship	3
TOTAL CREDITS	**23**

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
IV Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Internship/Project work	PROJ	0-0-0	12
				Total	**12**

Category	**CREDITS**
Internship/Project work	**12**
TOTAL CREDITS	**12**

Sri Krishnadevaraya University College of Engineering & Technology
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Mechanical Engineering

LIST OF OPEN ELECTIVES

Open Electives offered by Dept. of Mech. Engineering (Offered to other Departments)

1. Manufacturing Process
2. IC Engines
3. Automobile Engineering
4. Non Conventional Sources of Energy
5. Non Destructive Evaluation
6. Workshop Technology
7. Total Quality Management

O**ut of Open elective courses at least one course should be completed through MOOCs**

Open Electives offered by Dept. of E.C.E(Offered to other Departments)

1. Fundamentals of Digital Electronics
2. Basics of Signals and Systems
3. Fundamentals of Communication Systems
4. Fundamentals of Microprocessors and Microcontrollers
5. Microcontroller & Applications
6. Electronic Sensors
7. Electronic Instrumentation
8. Principles of Signal Processing
9. Embedded System Design
10. Introduction to Image Processing
11. Introduction to Internet of things
12. Consumer Electronics

O**ut of Open elective courses at least one course should be completed through MOOCs**

Open Electives offered by Dept. of C.S.E(Offered to other Departments)

1. Principles of Software Engineering (OE-1)
2. Java Programming (OE-2)
3. Fundamentals of Operating Systems (OE-3)
4. Fundamentals of Computer Networks (OE-4)
5. Principles of Database Management Systems
6. Web Technologies
7. Cyber Security

O**ut of Open elective courses at least one course should be completed through MOOCs**

Open Electives offered by Dept. of E.E.E(Offered to other Departments)

1.Electrical circuit Theory (OE-1)
2.Generation of Electric Power (OE-2)
3.Renewable Energy Sources (OE-3)
4.Basics of Power Electronics (OE-4)

O**ut of Open elective courses at least one course should be completed through MOOCs**

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Open Electives offered by Dept. of Civil Engineering (Offered to other Departments)

Open Elective-I

1. Engineering Material
2. Dister Mitigation and Management
3. Environmental Economics

Open Elective-II

1. Traffic Engineering
2. Ground Improvement Techniques
3. Environmental Pollution Control

Open Elective-III

1. Environmental Impact Assessment
2. Low Cost-Effective Housing Techniques
3. Water shed Management

Open Elective-IV

1. Construction Planning and Project Management
2. Noise and Air Pollution
3. Geographic Information System GIS

O**ut of Open elective courses at least one course should be completed through MOOCs**

Skill Oriented Courses

1. Skill Oriented Course – I (III Sem) – Application development with Python
2. Skill Oriented Course – II (IV Sem) – Soft skills
3. Skill Oriented Course –III – PCB Design and Development
4. Skill Oriented Course – IV – Industrial IoT
5. Skill Oriented Course – V – System Verilog

Humanities Electives – I (VII Sem)

1.Entrepreneurship and Incubation
2.Management Science
3.Organizational Behavior

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Honors Degree in Mechanical Engineering

Note
1.A student can opt any Four subjects @ 4 credits per subject
2.Concerned BoS can add or delete the subjects as per the decision of the board.
3.Prerequisites to be defined by the board for each course.
4.Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each

S.No.	Course Code	Course Name	L	T	P	Credits
1.		Advanced Thermodynamics	3	1	0	4
2.		Advanced Manufacturing Methods	3	1	0	4
3.		Product Design	3	1	0	4
4.		Robotics Modeling Analysis & Control	3	1	0	4
5.		Computational Fluid Dynamics	3	1	0	4
6		Alternative Energy Sources for Automobiles	3	1	0	4
7		MOOC course (8 weeks duration)				2
8		MOOC course (12 weeks duration)				2

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Minor Degree in Thermal Engineering

Note

1.A student can opt any Four subjects @ 4 credits per subject
2.Concerned BoS can add or delete the subjects as per the decision of the board.
3.Prerequisites to be defined by the board for each course.
4.Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

S.No.	Course Code	Course Name	L	T	P	Credits
1.		Production Engineering	3	1	0	4
2.		Mechanical Technology	3	1	0	4
3.		Introduction to Thermodynamics	3	1	0	4
4.		Thermal Engineering	3	1	0	4
5.		Automobile Engineering	3	1	0	4
7		MOOC course (8 weeks duration)				2
8		MOOC course (12 weeks duration)				2

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Note:

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during third semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
I Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Linear Algebra & Calculus	BS	3-0-0	3
2.		Engineering Chemistry	BS	3-0-0	3
3.		Basic Electrical and Electronics Engineering	ES	3-0-0	3
4.		Problem Solving & Programming	ES	3-0-0	3
5.		Basic Engineering Workshop	ES	0-0-3	1.5
6.		IT Workshop	ES	0-0-3	1.5
7.		Basic Electrical & Electronics Engineering Lab	ES	0-0-3	1.5
8.		Engineering Chemistry Lab	BS	0-0-3	1.5
9		Problem Solving & Programming Lab	ES	0-0-3	1.5
				Total	**19.5**

Category	**CREDITS**
Basic Science course	7.5
Engineering Science Courses	12
TOTAL CREDITS	**19.5**

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Mechanical Engineering

Course Code	LINEAR ALGEBRA & CALCULUS (Common to all branches of Engineering)	L	T	P	C
		3	0	0	3

I Year I Semester

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Bridge Course: Limits, continuity, Types of matrices .

Course Outcomes (CO): Student will be able to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications
- Utilize mean value theorems to real life problems
- familiarize with functions of several variables which is useful in optimization
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems
- Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

UNIT - I	**Matrix Operations and Solving Systems of Linear Equations**

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation

UNIT - II	**Mean Value Theorems**

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof);

UNIT - III	**Multivariable calculus**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers

UNIT - IV	**Multiple Integrals**

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

UNIT - V	**Beta and Gamma Functions**

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.
4. T.K.V Iyengar, B. Krishn Gandhi, S. Ranganatham and M.V.S.N. Prasad., S. chand Publishers.

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Mechanical Engineering

Course Code	ENGINEERING CHEMISTRY (CIV. & MECH. Branches)	L	T	P	C
		3	0	0	3

I Year I Semester

Course Objectives:

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

Course Outcomes (CO):

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

- **Demonstrate:** The corrosion prevention methods and factores affecting corrosion
- **Explain:** The preparation, properties, and applications of thermosetting and thermoplastics
- **Discuss:** Hydrogen-Oxygen fuel cell
- **Explain:** The setting and hardening of cement and concrete phase

UNIT - I	**Water technology**

Water: Source of water**,** impurities in water, hardness of water by using EDTA method, temporary and permanent hardness and its units. **Water for industrial purpose**: steam generation, boiler troubles–carry over (priming & foaming) boiler corrosion–scales and sludge.
Water internal and external treatment: Permutit or zeolite process. deminera- lization of brackish water, reverse-osmosis and electro dialysis.

UNIT - II	**Polymer Chemistry**

Polymers: Basic concepts of polymerization, types of polymerization addition and condensation polymerization. **Plastomers:** thermosetting and theromoplastics composition properties and engineering applications of PVC, teflon, bakelite and nylons. **Rubber:** rubber-processing of natural rubber and Vulcanisation of rubber, compounds of rubber, elastomers-buna **S**, buna **N** preparation, properties and its applications. **Conducting polymers:** Polyacetylene, polythiphene, polyphenylene and poly aniline, classifications of conducting polymers.Synthesis mechanism of conducting polymers and its applications

UNIT - III	**Fuel and Combustion**

Fuels: Metallurgical coke–characteristics and manufacture(**Otto-Halfmann's**). **Liquid Fuels**: synthetic refining petroleum (**Fischer-Tropsch's, Bergiue's**) process, fuel for IC engines, knocking and anti-knocking agent. Octane and cetane values. Cracking of oils: alternative fuels-hydrogen-oxygen and methane-oxygen fuel cells advantages, disadvantages and its applications.

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UNIT - IV	**Electrochemistry and Corrosion and its Control**

Electrochemical cells: galvanic cells, types of electrodes (standard hydrogen, calomel and quinhydrone), EMF of cells. **Batteries:** Nickel-cadmium, lithium ion batteries advantages, disadvantages and its applications. **Corrosion and its Control:** Theories (dry-wet, chemical and electrochemical corrosion) of corrosion and mechanism. Factors affecting the corrosion. Types of corrosions and control methods-cathode protection sacrificial anodic, impressed current method.

UNIT - V	**Advanced Engineering Materials**

Building materials: Portland cement composition, classification, preparation (dry and wet processes).Constituents, phases and reactivity of clinker, Setting and hardening of cement. **Refractories:**Criteries of refracteries,Classification,properties,Factors affecting the refractory materials and applications.Failures of refractories

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Textbooks:
1.A text book of engineering chemistry., Jain and Jain, Dhanpat Rai Publishing Company., 15th edition, New Delhi,**2008**. **2**. Chemistry of engineering., Prof. K.N. Jayaveera, Dr. G.V. Subba Reddy and Dr. C. Ramachandraiah. McGraw hill higher education. Hyderabad, **2009.** **3**. Peter Atkins, Julio de Paula and James Keeler, Atkin's Physical Chemistry, 10/e, Oxford University Press, 2010.
Reference Books:
1.D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth- Heineman,1992. **2**.H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997. **3**.Engineering chemistry 3e,B.Rama Devi et al., Cengage Learning.

Subjects	Web Sites
Organic Chemistry Help	p://www.chemhelper.com
Model ChemLab	p://modelscience.com/products.html?source=google
Virtual Library	p://www.liv.ac.uk/Chemistry/Links/links.html
The World Wide Club for the chemical community	p://www.chemweb.com/
International Chemistry Departments	p://www.liv.ac.uk/Chemistry/Links/international.html
Chemistry Software for Chemists	p://www.chemistry-software.com/
Guide to academic and research jobs in Europe	p://www.academicjobseu.com/
Guide to PhD studentships and chemical sciences	p://www.findaphd.com/firstmain.asp
Guide to postdoctoral positions	p://www.findapostdoc.com/firstmain.asp
Wiley InterScience	p://www.interscience.wiley.com/cgi-bin/home

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Mechanical Engineering

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to Civil, CSE and Mechnical.)	L	T	P	C
		3	0	0	3

I Year I Semester

Course Objectives:

- To introduce basics of electric circuits.
- To teach DC and AC electrical circuit analysis.
- To explain working principles of transformers and electrical machines.
- To impart knowledge on low voltage electrical installations
- To provide comprehensive idea about working principle, operation and applications of PN junction & zener diodes, BJT and operational amplifier
- To introduce fundamentals of digital electronics.

Course Outcomes (CO):

- Apply concepts of KVL/KCL in solving DC circuits
- Choose correct rating of a transformer for a specific application
- Illustrate working principles of induction motor - DC Motor
- Understand working operation of transformer
- Describe operation and characteristics of diodes and transistors and basic opamps

UNIT - I	**DC & AC Circuits**	

Electrical circuit elements (R - L and C) - Kirchhoff laws -Series and parallel connection of resistances with DC excitation. Superposition Theorem -Representation of sinusoidal waveforms -peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits.

UNIT - II	**DC Machines:**	

DC-Generators: Working Principle and construction of DC Generator– Generated emf equation – types of DC Generators-simple problems regarding EMF.
DC Motors : Working Principle of DC Motor-types of DC Motors -back emf -torque equation –speed control of DC Shunt Motor – applications of DC machines -losses in DC machines- Swinburne's test and efficiency calculation –simple problems.

UNIT - III	**Transformers:**	

Principle of operation of single phase transformers –Constructional features –Theory of an Ideal Transformer- EMF equation –Practical Transformer on no load and load–Equivalent circuit- Impedance Ratio-Shifting of Impedances – losses- regulation -OC & SC test- efficiency –simple problems.

UNIT - IV	**Analog Electronics**	

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 and bridge type-simple Problems. Formation of PNP and NPN transistors – CE configuration of NPN and PNP transistors- applications -Transistor as an amplifier-SCR characteristics and applications- construction and Principle of CRO(operation only)-Applications..

UNIT - V	**Operational Amplifiers and Digital Electronics**	

Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.
Introduction, Switching and Logic Levels, Digital Waveform, characteristics of digital ICs, logic gates, number systems.

Textbooks:

1. 1. D. P. Kothari and I. J. Nagrath - "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Power System" – S.Chand – 2018
3. D.P. Kothari, I.J.Nagrath, Basic Electronics, 2nd edition, McGraw Hill ducation(India)Private Limited
4. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 2nd edition, Pearson India Private Limited.

Reference Books:

1. R. Muthusubramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education, Reprint 2012.
2. David Bell, Electronic Devices and Circuits: Oxford University Press, 5th EDn., 2008.
3. L. S. Bobrow - "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
4. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.
5. C.L. Wadhwa – "Generation Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International Publications.

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	PROBLEM SOLVING AND PROGRAMMING (Common to all Branches Of Engineering)	L	T	P	C
		3	0	0	3
I Year I Semester					

Course Objectives:

- To illustrate the basic concepts of C programming language.
- To discuss the concepts of Functions, Arrays, Pointers and Structures.
- To familiarize with Stack, Queue and Linked lists data structures.
- To explain the concepts of non-linear data structures like graphs and trees.
- To learn different types of searching and sorting techniques

Course Outcomes (CO):

- Analyse the basic concepts of C Programming language.
- Design applications in C, using functions, arrays, pointers and structures.
- Apply the concepts of Stacks and Queues in solving the problems.
- Explore various operations on Linked lists.
- Demonstrate various tree traversals and graph traversal techniques.
- Design searching and sorting methods

UNIT - I	**Introduction to C Language** -

C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays

UNIT - II	**Functions**

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, Strings, string handling functions, and Command line arguments.

UNIT - III	**Data Structures**,

Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

UNIT - IV	**Linked Lists**

Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

UNIT - V	**Trees, Graphs ,Searching & Sorting**

Trees - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

Textbooks:

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
4. B.A. Forouzon and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg & Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T. Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	BASIC ENGINEERING WORKSHOP	L	T	P	C
		0	0	3	1.5
I Year I Semester					

Course Objectives:

- To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring Skills

Course Outcomes (CO):

After completion of this lab the student will be able to

- Apply wood working skills in real world applications.
- Build different objects with metal sheets in real world applications.
- Apply fitting operations in various applications.
- Apply different types of basic electric circuit connections.
- Use soldering and brazing techniques

List of Topics

Wood Working:
Familiarity with different types of woods and tools used in wood working and make following joints
a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint

Sheet Metal Working:
Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets
a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting:
Familiarity with different types of tools used in fitting and do the following fitting exercises
a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two wheeler tyre

Electrical Wiring:
Familiarities with different types of basic electrical circuits and make the following connections
a) Parallel and series b) Two way switch c) Godown lighting
d) Tube light e) Three phase motor f) Soldering of wires

Note: In each section a minimum of three exercises are to be carried out.

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Mechanical Engineering

Course Code	IT WORKSHOP	L	T	P	C
		0	0	3	1.5

I Year I Semester

Course Objectives:

- To make the students know about the internal parts of a computer, assembling and dissembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations and LAteX
- To learn about Networking of computers and use Internet facility for Browsing and Searching
- To learn about Google Forms and Google Sites

Course Outcomes (CO):

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors and Prepare spread sheets for calculations
- .using excel and also the documents using LAteX.
- Prepare Slide presentations using the presentation tool.
- Interconnect two or more computers for information sharing.
- Access the Internet and Browse it to obtain the required information

List of Experiments:

Week l

Preparing your Computer

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: **Operating system features**: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and Internet

Task 5: Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6: Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

Productivity tools

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

Task 9: Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

Task 10: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

Note: Use open source tools for implementation of the following exercises.

Reference Books:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint& Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH

Sri Krishnadevaraya University College of Engineering & Technology
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Mechanical Engineering

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

I Year I Semester

Course Objectives:

- To Verify Kirchoff's laws
- To verify Superposition theorem.
- To learn performance characteristics of DC Machines.
- To perform open circuit & Short Circuit test on 1- Phase Transformer.
- To Study the I – V Characteristics of Solar PV Cell

Course Outcomes (CO):

- Verify Kirchoff's Laws & Superposition theorem.
- Perform testing on AC and DC Machines.
- Study I – V Characteristics of PV Cell
- Describe construction, working and characteristics of diodes, transistors and operational amplifiers
- Demonstrate how electronic devices are used for applications such as rectification, switching and amplification
- Build different building blocks in digital electronics using logic gates
- Explain functionality of flip-flops, shift registers and counters for data processing applications

List of Experiments:

Part-A
Electrical Engineering Lab

List of experiments: -

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Open circuit characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Brake test on 3 - Phase Induction Motor.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

Part-B
Electronics Engineering Lab

List of Experiments:

1. Study of CRO
2. Draw and study the characteristics of Semi-conductor diode
3. Draw and study the characteristics of Zener Diode
4. Draw and study the static and transfer characteristics of NPN and PNP transistors in CE configuration.
5. Construct half wave and full wave rectifier circuits. Find ripple factor and plot their output waveforms with and without filters
6. Study the application of Op-amp as an Inverting amplifier, Non-inverting amplifier, Voltage follower, Summer and Subtractor
7. Realization of logic gates, AND, OR, NOT, NAND, NOR, XOR

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Mechanical Engineering

Course Code	ENGINEERING CHEMISTRY LAB (Common to Civil & Mechanical Engineering)	L	T	P	C
		0	0	3	1.5

I Year I Semester

Course Objectives:

- Verify the fundamental concepts with experiments

Course Outcomes (CO):

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

- **Determination:** Hardness of water by using EDTA
- **Estimation:** Amount of dissolved oxygen given water sample
- **Analysis:** Difference between the UV-Visible and IR spectroscopy
- **Explain:** Verification of Beer-Lambert's law I
- **Identify:** Acid -base buffer solution pH meter
- applications

List of Experiments:

Chemical methods: Volumetric analysis

1. Estimation of Ferrous (Fe^{2+}) Ion using Standard Potassium Dichromate

Iodometry Titrations:

2.Estimation of Copper (Cu^{2+}) Ion using Standard Potassium Dichromate

(i) Part-I : Standardization of sodium thiosulphate ($Na_2S_2O_3$) solution with standard $K_2Cr_2O_7$

(ii) Part-II: Estimation of Copper

Complexometry Titrations:

3.Estimation of Calcium hardness of water using Standard EDTA solution

4.Estimation of Copper by using Standard EDTA solution

5.Dissolved Oxygen: To test the amount of dissolved oxygen present in the given water sample.

Physical methods: Instrumental Analysis

6. pH metric titration of (i) strong acid vs strong base, (ii) weak acid vs strong base
7. Determination of cell constant and conductance of solutions
8. Determination of colorimetric titration with $KMnO_4$ solution
9. Verification of Beer-Lambert's law by $K_2Cr_2O_7$ solution.
10. Viscosity determination of Kerosin and Petrol by Red-wood viscometer.

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Mechanical Engineering

Course Code	PROBLEM SOLVING AND PROGRAMMING LAB (Common to All Branches of Engineering)	L	T	P	C
		0	0	3	1.5

I Year I Semester

Course Objectives:

- To get familiar with the basic concepts of C programming.
- To design programs using arrays, strings, pointers and structures.
- To illustrate the use of Stacks and Queues
- To apply different operations on linked lists.
- To demonstrate Binary search tree traversal techniques.
- To design searching and sorting techniques.

Course Outcomes (CO):

- Demonstrate basic concepts of C programming language.
- Develop C programs using functions, arrays, structures and pointers.
- Illustrate the concepts Stacks and Queues.
- Design operations on Linked lists.
- Apply various Binary tree traversal techniques.
- Develop searching and sorting methods.

List of Experiments:

Week l

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

(i)To find the factorial of a given integer.

(ii)To find the GCD (greatest common divisor) of two given integers.

Week 2

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

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

i) Addition of Two Matrices ii) Multiplication of Two Matrices

Week 3

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 a given position.

ii) To delete n characters from a given position in a given string.

Week 4

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.

Week 5

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

Week 6

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

(i)Reading a complex number

(ii)Writing a complex number

(iii)Addition of two complex numbers

(iv)Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 7

Write C programs that implement stack (its operations) using

(i)Arrays (ii) Pointers

Week 8

Write C programs that implement Queue (its operations) using

(i)Arrays (ii) Pointers

Week 9

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

(i) Converting infix expression into postfix expression

(ii) Evaluating the postfix expression

Week 10

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 11

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

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

i) Creating a Binary Tree of integers

ii) Traversing the above binary tree in preorder, inorder and postorder.

Week 14

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

(i)Linear search (ii) Binary search

Week 15

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

(i)Bubble sort

(ii)Selection sort

(iii)Insertion sort

(iv)Description Language

Text Books

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Sri Krishnadevaraya University College of Engineering & Technology
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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
I Year II Semester					
S.No	**Course No**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Differential Equations & Vector Calculus	BS	3-0-0	3
2.		Engineering Physics	BS	3-0-0	3
3.		Engineering Mechanics	ES	3-0-0	3
4.		Communicative English	HS	3-0-0	3
5.		Engineering Graphics	ES	1-0-4	3
6.		Basic Civil and Mechanical Engineering Lab	ES	0-0-3	1.5
7.		Engineering Physics Lab	BS	0-0-3	1.5
8.		Communicative English Lab	HS	0-0-3	1.5
9.		Environmental Studies	MC	2-0-0	0
				Total	**19.5**

Category	**CREDITS**
Basic Science course	7.5
Engineering Science Courses	7.5
Humanities and social science	4.5
TOTAL CREDITS	**19.5**

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Mechanical Engineering

Course Code	DIFFERENTIAL EQUATIONS & VECTOR CALCULUS (Common to ECE, EEE ,Civil & Mechanical Branches)	L	T	P	C
		3	0	0	3

I Year II Semester

Course Objectives:

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

Course Outcomes (CO):

- solve the differential equations related to various engineering fields
- Identify solution methods for partial differential equations that model physical processes
- interpret the physical meaning of different operators such as gradient, curl and divergence
- estimate the work done against a field, circulation and flux using vector calculus

UNIT - I	**Linear Differential Equations of Higher Order**

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.Simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

UNIT - II	**Partial Differential Equations – First order**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method and non-linear PDEs (Standard Forms).

UNIT - III	**Applications of Partial Differential Equations**

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation

UNIT - IV	**Multivariable Calculus (Vector differentiation)**

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

UNIT - V	**Multivariable Calculus (Vector integration)**

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

Textbooks:
1. 1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011. 2. 2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
Reference Books:
1. 1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011. 2. 2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018 3. 3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013. 4. 4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002. 5. 5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011. 6. 6.T.K.V Iyengar, B. Krishn Gandhi, S. Ranganatham and M.V.S.N. Prasad., S. chand Publishers.

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Mechanical Engineering

Course Code	ENGINEERING PHYSICS (Common CIVIL and MECH. Branches)	L	T	P	C
		3	0	0	3

I Year II Semester

Course Objectives:

- To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization.
- To explain the significant concepts of dielectric and magnetic materials this leads to potential applications in the emerging micro devices.
- To impart knowledge in basic concepts of optical fibers and LASERs along with its Engineering applications.
- To familiarize the basic concepts of acoustics and ultrasonics with their Engineering applications.

Course Outcomes (CO):

- Study the different realms of physics and their applications in both scientific and technological systems through physical optics.
- Identify the wave properties of light and the interaction of energy with the matter
- Asses the electromagnetic wave propagation and its power in different media
- Understands the response of dielectric and magnetic materials to the applied electric and magnetic fields.
- Explain the basic concepts of acoustics and ultrasonics.
- Apply the concept of NDT to material testing.
- Study the important properties of crystals like the presence of long-range order

UNIT - I **Wave Optics**

Interference: Principle of Superposition-Interference of light-Conditions for sustained Interference - Interference in thin films (reflected light)-Newton's Rings-Determination of Wavelength.
Diffraction: Introduction-Fresnel and Fraunhofer diffraction-Fraunhofer Diffraction-Single and Double slits - Diffraction Grating.
Polarisation: Introduction-Types of polarization- Polarisation by reflection and double refraction-Nicol's Prism-Half wave and Quarter wave plate.

UNIT - II **Lasers & Fiber Optics**

Lasers: Introduction-Spontaneous and Stimulated emission of radiation-Einstein's coefficients-Population inversion -Pumping Mechanisms-He-Ne laser- Semiconductor laser- Applications of laser.
Fibre optics: Introduction to Optical Fibers-Total Internal Reflection-Critical angle of propagation-Acceptance Angle-Numerical Aperture-Classification of fibers based on Refractive index profile – Propagation of electromagnetic wave through optical fiber–modes-Block Diagram of Fiber optic Communication -Medical Applications.

UNIT - III **Dielectric & Magnetic Materials**

Dielectric: Introduction--Dielectric Polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic, Ionic and Orientation polarisations (Qualitative) - Lorentz (internal) field-Clausius -Mossotti equation.
Magnetic Materials: Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability-Classification of Magnetic Materials-Hysteresis-soft and hard magnetic materials

UNIT - IV **Acoustics & Ultrasonics**

Acoustics: Introduction of Acoustics-Reverberation – Reverberation time – Sabine's formula-derivation using growth and decay method – Absorption coefficient and its determination –factors affecting acoustics of buildings and their remedies.
Ultrasonic: Introduction to ultrasonic-Properties of ultrasonic-Production of ultrasonic by magnetostriction and piezoelectric methods- Detection of ultrasonic-Applications of ultrasonic.

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UNIT - V	**Crystallography & X-ray diffraction**	

Crystallography: Space lattice, Basis, Unit cell and lattice parameters- Bravais lattice-Crystal Systems-Packing fraction- Coordination Number-Packing fraction of SC, BCC and FCC-Miller indices- Separation between successive(hkl) planes.

X-ray diffraction: X-ray diffraction by crystal planes-Bragg's law-Crystal structure determination by Laue method- Merits and demerits-Powder method.

Schrodinger wave equation (Eigen-value and Eigen-function). **Crystal field theory:** Crystal field theory and the energy level diagrams for transition metal ions, Salient features –splitting in octahedral and tetrahedral geometry**,** magnetic properties and colours.

Textbooks:

1. M. N. Avadhanulu, P.G. Kshirsagar& TVS Arun Murthy" AText book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012.

Reference Books:

1. Shatendra Sharma, Jyotsna Sharma, "Engineering Physics", Pearson Education,2018.
2. David J.Griffiths, "Introduction to Electrodynamics"- 4/e, Pearson Education,2014.
3. Applied Physics – P.K.Palanisamy SciTech Publications Pvt. Ltd.,
4. Engineering Physics- K. Vijay Kumar, S. Chand Publications.

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Mechanical Engineering

Course Code	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

I Year II Semester

Course Objectives:

- Explain the effect of force and moment in the different engineering applications.
- Teach centre of gravity and moment of inertia of solids and surfaces.
- Familiarize frictional forces in mechanical applications.
- Familiarize analysis of perfect frames.
- Familiarize mechanical vibrations

Course Outcomes (CO):

Students should be able to

- resolve forces and couples in mechanical systems.
- identify the frictional forces and its influence on equilibrium.
- find the centre of gravity and moment of inertia for various geometric shapes .
- identify the nature of forces acting on different frames.
- identify the different free vibrations

UNIT - I

Basic Concepts -System of forces– Moment of forces and its Application – Couples and Resultant of System of Forces.

Equilibrium of System of Forces : Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT - II

Friction : Types of friction– laws of Friction–Limiting friction–Cone of limiting friction–static and Dynamic Frictions – Motion of bodies.

Analysis of Perfect Frames : Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints and methods of sections for vertical loads, horizontal loads and inclined loads

UNIT - III

Centroid and Center of Gravity: Centroids of plane figures–Centroids ofComposite figures.

Centre of Gravity of bodies – Centre of Gravity of Composite figures.(Simple problems only

UNIT - IV

Area of Moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures

Mass Moment of Inertia : Moment of Inertia of Simple solids, Moment of Inertia of composite masses.(Simple problems only).

UNIT - V

Mechanical Vibrations : Definitions, Concepts. Simple harmonic motion. Free vibrations. Simple,Compound and Torsional pendulums- Numerical problems

Textbooks:
1. N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014. 2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013. 3. S S Bhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.
Reference Books:
1. Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015. 2. Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynam-ics, 4/e, Pearson, 2009. 3. K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010. .

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Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	COMMUNICATIVE ENGLISH (Common to All Branches of Engineering)	L	T	P	C
		3	0	0	3

I Year II Semester

Course Objectives:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing
- .

Course Outcomes (CO):

- Retrieve the knowledge of basic grammatical concepts
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
- Create a coherent paragraph interpreting a figure/graph/chart/table

UNIT - I	**On the Conduct of Life: William Hazlitt**	

Lesson: Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information. Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. Grammar and Vocabulary: Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh- questions; word order in sentences.

UNIT - II	**The Brook: Alfred Tennyson**	

Lesson: Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts. Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks. Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

UNIT - III	**The Death Trap: Saki**	

Lesson: Listening: Listening for global comprehension and summarizing what is listened to. Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Writing: Summarizing, Paragraph Writing Grammar and Vocabulary: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

UNIT - IV	**Innovation: Muhammad Yunus**	
Lesson: Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. Writing: Letter Writing: Official Letters/Report Writing Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice.		
UNIT - V	**Motivation: The Dancer with a White Parasol: Ranjana Dave**	
Lesson: Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Reading: Reading for comprehension. Writing: Writing structured essays on specific topics using suitable claims and evidences. Grammar and Vocabulary: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)		

Textbooks:

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler
8. A Remedial English Grammar For Foreign Students by Frederick T Wood.
9. Oxford English Grammar Course by Michael Swan & Catherine Walter

Web links

www.englishclub.com
www.easyworldofenglish.com
www.languageguide.org/english/
www.bbc.co.uk/learningenglish
www.eslpod.com/index.html www.myenglishpages.com

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Mechanical Engineering

Course Code	ENGINEERING GRAPHICS	L	T	P	C
		1	0	4	3

I Year II Semester

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling.
- Instruct graphical representation of machine components.

Course Outcomes (CO):

- draw various curves applied in engineering.
- show projections of solids and sections graphically.
- draw the development of surfaces of solids.

UNIT - I	**Introduction to Engineering graphics**	

:Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions.a) Conic sections including the rectangular hyperbola- general method only, b) Cycloid, epicycloids and hypocycloid - Normal and Tangent. c) Involutes –Normal and Tangent.

UNIT - II	**Projection of points, lines:**	

Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by lines.

UNIT - III	**Projections of regular planes and Solids**	

Projections of regular planes: inclined to one plane and both planes by rotational method.

Projections of solids: Projections of regular solids inclined to one plane by rotational or Auxiliary views method. – Prism, Cylinder, Pyramid, Cone.

UNT - IV	**Sections of solids and Development of surfaces**	

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, Pyramid and cone. True shapes of the sections.

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, Pyramid, cone and their sectional parts.

UNIT-V	**Orthographic, Isometric Projections and Perspective projections**

Orthographic Projections: Systems of projections, conventions and application to orthographic projections.
Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.
Perspective projections: Visual Ray Method.
Basic Definitions of Force – Stress – Strain – Elasticity. Shear force – Bending Moment –Torsion. Simple problems on Shear force Diagram and Bending moment Diagram for cantilever and simply supported beams.

Mechanical Engineering

Text Books

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

References

1. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
3. K.C.John, Engineering Graphics, 2/e, PHI, 2013
4. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

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Note:

1. Manual (part A) and Computer Aided Drafting (part B) classes can be held in alternative weeks for optimal utilization of computer facilities.
2. External examinations to be conducted both manual and computer mode with equal weight of marks.

Additional Sources

1. Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

Sri Krishnadevaraya University College of Engineering & Technology
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Mechanical Engineering

Course Code	BASIC CIVIL & MECHANICAL ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

I Year II Semester

Course Objectives:

- Impart basic principles of stress, strain, shear force, bending moment and torsion.
- To teach principles of strain measurement using electrical strain gauges
- Describe technical details of power plants, gas turbines, hydro power plants and nonconventional energy sources.
- Teach different types of drives for power transmission
- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- To teach working principle of hydraulic machinery.
- To familiarize the developments in IC engines.
- Explain the principles of refrigeration and air conditioning.

Course Outcomes (CO):

Upon the successful completion of course, students will be able to

- Conducting bending tests on Cantilever beam and simply supported beam.
- Finding the Use of electrical resistance strain gauges
- Conducting Compression test and Water absorption test on Bricks
- Explain different working cycles of engine.
- Illustrate the working of refrigeration systems
- Evaluate heat balance sheet of IC engine.

List of Experiments

Any 10 of the following experiments are to be conducted:

1. Bending test on (Steel/Wood) Cantilever beam.
2. Bending test on (Steel/Wood) simply supported beam.
3. Use of electrical resistance strain gauges.
4. Compression test on Bricks
5. Water absorption test on Bricks
6. Torsion test.
7. Tests on closed coiled and open coiled helical springs

Basic Mechanical Engineering Laboratory Experiments

1. Load test on four stroke Diesel Engine with mechanical loading.
2. Load test on four stroke Diesel Engine with DC Generator loading.
3. Heat balance test on Four Stroke Diesel Engine.
4. Load test on two stroke petrol engine.
5. A) Study of Valve & Port diagram. B) Study of boilers.
6. Performance test on vapour compression refrigeration system.
7. Performance test on vapour absorption refrigeration system.

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Mechanical Engineering

Course Code	ENGINEERING PHYSICS LAB	L	T	P	C
		0	0	3	1.5

I Year II Semester

Course Objectives:

- Understands the concepts of interference and diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and hall effect in a semiconductor.
- Apply the principles of semiconductors in various electronic devices.
- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its applicationin finding the particle size.

List of Experiments

Note: - In the following list of experiments, out of 15 experiments any 12 experiments must be performed in a semester.

List of Physics Experiments:

1. Determination of wavelength of LASER light using diffraction grating.
2. Determine the thickness of the wire using wedge shape method.
3. Determination of the radius of curvature of the lens by Newton's ring method.
4. Determination of Dispersive power of a prism.
5. Magnetic field along the axis of a circular coil carrying current-Stewart Gee's method.
6. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum).
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle.
8. To determine the energy gap of a semiconductor.
9. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
10. Determination of spring constant of springs using Coupled Oscillator.
11. Sonometer: Verification of the three laws of stretched strings.
12. Resolving power of a grating.
13. Determination of hysteresis loss by tracing B-H Curve of ferromagnetic material.
14. Determination of ultrasonic velocity in liquid (Acoustic grating).
15. Resistivity of semiconductor by four probe method.

References Books:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University.

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Mechanical Engineering

Course Code	COMMUNICATIVE ENGLISH LAB (Common to All Branches of Engineering)	L	T	P	C
		0	0	3	1.5

I Year I Semester

Course Objectives:

- students will be exposed to a variety of self instructional, learner friendly modes of language
- learning
- students will learn better pronunciation through stress, intonation and rhythm
- students will be trained to use language effectively to face interviews, group discussions,
- public speaking
- students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Course Outcomes (CO):

- Retrieve and reminisce the sounds of English Language
- Understand the different aspects of the English language
- Apply communication skills through various language learning activities
- Analyze the English speech sounds, stress, rhythm, intonation and syllable
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it

List of Topics

1. Phonetics
2. Reading comprehension
3. Describing objects/places/persons
4. Role Play or Conversational Practice
5. JAM
6. Etiquettes of Telephonic Communication
7. Information Transfer
8. Note Making and Note Taking
9. E-mail Writing
10. Group Discussions-1
11. Resume Writing
12. Debates
13. Oral Presentations
14. Poster Presentation
15. Interviews Skills-1

Suggested Software

Orel, Walden Infotech, Young India Films

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links

www.esl-lab.com
www.englishmedialab.com
www.englishinteractive.net

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Mechanical Engineering

Course Code	ENVIRONMENTAL SCIENCE	L	T	P	C
		2	0	0	0

I Year I Semester

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes (CO):

Students should be able to

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes

UNIT – I: Multidisciplinary Nature of Environmental Studies

Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II: Ecosystems, Biodiversity, and its Conservation

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION : Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III: Environmental Pollution and Solid Waste Management

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

SOLID WASTE MANAGEMENT : Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV:	**Social Issues and the Environment**

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V:	**Human Population and the Environment**

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK : Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

TEXT BOOKS :

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Palaniswamy – Pearson education
3. Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCES :

1. Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
2. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
4. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5. A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
II Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Complex Variables, Transforms & Application of PDE	BS	3-0-0	3
2.		Thermodynamics	PC	3-0-0	3
3.		Manufacturing Processes	PC	3-0-0	3
4.		Fluid Mechanics & Hydraulic Machinery	PC	3-0-0	3
5.		Mechanics of Materials	ES	3-0-0	3
6		UHV-II: Universal Human Values – Understanding harmony and Ethical Human Conduct	HS	2-1-0	3
7.		Fluid Mechanics & Hydraulic Machinery Lab	PC	0-0-3	1.5
8.		Manufacturing Processes Lab	PC	0-0-3	1.5
9.		Mechanics of Materials Lab	ES	0-0-3	1.5
10.		**Skill oriented course – I** Application Development with Python	SC	1-0-2	2
11		**NCC/NSS ACTIVITIES**			
			Total	**24.5**	

Category	**CREDITS**
Basic Science course	3
Humanities and Social Sciences	3
Professional Core Courses	12
Engineering Science Courses	4.5
Skill Oriented Course	2
TOTAL CREDITS	**24.5**

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Mechanical Engineering

Course Code	COMPLEX VARIABLES AND TRANSFORMS & APPLICATIONS OF PDE	L	T	P	C
		3	0	0	3

II Year I Semester

Course Objectives:

- This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables.
- The student develops the idea of using continuous/discrete transforms

Course Outcomes (CO): Student will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper
- integrals along contours.
- Understand the usage of Laplace Transforms and its applications in solvind Differrential equations.
- Evaluate the Fourier series expansion of periodic functions.
- Understand the solving of PDE for initial and boundary conditions

UNIT - I **Complex Variable – Differentiation**:

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations (sin z, e^z, cos z, z^2) Mobius transformations (bilinear) and their properties.

UNIT - II **Complex Variable – Integration**:

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with f(z) not having poles on real axis).

UNIT - III **Laplace Transforms**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

UNIT - IV **Fourier series**

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval's formula- Complex form of Fourier series.

UNIT - V **Classification of PDE**

Method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation, Two dimensional heat equation in steady state (Laplacian Equation)

Textbooks:
1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India
Reference Books:
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.
Online Learning Resources:
1. nptel.ac.in/courses/111107056 2. onlinelibrary.wiley.com 3. https://onlinecourses.nptel.ac.in/noc18ma12.

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Mechanical Engineering

Course Code	THERMODYNAMICS	L	T	P	C
		3	0	0	3

II Year I Semester

Course Objectives:

To make the student learn about

- To introduce the concepts of heat, work, energy and governing rules for conversion of one form to other.
- To explain relationships between properties of matter and basic laws of thermodynamics.
- To teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To introduce the concept of available energy for maximum work conversion.
- To impart knowledge on steam properties.
- To impart knowledge on steam power cycles.

Course Outcomes (CO):

- Understand the importance of thermodynamic properties related to conversion of heat energy into work.
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.
- Utilize steam properties to design steam based components.
- Analyze thermodynamic relations and vapour power cycles

UNIT - I	**First law of Thermodynamics**

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics and Temperature measurement.
Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics.

UNIT - II	**Second Law of Thermodynamics**

Kelvin- Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

UNIT - III	**Entropy, Availability and Irreversibility**

Clausius inequality - Concept of Entropy- entropy equation for different processes and systems. Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.Maxwell relations, TdS equations difference in heat capacities, ratio of heat capacities.

UNIT - IV	**Properties of Steam and use of Steam Tables**

Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry. Energy equation, Joule Thompson coefficient Clausius - Clapeyron equation.

UNIT - V	**Vapour Power Cycles**

Vapour power cycle, simple Rankine cycle, mean temp of heat addition, thermodynamic variables effecting efficiency, Rankine cycle – reheating and regeneration.

Textbooks:
1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013. 2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011
Reference Books:
1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012. 2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015 3. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010

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Mechanical Engineering

Course Code	MANUFACTURING PROCESSES	L	T	P	C
		3	0	0	3

II Year I Semester

Course Objectives:

- To introduce the students to working principle of different metal casting processes and gating system.
- To impart knowledge on plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- To teach principles of forging, tools and dies, working of forging processes.
- To develop fundamental understanding on classification of the welding processes, working of different types of welding processes and welding defects.
- To impart knowledge on manufacturing methods of plastics, ceramics and powder metallurgy.
- To introduce the basic concepts of Unconventional Machining Processes

Course Outcomes (CO):

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

- Demonstrate different metal casting processes and gating systems.
- Classify working of various welding processes.
- Evaluate the forces and power requirements in rolling process.
- Apply the principles of various forging operations.
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy.
- Identify different unconventional processes and their applications.

UNIT - I	**Casting Processes**	

Introduction: Importance and selection of manufacturing processes.
Introduction to casting process, process steps; pattern and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

UNIT - II	**Metal Forming & Forging**	

Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.Principles of forging, tools and dies Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

UNIT - III	**Metal Joining Processes**	

Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding. Applications, advantages and disadvantages of the above processes, Plasma Arc welding, Laser Beam Welding, Electron Beam Welding and Friction Stir Welding. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies.

UNIT - IV	**Plastic Processing, Ceramics and Powder Metallurgy**	

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding, and blow molding
Ceramics: Classification of ceramic materials, properties and their application, ceramic powder Preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.
Powder Metallurgy: Principle, manufacture of powders, steps involved.

UNIT - V	**Unconventional Machining Processes**	
Principle and processes parameters of Electrical discharge machining (EDM), electro-chemical machining (ECM), Laser beam machining (LBM), plasma arc machining (PAM), electron beam machining, Abrasive jet machining (AJM), water jet machining (WJM), and ultrasonic machining(UM		

Textbooks:

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

1. Introduction to Physical Metallurgy by Sidney H.Avner
2. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
3. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
1.

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Mechanical Engineering

Course Code	FLUID MECHANICS & HYDRAULIC MACHINERY	L	T	P	C
		3	0	0	3
II Year I Semester					

Course Objectives:

- To impart ability to solve engineering problems in fluid mechanics
- To explain basics of statics, kinematics and dynamics of fluids and various measuring techniques of hydrostatic forces on objects.
- To enable the students measure quantities of fluid flowing in pipes, tanks and channels
- To introduce concepts of uniform and non-uniform flows through open channel.
- To impart knowledge on design of turbines and pumps.

Course Outcomes (CO):

- Familiarize basic terms used in fluid mechanics
- Understand the principles of fluid statics, kinematics and dynamics
- Understand flow characteristics and classify the flows and estimate various losses in flow through channels
- Analyze characteristics for uniform and non-uniform flows in open channels.
- Design different types of turbines, centrifugal and multistage pumps.

UNIT - I	**Introduction to Fluid Statics**

Fluid Statics: Dimensions and units: Physical properties of fluids-specific gravity, viscosity, surface Tension vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT - II	**Fluid kinematics and Dynamics**

Fluid Kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady &unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow. Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT - III	**Analysis of Pipe Flow**

Closed conduit flow: Laminar and turbulent flow through pipes: Reynolds experiment significance of Reynold's number, formulae for laminar flow through circular pipes, Turbulent flow-Darcy Weisbach equation, - Minor losses in pipes- pipes in series and pipes in parallel - Measurement of flow: pitot tube, venturimeter, and orifice meter.

UNIT - IV	**Impact of Jets**

Basics of Turbo 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, flow over radial vanes..

UNIT - V	**Hydraulic Machinery**

Hydraulic Turbines : Introduction to hydroelectric power station-heads and efficiencies-Classification of power plants, turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies –draft tube theory-functions and efficiency.
Centrifugal Pumps: Classification, working, Work done and efficiency, loss of head; specific speed, minimum starting speed. Pumps in series and parallel.
Reciprocating Pumps: Working, Discharge, slip.

Textbooks:

1. P. M. Modi and S. M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House
2. K. Subrahmanya, "Theory and Applications of Fluid Mechanics", Tata McGraw Hill

Reference Books:

1. R. K. Bansal, A text of "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P)
2. Ltd., New Delhi.
3. K. Subramanya, Open channel Flow, Tata McGraw Hill.
4. N. Narayana Pillai, Principles of "Fluid Mechanics and Fluid Machines", Universities Press
5. Pvt Ltd, Hyderabad. 3rd Edition 2009.
6. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, "Fluid Mechanics and Machinery",
7. Oxford University Press, 2010.
8. Banga& Sharma, "Hydraulic Machines", Khanna Publishers.

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Mechanical Engineering

Course Code	MECHANICS OF MATERIALS	L	T	P	C
		3	0	0	3

II Year I Semester

Course Objectives:

- Understand the basics of stresses and strains
- Draw the shear force and bending moment drawings of various beams.
- Understand the Behaviour of members and Torsional forces
- Understand the Behaviour of cylinders
- Understand the stresses developing in curved beams

Course Outcomes (CO):

- Evaluate stresses and strains
- To draw the SF and BM diagrams for various beams under different loading conditions
- Determine the resistance and deformation in machine members subjected to torsional loads and springs.
- Analyze and design thin, thick cylinders.
- Analysis of stresses in curved bars.

UNIT - I	**Analysis of stress and strain**

Types of external loads - self weight - internal stresses - normal and shear stresses - strain - Hooke's law - Poisson's ratio - relationship between elastic constants - stress strain diagrams working stress - elongation of bars of constant and varying sections - Stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette – principal stress/strain problem as an eigenvalue problem.

UNIT - II	**Bending moment and shear force**

Different types of beams - shear force and bending moment diagrams for simply supported, overhanging and cantilever beams - relationship connecting intensity of loading, shearing force and bending moment - shear force and bending moment diagrams for statically determinate plane frames.

UNIT - III	**Torsion and Springs**

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT - IV	**Thin Cylinders, Spheres and Thick Cylinders**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame‟s theory – Application of theories of failure.

UNIT - V	**Bending of curved bars & Unsymmetrical Bending**

Stresses in bars of small initial curvature, Winkler-Bach theory, Stresses in bars of large initial curvature, Deflection of Crane hooks, Chain links, circular rings, stresses in circular rings.
Introduction to unsymmetrical bending, Stresses and deflection in unsymmetrical bending, Shear center for angle, Channel and I-sections.

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Mechanical Engineering

Textbooks:

1. Mechanics of Material – J. M. Gere and S. P. Timoshenko – CBS publisher
2. Popov, E.P., Mechanics of Materials, Prentice Hall India, New Delhi, 2002.

Reference Books:

1. Advanced Mechanics of Materials–A. P. Boresi and O. M. Sidebottom–John Wiley & Sons
2. Strength of Materials – R. K. Rajput – S. Chand & Company

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Mechanical Engineering

Course Code	UHV-II: UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	L	T	P	C
		2	1	0	3
II Year I Semester					

Course Objectives

- 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 facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

Course Methodology

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 28 lectures (discussions) and 14 practice sessions.
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Catalogue Description

Every human being has two sets of questions to answer for his/her life: a) what to do? and, b) how to do? The first set pertains to the value domain, and the other to the skill domain. Both are complimentary, but value domain has a higher priority. Today, education has become more and more skill biased, and hence, the basic aspiration of a human being, that is to live with happiness and prosperity, gets defeated, in spite of abundant technological progress. This course is aimed at giving inputs that will help to ensure the right understanding and right feelings in the students in their life and profession, enabling them to lead an ethical life. In this course, the students learn the process of self-exploration, the difference between the Self and the Body, the naturally acceptable feelings in relationships in a family, workplace and society, the comprehensive human goal in the society, the mutual fulfillment in the nature and the co-existence in existence. As a natural outcome of such inputs, they are able to evaluate an ethical life and profession ahead.

Course Syllabus

Module 1: Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution

The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution

Module2: Right Understanding (Knowing)- Knower, Known & the Process

The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).

Module 3: Understanding Human Being

Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self

Module 4: Understanding Nature and Existence

A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self-awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

Module 5: Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living

Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavor viz.,
realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence

Textbook

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course inHuman Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.

References

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Mode of Evaluation:

Based on participation of student in classroom discussions/Self-assessment/Peer assessment/Assignments/ Seminar/Continuous Assessment Test/Semester End Exam
Socially relevant project/Group Activities/Assignments may be given importance in this course

Course Outcomes

At the end of the course, the students will be able to
1. Evaluate the significance of value inputs in formal education and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Analyze the value of harmonious relationship based on trust and respect in their life and profession
4. Examine the role of a human being in ensuring harmony in society and nature.
5. Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.

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Mechanical Engineering

Course Code	FLUID MECHANICS & HYDRAULIC MACHINERY LAB	L	T	P	C
		0	0	3	1.5
II Year I Semester					

Course Objectives:

By performing this laboratory, the student will be able to know the fluid flow measurements by considering different types flow measurement devices and working principles of various pumps and motors.

Course Outcomes (CO):

By performing the various tests in this laboratory the student will be able to know the principles of discharge measuring devices and head loss due to sudden contraction and expansion in pipes and working principles of various pumps and motors.

Experiments(Execute any 12 experiments)

1. Calibration of Venturi meter.
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by constant head method.
4. Determination of Coefficient of discharge for a small orifice by variable head method.
5. Determination of loss of head in a sudden contraction.
6. Performance test on Impulse turbines
7. Performance test on reaction turbines (Francis turbine)
8. Impact of jet performance
9. Performance test on centrifugal pump, determination of operating point and efficiency
10. Performance test on Reciprocating pump, determination of operating point and efficiency

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Mechanical Engineering

Course Code	MANUFACTURING PROCESSES LAB	L	T	P	C
		0	0	3	1.5

II Year I Semester

Course Objectives:

Acquire practical knowledge on Metal Casting, Welding, Press Working and unconventional machining Process

Course Outcomes (CO):

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

- Fabricate different types of components using various manufacturing techniques.
- Adapt unconventional manufacturing methods.

List of Experiments:

1. Pattern design and making
2. Making a mould cavity for single piece pattern
3. Sheet metal operation-Blanking & Piercing operation
4. Sheet metal operation-Bending operation
5. Spot welding
6. TIG welding
7. Injection moulding
8. Blow molding
9. Stepped turning(Wooden Lathe Machine)

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Mechanical Engineering

Course Code	MECHANICS OF MATERIALS LAB	L	T	P	C
		0	0	3	1.5

II Year I Semester

Course Objectives:

- By performing this laboratory, the student will be able to know the structural behavior of various materials

Course Outcomes (CO):

- By performing the various tests in this laboratory the student will be able to know the structural behavior of various structural elements when subjected to external loads

List of Experiments:

1. Tension test.
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simply supported beam.
4. Torsion test.
5. Rockwell Hardness Test
6. Compression test on Open coiled springs
7. Tension test on Closely coiled springs
8. Compression test on wood/ concrete
9. Izod Impact test on metals
10. Charpy Impact test on metals

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Mechanical Engineering

Course Code	APPLICATION DEVELOPMENT WITH PYTHON	L	T	P	C
		1	0	2	2
II Year I Semester					

Course Objectives:

- To learn the basic concepts of software engineering and life cycle models
- To explore the importance of Databases in application Development
- Acquire programming skills in core Python
- To understand the importance of Object-oriented Programming

Course Outcomes (CO):

Students should be able to

- Identify the issues in software requirements specification and enable to write SRS documents for software development problems
- Explore the use of Object oriented concepts to solve Real-life problems
- Design database for any real-world problem
- Solve mathematical problems using Python programming language

Module 1. Basic concepts in software engineering and software project management

Basic concepts: abstraction versus decomposition, the evolution of software engineering techniques, Software development life cycle
Software project management: project planning and project scheduling

Task:
1. Identifying the Requirements from Problem Statements

Module 2. Basic Concepts of Databases
Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table), Data Manipulation Language(DML) Statements
Task:
1. Implement Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)
2. Implement Data Manipulation Language(DML) Statements

Module 3. Python Programming:
Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements
Python Data Structures: Lists, Dictionaries, Tuples.

Strings: Creating strings and basic operations on strings, string testing methods.

Functions: Defining a function- Calling a function- Types of functions-Function Arguments- Anonymous functions- Global and local variables

OOPS Concepts; Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

Modules and Packages: Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages

Working with Data in Python: Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:

1. OPERATORS

a. Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.
b. Read your name and age and write a program to display the year in which you will turn 100 years old.
c. Read radius and height of a cone and write a program to find the volume of a cone.
d. Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

2. CONTROL STRUCTURES

a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if…elif…else statement.
b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.
c. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +…….+ n/n!. (Input :n = 5, Output : 2.70833)
d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

3: LIST

a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)
c. Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).
d. Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

4: TUPLE

a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test_list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”,), (“Gfg”, “CS”)], Output : [(„GFG“, „IS“, „BEST“)]).
c. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

5: SET

a. Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).
b. Write a program to perform union, intersection and difference using Set A and Set B.
c. Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output: No. of vowels : 3)
d. Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

6: DICTIONARY

a. Write a program to do the following operations:
i. Create a empty dictionary with dict() method
ii. Add elements one at a time
iii. Update existing key‟s value
iv. Access an element using a key and also get() method
v. Deleting a key value using del() method
b. Write a program to create a dictionary and apply the following methods:
i. pop() method
ii. popitem() method
iii. clear() method
c. Given a dictionary, write a program to find the sum of all items in the dictionary.
d. Write a program to merge two dictionaries using update() method.

7: STRINGS

a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
d. Write a program to read a string and count how many times each letter appears. (Histogram).

8: USER DEFINED FUNCTIONS

a. A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
b. Write a function merge_dict(dict1, dict2) to merge two Python dictionaries.
c. Write a fact() function to compute the factorial of a given positive number.
d. Given a list of n elements, write a linear_search() function to search a given element x in a list.

9: BUILT-IN FUNCTIONS

a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
b. Write a program to demonstrate the working of built-in trignometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
d. Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

10. CLASS AND OBJECTS

a. Write a program to create a BankAccount class. Your class should support the following methods for
i) Deposit
ii) Withdraw
iii) GetBalanace
iv) PinChange
b. Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).

c. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info() method and also using dictionary (dict).
d. Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

11. FILE HANDLING

a. . Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations:
   i. Count the sentences in the file.
   ii. Count the words in the file.
   iii. Count the characters in the file.

b. . Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied.
c. Write a Python program to store N student‟s records containing name, roll number and branch. Print the given branch student‟s details only.

References:

1. Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018.
2. RamezElmasri, Shamkant, B. Navathe, “Database Systems”, Pearson Education, 6th Edition, 2013.
3.Reema Thareja, “Python Programming - Using Problem Solving Approach”, Oxford Press, 1st Edition, 2017.
4. Larry Lutz, “Python for Beginners: Step-By-Step Guide to Learning Python Programming”, CreateSpace Independent Publishing Platform, First edition, 2018

Online Learning Resources/Virtual Labs:

1. http://vlabs.iitkgp.ernet.in/se/
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php
3. https://python-iitk.vlabs.ac.in

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
II Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Numerical Methods & Probability Theory	BS	3-0-0	3
2.		Theory of Machines	PC	3-0-0	3
3.		Thermal Engineering - I	PC	3-0-0	3
4.		Material Science & Engineering	PC	3-0-0	3
5.		Managerial Economics & Financial Analysis	HS	3-0-0	3
6.		Thermal Engineering – I Lab	PC	0-0-3	1.5
7.		Material Science & Engineering Lab	PC	0-0-3	1.5
8.		Machine Drawing Lab	PC	0-0-3	1.5
9.		**Skill Oriented Course –II -** Soft Skills	SC	1-0-2	2
				Total	**21.5**
Community Service Project (Mandatory) for 2 months duration during summer vacation					

Category	**CREDITS**
Basic Science course	3
Professional Core Courses	12
Engineering Science Courses	4.5
Skill Oriented Course	2
TOTAL CREDITS	**21.5**

Course Code	**NUMERICAL METHODS AND PROBABILITY THEORY (COMMON TO MECH.& EEE)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
II Year II Semester					
Course Objectives:					

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This course aims at providing the student with the knowledge on

- Various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
- The theory of Probability and random variables.

Course Outcomes (CO):

CO1: Apply numerical methods to solve algebraic and transcendental equations

CO2: Derive interpolating polynomials using interpolation formulae

CO3: Solve differential and integral equations numerically

CO4: Apply Probability theory to find the chances of happening of events.

CO5: Understand various probability distributions and calculate their statistical constants

UNIT - I	**Solution of Algebraic & Transcendental Equations**

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

UNIT - II	**Interpolation**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae.Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT - III	**Numerical Integration & Solution of Initial Value Problems to Ordinary Differential Equations**

Numerical Integration: 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-Modified Euler's Method-Runge-Kutta Methods.

UNIT - IV	**Probability theory**

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT - V	**Random Variables & Distributions**	

Probability distribution - Binomial, Poisson approximation to the binomial distribution andnormal distribution-their properties-Uniform distribution-exponential distribution.

Textbooks:

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna publishers.
2. Ronald E. Walpole, "Probability and Statistics for Engineers and Scientists", PNIE.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

Reference Books:

1. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
2. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier Publishers

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Mechanical Engineering

Course Code	THEORY OF MACHINES	L	T	P	C
		3	0	0	3

II Year II Semester

Course Objectives:

- Introduce various basic mechanisms and their applications
- Explain importance of degree of freedom
- Familiarize velocity and acceleration in mechanisms
- Describe the cams and follower motions
- Explain the importance of gyroscopic couples
- Introduce the equation of motion for single degree of freedom system

Course Outcomes (CO):

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

- Understand different mechanisms and their inversions.
- Calculate velocity and acceleration of different links in a mechanism,
- Apply the effects of gyroscopic couple in ships, aero planes and road vehicles.
- Evaluate unbalance mass in rotating machines.
- Analyse free and forced vibrations of single degree freedom systems.

UNIT - I

Simple Mechanisms:
Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains- Limit positions – Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line mechanisms- Universal Joint – Rocker mechanisms.

UNIT - II

Velocity analysis: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations-kinematic analysis of simple mechanisms-slider crank mechanism dynamics-Coincident points-Coriolis component of acceleration-introduction to linkage synthesis-three postion graphical synthesis for motion and path generation.

UNIT - III

Gyroscope: Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two wheeler, simple problems
Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting-helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

UNIT - IV

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.
Cams: Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting.

UNIT - V

Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility, Vibration measuring instruments: displacement, velocity, acceleration and frequency measurement.

Textbooks:

1. S.S.Rattan ,Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014
2. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009

Reference Books:

1. F. Haidery, Dynamics of Machines, 5/e, Nirali Prakashan, Pune, 2003
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014
3. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.
4. Norton, R.L., , Design of Machinery - An introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J. : Prentice Hall, 1993.

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Mechanical Engineering

Course Code	THERMAL ENGINEERING-I	L	T	P	C
		3	0	0	3

II Year II Semester

Course Objectives:

To make the student learn about
- To introduce students to the Working of boilers.
- To impart knowledge on different types of condensors.
- To familiarize concepts of thermodynamic cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.
- To familiarize concepts of thermodynamic cycles used in air standard cycles.

Course Outcomes (CO):

- After completing this course, the students can
- Understand the working of steam boilers and condensers.
- Select condensers and cooling towers for different applications.
- Use T-s diagram in gas power cycles.
- To provide fundamental concepts of air standard cycles used in IC engines and gas turbines.
- Evaluate the relative performance of different steam turbines
- Select appropriate refrigerant for different applications

UNIT - I	**Steam Boilers & Steam Condensers**

Steam Boilers : Classification based on Working principles –Mountings and Accessories – Boiler equivalent evaporation, efficiency. Draught: classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney.
Steam Condensers: Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency, cooling towers and types of cooling towers.

UNIT - II	**Steam Nozzles & Steam Turbines**

Type of nozzles - gas and steam nozzles.Compressible flow through nozzle- condition for maximum discharge - Nozzle efficiency.
Steam Turbines - impulse turbine and reaction turbine – compounding of impulse turbines - velocity diagrams in impulse and reaction turbines.

UNIT - III	**Gas Power Cycles**

Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles.

UNIT - IV	**Air standard cycles**

Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles.

UNIT - V	**Refrigeration & Air-Conditioning**

Refrigeration: Bell-Coleman cycle - vapour compression cycle, sub cooling and super heating-vapour absorption cycle, properties of common refrigerants.
Principles of Psychrometry and Air Conditioning: Psychometric properties, psychometric processes, summer and winter air conditioning systems

Textbooks:

1. Thermal Engineering, Mahesh V Rathore, Tata McGraw Hill 2017
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014

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Mechanical Engineering

Course Code	MATERIAL SCIENCE & ENGINEERING	L	T	P	C
		3	0	0	3

II Year II Semester

Course Objectives:

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams.
- Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints.
- Explain the methods to change the properties of materials through heat treatment processes
- Familiarize properties and applications of ceramics, polymers and composite materials.
- Demonstrate the fundamental properties of nano-materials and their applications

Course Outcomes (CO):

- Explain the principles of binary phases.
- Select steels and cast irons for a given application.
- Apply heat treatment to different applications.
- Utilize nonferrous metals and alloys in engineering.
- Choose composites for various applications.
- Assess the properties of nano-scale materials and their applications

UNIT - I **Structure of Metals and Constitution of Alloys**

Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-Iron-carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT - II **STEELS AND CASTIRONS**

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Micro structure, properties and applications of alloy steels- stainless steels and tool steels.

Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT - III **Heat Treatment of Steels:**

Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for Fe-Fe_3C alloys and microstructure development. Continious cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

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UNIT - IV **Non-ferrous Metals and Alloys:**

Micro structure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al-Cu phase diagram, precipitation hardening. Micro structure, properties and applications of titanium and its alloys.

UNIT - V **Ceramics, Polymers and Composites**

Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

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Textbooks:

1. V.Raghavan, "Material Science and Engineering", 5th edition, Prentice Hall of India, 2004.
2. R.Balasubramaniam, Callister's "Material Science and Engineering:, 2nd edition, Wiley India, 2014

.

References:

1. Y. Lakhtin, "Engineering Physical Metallurgy", University Press of the Pacific, 2000.
2. S.H.Avner, "Introduction to Physical Metallurgy", 2nd edition, Tata McGraw- Hill, 1997.
3. L.H.Van Vlack, "Elements of Material Science and Engineering", 6th edition, Pearson Education, 2008.
4. George E.Dieter, "Mechanical Metallurgy", 3rd edition, McGraw-Hill, 2013.

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Mechanical Engineering

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T	P	C
		3	0	0	3

II Year I Semester

Course Objectives:

- To inculcate the basic knowledge of micro economics and financial accounting
- To make the students learn how demand is estimated for different products
- To know the input- output relationship for optimizing production and cost
- To give an overview on investment appraisal methods to promote the students to learn howto plan long-term investment decisions.
- To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

Course Outcomes (CO):

- Understand the fundamentals of Economics viz., Demand, Production, cost andrevenue
- Apply concepts of production , cost and revenues for effective business decisions
- Students can analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Prepare the accounting statements and evaluate the financial performance of business entity.

UNIT - I	**Introduction To Managerial Economics**

Introduction to Economics and Managerial Economics – Definitions-Nature and Scope of Managerial Economics–Demand Analysis- Demand determinants- Law of Demand – Exceptions of law of demand

UNIT - II	**Elasticity And Forecasting Demand**

Elasticity of Demand- Definition-Types-Measurement - Significance of Elasticity of Demand Demand Forecasting- Factors governing demand forecasting- Methods of demand forecasting (survey methods- statistical methods- expert opinion method- test marketing- controlled experiments-judgmental approach to demand forecasting).

UNIT - III	**Theory Of Production And Cost Analysis**

Production Function – Iso-quants- Iso-costs - MRTS- least cost combination of inputs- Cobb-Douglas production function -laws of returns - Internal and External economies of scale. Cost concepts- opportunity cost- fixed Vs variable costs-explicit costs Vs Implicit costs- out of pocket costs Vs Imputed costs- Break-Even Analysis (BEA)- Determination of Break Even Point -Simple Problems- Managerial significance and limitations of BEA.

UNIT - IV	**Forms Of Business Organizations And New EconomicEnvironment**

Business & New Economic Environment- Forms of business organizations-Factors affecting the choice of form of business organization- Features and evaluation of Sole Proprietorship- Partnership-Joint Stock Company- Public Enterprises and their types- Liberalization- Privatization-Globalization - Changing Business Environment in Post-liberalization scenario.

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UNIT - V	**Capital Budgeting And Financial Accounting**

Concept of Capital - Significance - Types of Capital - Components of Working Capital - Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Cash Budget - Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects : Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) method (simple problems)-Introduction to Financial Accounting-Double-Entry Book Keeping- preparation of Journal- Ledger-Trial Balance- Final Accounts (Trading & Profit and Loss Account and Balance Sheet with simple adjustments).

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market
https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
https://www.slideshare.net/ashu1983/financial-accounting

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Mechanical Engineering

ourse Code	THERMAL ENGINEERING –I LAB	L	T	P	C
		0	0	3	1.5

II Year II Semester

Course Objectives:

- Understand the functioning and performance of I.C. Engines
- To understand working of various types of boilers.

Course Outcomes (CO):

Upon the successful completion of course, students will be able to

- Explain different working cycles of engine
- Describe various types of combustion chambers in IC engines
- Evaluate heat balance sheet of IC engine.
- Illustrate the working of various boilers

List of Experiments:

Demonstration of diesel and petrol engines by cut models

1. Valve timing diagram of 4-stroke diesel engine
2. Valve timing diagram of 4-stroke petrol engine
3. Port timing diagram of 2-stroke petrol engine
4. Performance of 2-stroke single cylinder petrol engine
5. Performance of 4-stroke single cylinder diesel engine
6. Assembly and disassembly of diesel and petrol engines
7. Exhaust gas analysis
8. Performance of two stage reciprocating air compressor
9. Study the various boilers
10. Determine the viscosity of oils.
11. Flash and Fire point apparatus.

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Mechanical Engineering

Course Code	MACHINE DRAWING LAB	L	T	P	C
		0	0	3	1.5
II Year II Semester					

Course Objectives:

- To familiarize with the standard conventions for different materials and machine parts in working drawings. To make part drawings including sectional views for various machine elements. To prepare assembly drawings given the details of part drawings.

Course Outcomes (CO):

- Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
- Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
- Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
- Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
- Title boxes, their size, location and details - common abbreviations and their liberal usage
- Types of Drawings – working drawings for machine parts.

UNIT – I

Drawing Conventions: Conventional representation of materials, common Machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

Screwed Fastenings: Various thread profiles, Square and hexagonal bolts and nuts, Assembly of bolt, nut and washer, Eye bolts. Locking arrangements for nuts, Foundation bolts.

UNIT - II

Keys, Cotters and Pin Joints: Different types of keys in assembly, cotter joint with sleeve, cotter joint with socket and spigot ends, cotter joint with gib, knuckle joint.

Bearings: Solid and bushed journal bearing, Pedestal bearing, Footstep bearing.

Unit–III

Riveted Joints: Different types of riveted heads, Single riveted lap joint, double riveted chain and zigzag lap and butt joints.

Unit–IV

Shaft Couplings: Muff couplings, Flanged coupling, Compression coupling, Universal coupling and Oldham coupling.

Unit - V

Assembly Drawing: Assembly drawings of the following:

Engine Parts: Stuffing box, Steam engine Crosshead, eccentric. Petrol engine Connecting rod.

Machine Tool Parts and Accessories: Square tool post, Lathe Tail Stock and Shaper tool post.

Miscellaneous Parts: Screw Jack, Swivel bearing, Plummer block and Pipe Vice.

TEXT BOOKS:

K.L.Narayana, K.Venkata Reddy, Machine Drawing, NAI Publication, New Delhi.
N.D. Junnarkar, Machine Drawing, Pearson Publication, New Delhi.
N.Sidheswar, P. Kannaiah ,Machine Drawing, TMH Publishers, New Delhi

REFERENCE BOOKS:

K.R.Gopalakrishna, Machine Drawing, Subhash Publication, New Delhi.
P.S.Gill, Machine Drawing, Kataria Publication

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Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	SOFT SKILLS	L	T	P	C
		1	0	2	2

II Year II Semester

Course Objectives:

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To develop leadership skills and organizational skills through group activities
- To function effectively with heterogeneous teams

Course Outcomes (CO):

By the end of the program students should be able to

- Memorize various elements of effective communicative skills
- Interpret people at the emotional level through emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Judge the situation and take necessary decisions as a leader
- Develop social and work-life skills as well as personal and emotional well-being

UNIT – I	Soft Skills & Communication Skills	10 Hrs

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT – II	Critical Thinking	10 Hrs

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT – III	Problem Solving & Decision Making	

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution –
Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion

UNIT – IV	Emotional Intelligence & Stress Management	10 Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT – V	Leadership Skills	10 Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
III Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Machine Tools	PC	3-0-0	3
2.		Thermal Engineering - II	PC	3-0-0	3
3.		Metrology & Measurements	PC	3-0-0	3
4.		**Professional Elective-I**	PE	3-0-0	3
5.		**Open Elective-I**	OE	3-0-0	3
6.		Thermal Engineering-II Lab	PC	0-0-3	1.5
7.		Metrology & Measurements Lab	PC	0-0-3	1.5
8.		**Skill oriented course-III** Innovation through IOT/ MS Project	SC	1-0-2	2
9.		Evaluation of Community Service Project	PR		1.5
				Total	**21.5**

List of Professional Electives-I	List of Open Electives-I
1.Design of Machine Elements-2, Power Plant Engineering 3.Optimization Techniques	Candidate should select the subject from list of subjects offered by other departments.

Category	CREDITS
Professional Core Courses	12
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill oriented course	2
Summer Internship	1.5
TOTAL CREDITS	**21.5**

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	MACHINE TOOLS	L	T	P	C
		3	0	0	3

III Year I Semester

Course Objectives:

- Explain parameters in the metal cutting operation.
- Relate tool wear and tool life and the variables that control them.
- Calculate machining times for different machining processes.
- Teach various metal cutting processes. (lathe, drilling, boring shaping, slotting, milling and grinding).

Course Outcomes (CO):

- Choose cutting processes and variables.
- Relate tool wear and tool life.
- Calculate the machining parameters for different machining processes.
- Identify methods to generate different types of surfaces.
- Explain work-holding requirements.

UNIT - I

Geometry of single point cutting tools and angles-Mechanism of chip formation in machining ductile and brittle materials- and 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, tool life and wear, economics of machining-coolants-methods of applications of cutting fluids, mach inability –Tool materials.

UNIT - II

Engine lathe – Principle of working, specification of lathe – types of lathes – work holders, tool holders – Box Tools, Taper turning, thread turning and attachments for Lathes. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – Lathe Operations.

UNIT - III

Shaping, Slotting and planning machines – their Principles of working – Principal parts – specification, classification, Operations performed-Machining time calculations. Shaper size, shaper mechanism, Crank and slotted link mechanism, Whit worth quick return mechanism, Hydraulic shaper mechanism,

UNIT - IV

Drilling and Boring Machines – Principles 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 – Principles of working – specifications – classifications and principle features of milling machines – machining operations, Types and geometry of milling cutters– methods of indexing –Direct Rapid indexing, Plain or simple indexing, Compound indexing, Differential indexing and angular indexing.
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.

Textbooks:

1. Elements of Workshop Technology: Vol: II machine tools; By Choudhury, S. K. Hajara, Choudhury, A. K. Hajara & Roy, Nirjhar.
2. Workshop Technology – Vol II, B.S. Raghuvamshi.
3. Metal cutting by Bhattacharya
4. P.N. Rao, Manufacturing Technology: Metal Cutting and Machine Tools, (Volume 2), 3/e, Tata McGraw-Hill Education, 2013
5. R.K. Jain and S.C. Gupta, Production Technology, 17/e, Khanna Publishers, 2012.

Reference Books:

1. Kalpakzian S and Schmid SR, Manufacturing Engineering and Technology, 7/e, Pearson, 2018.
2. Milton C.Shaw , Metal Cutting Principles, 2/e, Oxford, 2012
3. Hindustan Machine Tools, Production Technology, TMH, 2001
4. V.K.Jain, Advanced Machining Process,12/e, Allied Publications, 2010
5. AB. Chattopadhyay, Machining and Machine Tools, 2/e, Wiley, 2017
6. Halmi A Yousuf & Hassan, , Machine Technology: Machine Tools and Operations, CRC Press Taylor and Francis Group, 2008

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Mechanical Engineering

\Course Code	Thermal Engineering - II	L	T	P	C
		3	0	0	3

III Year I Semester

Course Objectives:

- To introduce students to the working of compressors.
- To impart knowledge on different types of turbines.
- To familiarize concepts combustion in SI and CI engines.
- To impart knowledge on the working of different refrigeration systems.
- To familiarize concepts of air conditioning systems and heat load concepts

Course Outcomes (CO):

- After completing this course, the students can
- Understand the working of compressors.
- Understand the working of turbines.
- To provide concepts of IC engines combustion processes.
- Understand the working of different refrigeration systems.
- Understand the working of different air conditioning systems

UNIT – I

Vapour compression Refrigeration System- Unit of Refrigeration -COP- Air refrigerator working on reversed CARNOT cycle, Heat engine-, COP of refrigerator, COP of heat pump. Classification of refrigerants and desirable properties of refrigerants and simple problems.

UNIT – II

Vapour Absorption Refrigeration System : Simple vapour absorption system- practical vapour absorption system - advantages and disadvantages of VAR over VCR - COP of idle VAR system – working principle and operation

Steam Jet Refrigeration System: Working Principle and Basic Components – Principle and operation of Thermo-Electric Refrigerator.

UNIT - III

Comfort Air Conditioning : Requirements of human comfort and concept of Effective Temperature- Comfort chart –Comfort Air Conditioning – summer, winter & year round air conditioning.
Air Conditioning equipment-Fans, blowers and all types.
Need for Ventilation – Infiltrated air – **Heat Load concepts** - RSHF, GSHF - Problems.

UNIT – IV

Combustion in S.I. Engines: Homogeneous Mixture - Stages of combustion –Abnormal Combustion - Rating of S.I Engine fuels.
Combustion in C.I. Engines: Heterogeneous Mixture - Stages of combustion – Delay period and its importance –Rating of C.I Engine fuels.

UNIT - V

COMPRESSORS- types – working of reciprocating- single and double acting –centrifugal compressors- types- axial flow compressors- work done- surging - stalling –choking of compressors.

Textbooks:

1. Refrigeration and Air Conditioning,by C.P.Arora
2. IC ENGINES by, V. Ganesan, Tata McGraw-Hill
3. Subramanya, K., Hydraulic Machine, Tata McGraw Hill 2013
4. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar, Dhanpatrai
5. Thermal Engineering, R.S.Khurmi, J.K.Gupta, S.CHAND Publications

References:

1. Manufacturing science by Amitab Ghosh and Ashok Kumr Mallik, Tata-McGraw-Hill Publications
2. Production Technology by Pakkirappa - Durga Publications.

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Mechanical Engineering

Course Code	METROLOGY & MEASUREMENTS	L	T	P	C
		3	0	0	3

III Year I Semester

Course Objectives:

- Introduce the basic concepts of metrology and measurement methods.
- Demonstrate the importance of metrology in manufacturing
- Explain the concepts of transducers and its practical applications.
- Expose with various measuring instruments
- Familiarize calibration methods of various measuring instruments.

Course Outcomes (CO):

- List various measuring instruments used in metrology.
- Examine geometry of screw threads and gear profiles.
- Measure force, torque, temperature, pressure and sound.
  Calibrate various measuring instruments.

UNIT - I

Concept of measurement -Definition –Introduction, basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics sources of error, Classification and elimination of errors, Tolerances,Sensors,interchangeability.

Transducers: Introduction, Theory and construction of various transducers to measure displacement - Inductive, capacitance, Piezo electric, resistance and Photo electric transducers.

UNIT - II

Measurement of Pressure : Introduction, Classification - different principles used- Bourdon pressure gauges, Bellows – Diaphragm gauges. Thermal conductivity gauges - ionization pressure gauges, Mcleod pressure gauge.

Measurement of Speed: Mechanical tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer.

Measurement of level: Introduction, Direct method, float type, indirect methods – electrical, capacitative, magnetic, liquid level indicators.

UNIT - III

Measurement of force, torque and power- Elastic force meters, load cells, Torsion meters, Dynamometers.

Flow measurement: Introduction, types of flow measuring instruments, Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of temperature: Introduction, Classification - Ranges - Various Principles of measurement – Liquid filled thermometers, Electrical Resistance thermometers, Thermistor, Thermocouple.

UNIT - IV

Flatness Measurement: Measurement of flatness – straight edges – surface plates, optical flat and autocollimators, interferometers and their applications.

Linear and Angular Measurement : Differences between surface roughness and surface waviness,Vernier calipers, vernier height gauge, micrometers, telescopic gauge, dial bore gauge, slip gauges, Dial indicators, vernier and optical bevel protractor, optical dividing head, sine principle and sine bars, angle gauges, sprit level, clinometers, rollers and spheres used to determine the tapers.

UNIT - V

Screw thread measurements: Elements of threads, errors in screw threads, various methods for measuring external and internal screw threads, screw thread gauges.

Gear Measurement: Gear tooth terminology, measurement of gear elements-runout, lead, pitch backlash, profile, pressure angle, tooth thickness, diameter of gear, constant chord and base tangent method.

Textbooks:

1. Mechanical Measurements, D.S Kumar.
2. Engineering Metrology by R.K.Jain, Khanna publishers.

Reference Books:

1. Instrumentation Measurement & Analysis,B.C.Nakra and K.K Choudhary.TMH

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Mechanical Engineering

Course Code	Design of Machine Elements-I (Professional Elective-I)	L	T	P	C
		3	0	0	0

III Year I Semester

Course Objectives:

- To impart the general procedure to design the machine elements
- To familiarize the selection of engineering materials to design based on mechanical properties
- To explain basics various types of joints, couplings, & loads
- To familiarize various testing methods from theories of failures

Course Outcomes (CO):

- Know the significance of the design of machine elements
- Minimum needs of design of machine element for a design engineer
- Learn various testing methods from theories of failure
- Know the Strength & rigidity to design of solid & hallow shafts
- Gain the knowledge to design shaft for different loads
- Know the procedure to solve the problems in types of coupling

UNIT - I **Introduction**

Introduction: The art and science of machine design- Types of design methods - stages in machine design selection of engineering materials based on mechanical properties-Types of loads, Factor of safety. Introduction of various theories of failure.

UNIT - II **Strength of Machine Elements**

Strength of Machine Elements: Stress concentration–notch sensitivity, Fatigue stress concentration factor –Design for fluctuating stresses – Endurance limit, S-N Curve – Estimation of Endurance strength –Gerber, Goodman's & Soderberg's methods, and simple problems.

UNIT - III **Rivited & Welded joints**

Riveted Joints: Types of riveted joints - modes of failure-strength and efficiency of riveted joints, pitch of the rivets, design stresses - boiler joints, - Riveted joints under eccentric loading.
Welded Joints: Types of welded joints, strength of welds, Design of simple welded joints.

UNIT - IV **Bolted joints Keys,Cotters & Knuckle Joints**

Bolted Joints: Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses – Design of joints under eccentric loading– Bolts of uniform strength.
Keys, Cotters and Knuckle Joints: Types of Keys, stresses in Keys, design of rectangular and square Keys. Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints.

UNIT - V **Design of Shafts and Couplings**

Design of Shafts and Couplings-Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads. Design of Rigid couplings: Muff, Split muff and Flange couplings.

Textbooks:

1. Machine design, R.S Khurmi and JK Gupta.S.Chand& Chand
2. V.B.Bhandari, Design ofMachineElements,TMHPublishers,NewDelhi.
3. Machine Design, Kannaiah, Scietech.
4. Machine Design by S.Md. Jalaluddin, Anardha Publishers, Chennai.

Reference Books:

1. Machine design, J.E. Shigley.
2. Design of Machine Elements, M.F. Spotts, PHI

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Mechanical Engineering

Course Code	POWER PLANT ENGINEERING (Professional Elective-I)	L	T	P	C
		3	0	0	3

III Year I Semester

Course Objectives:

- Learn the sources of energy
- Methods of pollution control
- Know the various power plants

UNIT - I

Introduction To The Sources Of Energy – Resources and Development of Power in India.
Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection, Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor – Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment – Pollutants and Pollution Standards – Methods of Pollution Control. Inspection And Safety Regulations.

UNIT - II

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems. Steam Power Plant : Combustion Process : Properties of Coal – Overfeed and Under Feed Fuel Beds, Traveling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders.

UNIT - III

Diesel Power Plant: Diesel Power Plant: Introduction – IC Engines, Types, Construction– Plant Layout with Auxiliaries – Fuel Storage Gas Turbine Plant : Introduction – Classification - Construction – Layout With Auxiliaries – Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT - IV

Hydro Electric Power Plant: Water Power – Hydrological Cycle / Flow Measurement – Drainage Area Characteristics – Hydrographs – Storage and Pondage – Classification of Dams and Spill Ways. Hydro Projects and Plant: Classification – Typical Layouts – Plant Auxiliaries – Plant Operation Pumped Storage Plants.

UNIT - V

Power from Non-Conventional Sources: Utilization of Solar Collectors- Principle Of its Working, Wind Energy – Types of Turbines – HAWT & VAWT-Tidal Energy. MHD power Generation.

Textbooks:

1. Power plant Engineering, P.K. Nag, TMH, 3rd edition, 2013.
2. A course in power plant Engineering, Arora and S. Domkundwar.

Reference Books:

1. A Text Book of Power Plant Engineering , Rajput , Laxmi Publications, 4th edition, 2012.
2. Power plant Engineering, Ramalingam, Scietech Publishers
3. power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.

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Mechanical Engineering

Course Code	OPTIMIZATION TECHNIQUES (Professional Elective-I)	L	T	P	C
		3	0	0	3

III Year I Semester

Course Objectives:

- Design constrains,design vector and problems
- Classical optimization techniques and its types
- Student can learn Transportation problems

Course Outcomes (CO):

- Student can learn error control coding
- Transportation problems
- Unconstrained problems
- Student can write Non linear programming.

UNIT - I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem - design vector - design constraints - constraint surface - objective function - objective function surfaces - classification of Optimization problems.

UNIT - II

Classical Optimization Techniques : Single variable Optimization - multi variable Optimization without constraints - necessary and sufficient conditions for minimum/maximum - multivariable Optimization with equality constraints.
Solution by method of Lagrange multipliers - multivariable Optimization with inequality constraints - Kuhn - Tucker conditions.

UNIT - III

Error Control Coding: Introduction to Error Control Codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check Bit Coding for Error Detection, Block Coding for Error Detection and Correction, The Hamming Distance, The upper bound of the Probability of Error with Coding, Soft Decision Decoding, Hard Decision Decoding.

UNIT - IV

Transportation Problem: Finding initial basic feasible solution by north - west corner rule, least cost method and Vogel's approximation method - testing for optimality of balanced transportation problems.

UNIT - V

Unconstrained Nonlinear Programming: One - dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method

Textbooks:

1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. " Introductory Operations Research" by H.S. Kasene & K.D. Kumar, Springer(India), Pvt .LTd.

Reference Books:

1. " Optimization Methods in Operations Research and systems Analysis" - by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research - by Dr. S.D.Sharma.
3. "Operations Research : An Introduction" - by H.A. Taha, PHI Pvt. Ltd., 6th edition
4. Linear Programming - by G. Hadley

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Mechanical Engineering

Course Code	Thermal Engineering-II LAB	0	0	3	1.5

III Year I Semester

Course Objectives:

- To introduce students to the working of compressors.
- To impart knowledge on different types of turbines.
- To impart knowledge on the working of different refrigeration systems.
- To familiarize concepts of air conditioning systems and heat load concepts

Course Outcomes (CO):

- After completing this course, the students can
- Understand the working of compressors.
- Understand the working of different refrigeration systems.
- Understand the working of different air conditioning systems

List of Experiments:

1. Refrigeration test rig
2. Vapour absorption test rig
3. Window type AC
4. Air washer test rig
5. Water cooler
6. Mechanical heat pump
7. Thermo electric apparatus
8. Gas charging unit
9. Cooling tower test rig
10. Performance test on 4 stroke diesel engines
11. Performance test on 2 stroke petrol engines
12. Air compressor test rig.
13. Flash and fire point apparatus
14. Redwood and say bolt viscometer apparatus.
15. VTD and PTD of 2 and 4 stoke engine.
16. Study of boilers, SI and CI Engines, Assemble and disassemble of Engines, Carburetor and fuel injector.

Note: Any 12 of the above equipments

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Mechanical Engineering

Course Code	METROLOGY & MEASUREMENTS LAB	L	T	P	C
		0	0	3	1.5

III Year I Semester

Course Outcomes (CO):

- Introduce the basic concepts of metrology and measurement methods.
- Demonstrate the importance of metrology in manufacturing
- Explain the concepts of transducers and its practical applications.
- Expose with various measuring instruments
  Familiarize calibration methods of various measuring instruments.

List of Experiments:

1. Strain measurement trainer
2. Temperature measurement trainer R.T.D
3. Temperature measurement trainer Thermocouple
4. Temperature measurement trainer Thermister
5. LVDT measurement trainer
6. Rota meter test Rig
7. Pressure measurement trainer
8. Speed measurement trainer
9. Angular type capacitance measurement trainer
10. McLeod Gauge
11. Vibration measurement trainer
12. Tool maker's microscope
13. Measurement of length, height, and diameter by verniercallipers, vernier height gauge and micrometer.
14. Measurement of bores using dial bore indicator.
15. Angle and tapper measurement using Bevel protractor and SINEBAR
16. Measurement of thickness of gare teeth by vernier tooth caliper
17. surface roughness measurement by Talysurf
18. Flatness of surface plate by using sprit level.
19. Alignment tests

Note: Any 12 of the above equipments

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Mechanical Engineering

Course Code	(Skill Oriented Course-III) INTRODUCTION TO INTERNET OF THINGS	L	T	P	C
		3	0	0	3

III Year I Semester

Course Objectives:

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

Course Outcomes (CO):

After completion of this course the students will be able to

- Understand the application areas of IOT
- Understand building blocks of Internet of Things and characteristics.
- Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

UNIT - I

Overview: Internet of Things Definition Evolution, IoT Architectures, Resource Management, IoT data management and Analytics, Communication Protocols, Applications, Security, Identity Management and Authentication, Privacy, Standardization and Regulatory Limitations.

UNIT - II

Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.

UNIT - III

Introduction to Sensor Interfacing, Microcontrollers, and Their Interfacing: Introduction to Sensor Interfacing, Types of Sensors, Controlling Sensors through Webpages, Microcontrollers: A Quick Walkthrough, Advanced RISC Machine, Introduction Arduino**,** Setting up the Arduino development environment

UNIT - IV

Protocols for IoT – Messaging and Transport Protocols: Introduction, Messaging Protocols, XMPP and DDS Protocols, Transport Protocols

Addressing and Identification: Introduction, Internet Protocol Version 4, Internet Protocol Version 6 (IPv6), Uniform Resource Identifier (URI)Packages.

UNIT - V

Application Building with IoT: Introduction, Smart Perishable Tracking with IoT and Sensors, IoT–Based Application to Monitor Water Quality, Smart Warehouse Monitoring, Smart Retail – IoT Possibilities in the Retail Sector, Prevention of Drowsiness of Drivers by IoT-Based Smart Driver Assistance Systems, System to Measure Collision Impact in an Accident with IoT, Integrated Vehicle Health Management

Textbooks:

1. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, 2nd Edition, Wiley Publications.
2. Vijay Madisetti, Arshdeep Bahga, Internet of Things A Hands-On- Approach‖,2014.

Reference Books:

1. Adrian McEwen, ―Designing the Internet of Things, Wiley Publishers, 2013.
2. Daniel Kellmereit, ―The Silent Intelligence: The Internet of Things, 2013.

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Mechanical Engineering

Course Code	CONSITUTION OF INDIA (Mandatory Course)	L	T	P	C
		2	0	0	0

III Year I Semester

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of india and election commission of india.
- To understand the central and state relation financial and administrative

Course Outcomes (CO):

- At the end of the semester/course, the student will be able to have a clear knowledge on the following:
- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
- Know the sources, features and principles of Indian Constitution.
- Learn about Union Government, State government and its administration.
- Get acquainted with Local administration and Pachayati Raj.
- Be aware of basic concepts and developments of Human Rights.
- Gain knowledge on roles and functioning of Election Commission

UNIT - I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT - II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;
.

UNIT - III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT - IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT - V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics

5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

Sri Krishnadevaraya University College of Engineering & Technology
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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
III Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Design of Machine Elements - II	PC	3-0-0	3
2.		CAD / CAM	PC	3-0-0	3
3.		Heat Transfer	PC	3-0-0	3
4.		**Professional Elective-II**	PE	3-0-0	3
5.		**Open Elective-II**	OE	3-0-0	3
6.		CAD / CAM Lab	PC	0-0-3	1.5
7.		Machine Tools Lab	PC	0-0-3	1.5
8.		Heat Transfer Lab	ES	0-0-3	1.5
9.		**Skill oriented course-IV MAT LAB/CFD**	SC	1-0-2	2
				Total	**21.5**
Industrial/Research Internship (Mandatory) for 2 months duration during summer vacation					

List of Professional Electives-II	List of Open Electives-II
1.Finite Element Analysis 2.Non-conventional sources of Energy 3.Nano Technology.	Candidate should select the subject from list of subjects offered by other departments.

Category	CREDITS
Professional Core Courses	13.5
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill oriented course	2
TOTAL CREDITS	**21.5**

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Mechanical Engineering

Course Code	DESIGN OF MACHINE ELEMENT-II	L	T	P	C
		3	0	0	3

III Year II Semester

Course Objectives:

- Importance of design
- How to design the various components and design procedures
- Usage of design data hand book.

Course Outcomes (CO):

- Should know the various gears and power screws
- Learn difference between various types of power transmission systems.
- Also learn how to design various types of power transmission systems
- Know the difference between hoop and longitudinal stresses.
- Remember the I C Engine components and working principle.
- Learn Working, design ,classification and constructional details of bearings
- Know the Design procedures for various types of bearings.

UNIT - I

Bearings: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life.

UNIT - II

Design of I.C.Engine Parts: Design of connecting rod-stress due to whipping action on Connecting rod – design of trunk type piston for I.C. engine, design of crank and crankshafts.

UNIT - III

DESIGN OF PRESSURE VESSELS AND PIPES: Introduction- classification of pressure vessels-stresses in thin cylinder, circumferential& hoop stresses, longitudinal stresses-thin and thick cylinders-Pipe joints-design of circular, oval & flanged pipe joints- standard pipe flanges for steam-hydraulic pipe joints for high pressures

UNIT - IV

Power Transmission Systems: 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.

Power Screws : Design of screw, Square ACME, Buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

Textbooks:

1. V.B.Bhandari, Design ofMachineElements,TMHPublishers,NewDelhi.
2. Machine Design, Kannaiah/ Scietech
3. Machine Design, S MD Jalaludin, Anuradha Publishers

Reference Books:

1. SadhuSingh[2000],Machine Design,KhannaPublishers, NewDelhi.
2. M.F.Spotts, DesignofMachineElements,PHIPublishers, NewDelhi.

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Mechanical Engineering

Course Code	CAD/CAM	L	T	P	C
		3	0	0	3

III Year II Semester

Course Objectives:

- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modeling methods in CAD.
- Familiarize numerical control (NC), computer numerical control (CNC) and direct numerical control (DNC) machines.
- Impart knowledge on manual part programming and computer aided part programming.

Course Outcomes (CO):

- Apply the basics of geometric representation and transformations in CAD/CAM.
- Choose geometric modeling methods for building CAD models.
- Compare NC, CNC and DNC.
- Develop manual and computer aided part programming for turning and milling operations.

UNIT - I

Product cycle, steps involved in Designing a CAD, CAD tools, CAM tools, CPU, input devices, output devices, Memory types, Application of computers for design, benefits of CAD, storage devices

UNIT - II

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

UNIT - III

Geometric modeling: Wire frame models, Wire frame entities, curve representation, parametric representation of synthetic curves, curve manipulations- problems.

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 Tech: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.
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.

Textbooks:

1. CAD/CAM, A Zimmers & P.Groover, PE, PHI.
2. CAD/CAM-Principles and applications, P.N. Rao, TMH.
3. P. N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017
4. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, 2/e, Tata McGraw-Hill, Delhi, 2009

Reference Books:

1. Automation, Production systems & Computer integrated Manufacturing, Groover, P.E.
2. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age
3. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008
4. P. Radhakrishnan, S. Subramanyan & V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008
5. Computer Aided Manufacturing, 3/e, Tien Chien Chang, Pearson, 2008

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Mechanical Engineering

Course Code	HEAT TRANSFER	L	T	P	C
		3	0	0	3

III Year II Semester

Course Objectives:

- To impart the basic laws of conduction, convection and radiation heat transfer and their applications
- To familiarize the convective heat transfer concepts
- To explain basics of radiation heat transfer
- To explain about types of heat exchangers.

Course Outcomes (CO):

- identify the phenomenon related to different modes of heat transfer
- compare different types of conduction heat transfer
- apply concept of thermal resistance and its importance in practical problems
- learn heat conduction in fins
- learn about unsteady state heat conduction
- Explain the working of different types of heat exchangers
- Calculate the heat transfer in heat exchangers
- Design a heat exchanger for a given application

UNIT - I

Introduction: Basic modes of heat transfer- rate equations- generalized heat conduction equation for plane walls, cylindrical surfaces and spherical surfaces, 1-D steady state heat conduction solution for plain and composite slabs - cylinders –spheres--problems- critical thickness of insulation.

UNIT - II

Heat conduction through extended surfaces- fins of uniform cross section- fin effectiveness and efficiency.
Unsteady State Heat Transfer Conduction- Transient heat conduction- lumped system analysis and use of Heisler charts.

UNIT - III

Convection: Basic concepts of convection–heat transfer coefficients - types of convection –forced convection and free convection.
Forced convection in external flow–concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders.
Free Convection -development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation.

UNIT - IV

Radiation: Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies – shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect.

UNIT - V

Heat Exchangers: Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods for parallel and counter flow heat exchangers.

Textbooks:

1. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.
2. F. P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6/e, John Wiley, 2007.

Reference Books:

1. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill,2008.
2. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.
3. S.P. Sukhatme, A Textbook of Heat Transfer, Universities Press, 2005
4. Lienhard and Lienhard, A Heat and Mass Transfer, Cambridge Press, 2011.
5. C.P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer databook, New Age Publications, 2014

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Mechanical Engineering

Course Code	FENITE ELEMENT ANALYSIS (Professional Elective-II)	L	T	P	C
		3	0	0	3

III Year II Semester

Course Objectives:

- To learn basic principles of finite element analysis procedure..
- To learn the theory and characteristics of finite elements that represent engineering structures.
- To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others.
- Learn to model complex geometry problems and solution techniques.

Course Outcomes (CO):

- To learn the theory and characteristics of finite elements that represent engineering structures.
- To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others.
- Learn to model complex geometry problems and solution techniques.

UNIT - I

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.

UNIT - II

Finite element technique: Finite element modeling 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, Thermal stresses in 1-D bar element- Two-dimensional truss element, stiffness matrix for two-dimensional truss, 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.

Steady State Heat Transfer Analysis: Derivation of basic differential equation, One-dimensional heat transfer through a fin and composite wall.

Textbooks:

1. Tirupati Chandrapatla and Bellagundu Introduction to Finite Element in Engineering, Pearson Education, New Delhi.
1. S.Md. Jalaluddin Introduction of finite element Analysis, Anuradha Publishers, Chennai.
2. David V. Hutton Fundamentals of Finite Element Analysis, TMH Publishers, New Delhi.
3. Chandraputla, Ashok &Belegundu,Introduction to Finite Element in Engineering, Prentice Hall.

S.S.Rao, The Finite Element Methods in Engineering,Elsevier Butterworth -Heinemann 2nd Edition, 2011.

Reference Books:

1. C.S. Krishna Moorthy, Finite Element Analysis, TMH Publishers, New Delhi.
2. S.S.Rao Finite Element Methods, Pergamom Press, New York.
3. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993.
4. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3rd Edition, John Wiley, New York, 1989.
5. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs,1982.
6. T J R Hughes, the Finite Element Method, Prentice-Hall, Englewood Cliffs, NJ, 1986.

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Mechanical Engineering

Course Code	NON CONVENTIONAL SOURCES OF ENERGY (Professional Elective-II)	L	T	P	C
		3	0	0	3

III Year II Semester

Course Objectives:

- Familiarize with basics of solar radiation, available solar energy and its measurement.
- Familiarize with solar collectors, construction and operation of solar collectors.
- Understand solar energy conversion systems, applications and power generation.

Course Outcomes (CO):

- Gain Knowledge on basic concepts of solar radiation and solar collectors
- Design of a community Biogas plant
- Know solar heating/cooling technique, solar distillation and drying.

UNIT - I

Principles of Solar Radiation : Introduction - solar constant - Role and potential of new and renewable source, Environmental impact of solar power, physics of the sun, instruments for measuring solar radiation .

UNIT - II

Solar Energy Collectors : Introduction – type - Flat plate and concentrating (Parabolic) collectors - Merits & Demerits of Flat plate and Concentrating (Parabolic) Collectors.

UNIT - III

Solar Energy Storage and Applications: Introduction - Different methods - Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion- photovoltaic Cells

UNIT - IV

Wind Energy: Introduction – Basic Principle of wind energy conversion - Basic components **–** classification – Horizontal & Vertical Axis wind mill **–** Merit & demerits. Wind energy collectors advantages, disadvantages.

UNIT - V

Geothermal Energy: Introduction – nature of geothermal fields – geothermal sources – hybrid systems – merits and demerits- applications.
Ocean Energy: Introduction – OTEC (open, closed & hybrid cycle) – Energy from Tides – components – Operating methods – Ocean waves – wave energy conversion devices.
Biomass: Principles of Bio-Conversion - Anaerobic/Aerobic Digestion – Design of a community Biogas plant for a village-classification of biomass gasifiers- up draught, down draught & cross draught gasifiers

Textbooks:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Renewable Energy Sources /Twidell & Weir.
3. Non-Conventional Energy Sources /G.D. Rai.

Reference Books:

1. Solar Energy /Sukhatme.
2. Solar Power Engineering / B.S Magal Frank Kreith & J.F Kreith

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Mechanical Engineering

Course Code	Nano Technology (Professional Elective-II)	L	T	P	C
		3	0	0	3

III Year II Semester

Course Outcomes:

- Introduce the students, the basic concepts of Total Quality Management.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of customer satisfaction by the application of various quality concepts.
- Understand the importance of Quality standards in Production.

UNIT - I

General Introduction: Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.

UNIT - II

Silicon Carbide: Application of Silicon carbide, nano materials preparation, Sintering of SiC, X-ray Diffraction data, lectron microscopy sintering of nano particles.
Nano particles of Alumina and Zirconia: Nano materials preparation, Characterization, Wear materials and nano composites.

UNIT - III

Mechanical Properties: Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties.

UNIT - IV

Process of synthesis of nano powders, Electro deposition, important nano materials.

UNIT - V

Investigating and Manipulating Materials in the Nanoscale: Electron microscopic, scanning probe microscopic, optical microscopic for nano science and technology, X-ray diffraction.
Nanobiology: Interaction between bio-molecules and nano particle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology
Nano Medicines: Developing of Nano medicines Nano sytems in use, Protocols for nano drug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications.

Textbooks:

1. T.Pradeep [2007], Nano: The Essentials- Tata Mc Graw Hill Publishing Company Limited New Delhi.
2. Nano Materials- A.K.Bandyopadhyay/ New Age Publishers.

REFERENCE BOOKS:

3. Nano materials by J.Dutta & H.Hofman.
4. Nano structures & Nano materials by Guozhong cao, Imperial college press

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Mechanical Engineering

Course Code	CAD/CAM LAB	L	T	P	C
		0	0	3	1.5

III Year 2nd Semester

Course Outcomes (CO):

- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modeling methods in CAD.
- Familiarize numerical control (NC), computer numerical control (CNC) and direct numerical control (DNC) machines.
  Impart knowledge on manual part programming and computer aided part programming.

List of Experiments:

1. Introduction and initiating the graphics package, setting the paper size, space, setting the limits, units, use of snap, or-tho and grid commands.
2. Practicing Autocad commands: Line, Circle, Arc, Array, Offset, Trim, Extend, Mirror, Move, Copy, Rotate, Erase, Zoom, Pan, Etc.
3. Dimensioning the drawing and adding text.
4. Create a 2-D view of the given diagram using Auto cad
5. Create a 2-D view of the given diagram using Auto cad
6. Create a iso metric from the given orthographic views using Auto cad.
7. Create a iso metric from the given orthographic views using Auto cad CA
8. To creating 3-D modeling from the given or-tho graphic views using Auto cad 3-D commands.
9. To creating 3-D modeling from the given or-tho graphic views using Auto cad 3-D commands.

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Mechanical Engineering

Course Code	Machine Tools LAB	L	T	P	C
		0	0	3	1.5

III Year II Semester

Course Objectives:

- Explain parameters in the metal cutting operation.
- Relate tool wear and tool life and the variables that control them.
- Calculate machining times for different machining processes.
- Teach various metal cutting processes. (lathe, drilling, boring shaping, slotting, milling and grinding).

Course Outcomes (CO):

- Choose cutting processes and variables.
- Relate tool wear and tool life.
- Calculate the machining parameters for different machining processes.
- Identify methods to generate different types of surfaces.
- Explain work-holding requirements.

List of Experiments:

1. Step Turning and Taper Turning on Lathe
2. Thread Cutting and Knurling on Lathe
3. Machining Flat Surface using Shaper Machine
4. Manufacturing of Spur Gear using Milling Machine
5. Making Internal Splines using Slotting Machine
6. Drilling, Tapping & Grinding
7. Grinding of Single Point Cutting Tool
8. Planing Machine
9. Lathe Tool and Drill Tool Dynamometers

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Mechanical Engineering

Course Code	Heat Transfer Lab	L	T	P	C
		1	0	2	2

III Year II Semester

Course Objectives:

- To impart the basic laws of conduction, convection and radiation heat transfer and their applications
- To familiarize the convective heat transfer concepts
- To explain basics of radiation heat transfer
- To explain about types of heat exchangers.

Course Outcomes (CO):

- identify the phenomenon related to different modes of heat transfer
- compare different types of conduction heat transfer
- apply concept of thermal resistance and its importance in practical problems
- learn heat conduction in fins
- learn about unsteady state heat conduction
- Explain the working of different types of heat exchangers
- Calculate the heat transfer in heat exchangers
- Design a heat exchanger for a given application

Syllabus

Textbooks:

1. Composite wall apparatus
2. Heat transfer in natural convection
3. Lagged pipe
4. Stefan Boltzmann apparatus
5. Heat transfer in force convection
6. Heat transfer in pin fin
7. Heat pipe demonstrator
8. Emmisitivity measurement
9. Drop wise and film vise apparatus
10. Counter flow and parallel flow heat exchangers apparatus.

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Mechanical Engineering

Course Code	(Skill Oriented Course-IV) MATLAB	L	T	P	C
		3	0	0	3

III Year II Semester

Course Objectives:

- Introduce basics of MATLAB
- Familiarize the fundamentals of optimization
- Explain single variable optimization using various methods
- Implement multi variable optimization using various methods
- Train various evolutionary algorithms.

Course Outcomes (CO):

After completion of this course the student can be able to

- Use optimization terminology and concepts, and understand how to classify an optimization problem.(L4)
- Apply optimization methods to engineering problems.
- Implement optimization algorithms.
- Compare different genetic algorithms.
- Solve multivariable optimization problems.

Introduction to MAT LAB: Overview, MATLAB Preliminaries, Basics of MATLAB, Beyond the Basics of MATLAB, Popular Functions and Commands, Plotting using MATLAB, Optimization with MATLAB.

Single Variable Optimization: Finite difference method, Central difference method, Runge-Kutta method, interval halving method, golden section method with MATLAB code.

Multi Variable Optimization: Conjugate gradient method, Newton's method, Powell's method, Flectcher-Reeves method, Hook and Jeeves method, interior penalty function with MATLAB code.

Evolutionary Algorithms: Overview, Genetic Algorithms: Basics of Genetic Algorithms, Options in MATLAB, Multi Objective Optimization using Genetic Algorithms, Ant Colony Optimization, Simulated Annealing, Particle Swarm Optimization.

Textbooks:

1. 1.Rao V.Dukkipati, MATLAB: An Introduction with Applications, Anshan, 2010.
2. Achille Messac, Optimization in practice with MATLAB, Cambridge University Press, 2015.
3. Jasbir S Arora, Introduction to optimum design, 2/e. Elsevier, 2004.

Reference Books:

1. Cesar Perez Lopez, MATLAB Optimization Techniques, Academic press, Springer publications, 2014.
2. Steven C.Chapra, Applied Numerical Methods with MATLAB for Engineers and scientists, 4/e, McGraw-Hill Education, 2018.

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Mechanical Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Mechanical Engineering					
IV Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		**Professional Elective-III**	PE	3-0-0	3
2.		**Professional Elective-IV**	PE	3-0-0	3
3.		**Professional Elective-V**	PE	3-0-0	3
4.		**Open Elective-III**	OE	3-0-0	3
5.		**Open Elective-IV**	OE	3-0-0	3
6.		**Humanities Elective-I**	OE	3-0-0	3
7.		**Skill oriented course V**	SC	1-0-2	2
8.		Evaluation of Industrial Internship	PR	0-0-0	3
				Total	**23**

List of Professional Electives-III	**List of Professional Electives-V**
1. Operation Research 2. Robotics Composite Materials	1. Automobile Engineering 2. Tool Design Industrial Management
List of Professional Electives-IV	**Humanities Elective-I**
1. Non-Destructive Evaluation (NDE) 2. Solar Energy Systems 3. Mechanical Behavior of Materials	1)Entrepreneurship and Design Thinking 2)Management Science 3)Organizational Behavior
List of Open Electives-III & IV Candidate should select the subject from list of subjects offered by other departments.	

Category	**CREDITS**
Professional Elective Courses	9
Open Elective Course/Job Oriented Elective	6
Humanities and Social Science Elective	3
Skill oriented course	2
Industrial Internship	3
TOTAL CREDITS	**23**

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Mechanical Engineering

Course Code	OPERATION RESEARCH (Professional Elective-III)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- To impart knowledge in concepts and tools of Operations Research
- To understand mathematical models used in Operations Research
- To apply these techniques constructively to make effective business decisions

Course Outcomes (CO):

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

- Solve Linear Programming Problems
- Solve Transportation and Assignment Problems
- Understand the usage of game theory and Simulation for Solving Business Problems

UNIT - I

Linear Programming: Introduction-structure of linear programming model- Formulation–Graphical solution – Simplex method, Big-M method, Two phase method (maximization case and minimization case), Special cases-Duality, dual simplex method.

UNIT - II

Transportation: Introduction-methods of finding initial solution-optimal solution-variations in transportation problem-maximization.
Assignment problems: Hungarian method of Assignment problem- variations of the assignment problem-Travelling sales man problem.

UNIT - III

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 - IV

Queuing theory: introduction-characteristics of queuing system-probability distributions in queuing system-single server queuing models-multi server queuing models.
Job sequencing: n jobs - two machines, n jobs - three machines, two jobs - n machines.

UNIT - V

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.

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.
Network Flow Models: maximal flow, minimal flow.

Textbooks:

1. Operations Research- theory and applications, second edition, J.K. Sharma/MacMillian publications.
2. Introduction to operations research, Hamdy A. Taha/PHI publications.
3. Production & operation management , Panner selvam
4. Sharma S.D., Operations Research: Theory, Methods and Applications, 15th Edition, Kedar Nath Ram Nath, 2010
5. Taha H.A., Operations Research, 9th Edition, Prentice Hall of India, New Delhi, 2010.

Reference Books:

1. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7th Edition, Tata McGraw Hill, 2010.
2. Sharma J.K., Operations Research: Theory and Applications, 4th Edition, Laxmi Publications, 2009.
3. Prem kumar Gupta and Hira, Operations Research, 3rd Edition, S Chand Company Ltd., New Delhi, 2003.
4. Pannerselvam R., Operations Research, 2nd Edition, Pentice Hall of India, New Delhi, 2006.
5.

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Mechanical Engineering

Course Code	ROBOTICS (Professional Elective-III)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.
- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students to understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

Course Outcomes (CO):

- Explain a robot and homogeneous transformations.
- Classifications of robot based on the geometry
- Different types of locomotion devices
- The basic concepts of robot controlling systems.
- Applications of robot in various industrial applications
- Identify the components of robot vision system.
- Evaluate D-H notations for simple robot manipulator
- Understand the Trajectory planning, path planning.

UNIT - I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

UNIT - II

Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT - III

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric &stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors. Robot Applications in Manufacturing, welding, Assembly and Inspection.

UNIT - IV

Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.
Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT - V

Differential transformation and manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.
Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages.

Textbooks:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.
3. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey , Industrial Robotics — Mc Graw Hill, 1986.
4. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.

Reference Books:

1. Robotics / Fu K S/ McGraw Hill.
2. An Introduction to Robot Technology, / P. Coiffet and M. Chaironze / Kogam Page Ltd. 1983 London.
3. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
4. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1st Edition Wiley- Interscience, 1986.

5. Robert J. Schillin, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.
6. Mohsen shahinpoor, A robot Engineering text book, Harper & Row Publishers,1987.
7. John.J.Craig Addison, Introduction to Robotics: Mechanics and Control, Wesley, 1999.
8. K.S. FU, R.C. Gonzalez and C.S.G Lee, Robotics: Control, sensing, vision, and intelligence . Mc Graw Hill, 1987.
9. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

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Mechanical Engineering

Course Code	COMPOSITE MATERIALS (Professional Elective-III)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

Course Outcomes (CO):

- Identify the practical applications of composites.
- Identify the polymer matrix composites.
- Classify of bio- degradable composites.
- Outline the various types of ceramic matrix materials.

UNIT - I

Introduction to composites: Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications

UNIT - II

Polymer matrix composites: Polymers - Polymer matrix materials – PMC processes - hand layup processes – spray up processes – resin transfer moulding – Pultrusion – Filament winding – Auto clave based methods - Injection moulding – sheet moulding compound – properties and applications of PMCs.

UNIT - III

Metal matrix composites: Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – Insitu processes. Properties and applications of MMCs.

UNIT - IV

Ceramic matrix composites: Ceramic matrix materials – properties – processing of CMCs –Sintering - Hot pressing – Infiltration – Lanxide process – Insitu chemical reaction techniques – solgel polymer pyrolsis – SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

UNIT - V

Advances in composites: Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications. Biodegradability, introduction of biocomposites, classification, processing of biocomposites, applications of biocomposites - Mechanical, Biomedical, automobile Engineering.

Textbooks:

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

Reference Books:

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bioplastics & Biocomposites for Engineering applications, John Wiley publications.

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Mechanical Engineering

Course Code	AUTOMOBILE ENGINEERING (Professional Elective-IV)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- Impart the knowledge of vehicle structure and its components.
- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

Course Outcomes (CO):

- Identify different parts of automobile.
- Explain the working of various parts like engine, transmission, clutch, brakes.
- Describe the working of steering and the suspension systems.
- Summarize the environmental implications of automobile emissions.
- Outline the future developments in the automobile industry.

UNIT - I

Introduction to vehicle structure and engine components: Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters - Cooling system - Types - Water pumps - Radiators - Thermostats - Anti-freezing compounds.

UNIT - II

Ignition system: Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system –

Fuel supply system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI-

Automobile Emissions - Source of formation – Effects on human health and environment - Control techniques - Exhaust Gas Recirculation (EGR) - Catalytic converter - Emission tests and standards (Indian and Europe)

UNIT - III

Transmission system: Clutches - Function - Types - Single plate, Multiple plate

Gearbox - Manual - Sliding - Constant - Synchromesh -Automatic transmission - Torque converter - Epicylic and Hydromatic transmission – Continuously variable transmission - Universal joint - Propeller shaft - Differential - Need - Construction – Non-slip differential – Differential locks - Four wheel drive.

UNIT - IV

Steering system: Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering concept.

Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers – Wheels and Tires - Construction - Type and specification - Tire wear and causes – **Braking system** - Needs – Classification –Drum and Disc -Mechanical - Hydraulic and pneumatic - Anti-lock Braking System(ABS)

UNIT - V

Automobile electrical systems, instrumentation and advances in automobile engineering: Battery-General electrical circuits-Dash board instrumentation - Passenger comfort – Safety and security - HVAC - Seat belts - Air bags - Automotive Electronics - Electronic Control Unit (ECU) - Variable Valve Timing (VVT) - Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP) Traction Control System (TCS) - Global Positioning System (GPS) - X-by-wire - Electric - Hybrid vehicle.

Textbooks:

1. William.H.Crouse, Automotive Mechanics, 10/e Edition, McGraw-Hill, (2006).
2. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, (2009).
3. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International (2004).

Reference Books:

1. Bosch, Automotive Hand Book, (2007), 6/e SAE Publications year.
2. K. Newton and W. Steeds, The motor vehicle, 13/e Butterworth-Heinemann Publishing Ltd. (year).
3. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications year.

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Mechanical Engineering

Course Code	Tool Design (Professional Elective-IV)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- To learn basic concepts, functions and design principles of Jigs, Fixtures and Dies
- Implement the tool design process when designing tooling for the manufacturing of a product.
- Evaluate and select appropriate materials for tooling applications.
- Design, develop and evaluate cutting tools and work holders for a manufactured product.
- Apply Geometric Tolerancing principles in the designs of tooling.

Course Outcomes (CO):

- Design mechanical components with economical consideration .
- Select materials and machining processes.
- Identify the necessity for redesigning components out of manufacturing considerations.
- Consider the manufacturing considerations while designing cast, forged weld and sheet metal components.
- Design plastic parts with manufacturing considerations.

UNIT - I

Design of single point cutting tools: Single point, cutting tools-various systems of specifications, geometry and their inter relation, theories of formation of chip and their effect, design of broach.

UNIT - II

Design of multipoint cutting tools: Drill geometry, Design of Drills, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speeds and feed-machining times-design-form cutters, combination tools, reamers etc.

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.

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.

Textbooks:

1. Tool Design, Donaldson, Lecain and Goold, TMH.
2. Principles of Metal cutting, A Bhattacharya, New Central Book Agency, Calcutta

Reference Books:

1. Production Engineering Design (Tool Design), Surendra Kenav and Umesh Chandra, Satyaprakashan, New Delhi 1994.
2. Design of Cutting Tools. Use of Metal Cutting Theory, Amitabh Bhattacharya and Inyong Ham, ASTME publication Michigan USA, 1969.
3. Fundamentals of Machining and Machine Tools, RK Singal and Others, I.K. International, 2008.
4. Metal Cutting Principles, Shaw, Oxford Univ. Press

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Mechanical Engineering

Course Code	Industrial Management (Professional Elective-IV)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- To understand the basic concepts of satellite communications, orbital mechanics and launchers, various subsystems of a satellite and earth station, multiple access techniques,low earth orbit and geo-stationary satellite systems.
- To apply frequency allocation standards, reliability techniques, multiple access techniques power test methods to satellite systems.
- To analyze satellite navigation and global positioning system.
- To design Uplink and Downlink of a satellite.

Course Outcomes (CO):

- Understand the orbital and functional principles of satellite communication systems
- Architect, interpret, and select appropriate technologies for implementation of specified satellite communication systems
- Analyze and evaluate a satellite link and suggest enhancements to improve the link performance. Select an appropriate modulation, multiplexing, coding and multiple access schemes for a given satellite communication link.
- Specify, design, prototype and test analog and digital satellite communication systems as per given specifications.

UNIT - I

Introduction: Concepts of Management and Organization – Functions of Management – Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs – Systems Approach to Management.

UNIT - II

Plant Location & Layout: Plant location, definition, factors affecting the plant location, comparison of rural and urban sites- methods for selection of plant- Matrix approach. Plant Layout – definition, objectives and types of plant layout.

UNIT - III

Work Study: Principles of Management- Management Tools – time and motion study, work simplification- process charts and flow diagrams, Production Planning, Specification of Production requirements.
Production Planning & Control: Introduction, functions of PPC , Scheduling.

UNIT - IV

Materials Management: Objectives, Inventory – functions, types, associated costs, inventory control techniques-ABC and VED analysis. Stores Management and Stores Records. Purchase management, duties of purchase of manager, associated forms. Introduction to MRP- Inputs to MRP, benefits, MRP-II

UNIT - V

Quality control: Meaning, process control, SQC control charts, single, double and sequential sampling, Introduction to TQM.
Job Evaluation and merit rating: Introduction-Job evaluation-objectives, benefits and limitations of job evaluation-methods of job evaluation: simple ranking system, grade description method, factor comparison method, point method-merit rating-objectives of job evaluation-methods of merit rating: Ranking method, paired comparison method, checklist method, graphic rating method, rating by result-requirements for success of merit rating system.

Textbooks:

- Khanna O.P.: Industrial Engineering
- T.R. Banga : Industrial Engineering and Management
- DR. Ravi Shankar: Industrial Engineering and management/Galgotia publications pvt. Ltd.

Reference Books:
• Sharma B.R: Environmental and Pollution Awareness. • Industrial engineering and operations management by S.K. Sharma and Savita Sharma

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Mechanical Engineering

Course Code	Non-Destructive Evaluation (Professional Elective-V)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- Introduce basic concepts of non destructive testing.
- Familiarize with characteristics of ultrasonic test.
- Describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- Explain the principles of Radiographic Inspection.
- Impart NDE and its applications in pressure vessels, casting and welded constructions.

Course Outcomes (CO):

- Explain various methods of non-destructive testing.
- Apply relevant non-destructive testing method for different applications.
- Outline the limitations and disadvantages of NDE.

UNIT - I

Introduction: An Overview, Factors influencing the Reliability of NDE, Defects in materials, Defects in composites. NDT methods used for evaluation of materials and composites.
Visual Inspection: Basic principle, types of visual testing , equipment used in visual inspection and applications.

UNIT - II

Liquid Penetrant Testing: Principle, scope. Equipment & test procedure , Tests stations, Advantages, types of penetrant and developers and their properties. Penetrant testing methods. Applications of liquid penetrant testing. Leak testing. Zyglo test.

UNIT - III

Radiographic Inspection: Principles of X – ray radiography, equipment, Absorption, Scattering, X-ray film processing, General radiographic procedures, Reading and Interpretation of Radiographs, Industrial radiographic practice, Limitations and Applications, Welding defects detection. Gamma ray radiography.

UNIT - IV

Ultrasonic Testing: Principle of wave propagation, Ultrasonic equipment, Variables affecting an ultrasound test, Basic methods: Pulse Echo and Through Transmission, Types of scanning.
Applications of UT: Testing of products, Welding Inspection, Tube Inspection, Thickness Measurement, inspection of castings, corrosion inspection, inspection of composite materials.

UNIT - V

Magnetic Particle Inspection: Methods of generating magnetic field, Demagnetization of materials, Magnetic particle test: Principle, Test Equipment and Procedure, Interpretation and evaluation.
Introduction to Accostic Emission Testing and Thermography (Basic principle, Procedure and applications only)
Eddy Current Testing: Principle of eddy current, Factors affecting eddy currents, Test system and test arrangement,advantages & disadvantages and Applications. Comparison and Selection of NDT Methods, Codes and Standards .

Textbooks:

1. Non-Destructive Testing by Baldev Raj et. al., Narosa Publishing House.
2. J Prasad, GCK Nair , Non destructive test and evaluation of Materials, Tata mcgraw-Hill Education Publishers, 2008.
3. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag, 1983.
4. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

Reference Books:

1. Non-Destructive Testing by P. Halmshaw
2. Metals Handbook Vol.II, Nondestructive inspection and quality control
3. Non-Destructive Testing by Warren J.Mcgomnagle, Mc Grawhill
4. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007.
5. ASTM Standards, Vol 3.01, Metals and alloys

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Mechanical Engineering

Course Code	Solar Energy Systems (Professional Elective-V)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

The main objectives of this course are to make the student

- Familiarize with basics of solar radiation, available solar energy and its measurement.
- Familiarize with solar collectors, construction and operation of solar collectors.
- Understand solar energy conversion systems, applications and power generation.
- Learn the principles PV technology and techniques of various solar cells/ materials for energy conversion
- Know the advance current technology of the solar energy systems for making the process economical, environmentally safe and sustainable.

Course Outcomes (CO):

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

- Gain Knowledge on basic concepts of solar radiation and solar collectors
- Illustrate design and operation of solar heating and cooling systems
- Discuss the principles of solar thermo photovoltaics
- Analyze the performance of a solar cell array system
- Explain Passive heating concepts and passive cooling concepts

UNIT - I

Solar radiation and collectors: Solar angles – Sun path diagrams – Radiation - extra terrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods-evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.

UNIT - II

Solar thermal technologies: Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying.

UNIT - III

Solar PV fundamentals: Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics.

UNIT - IV

SPV system design and applications: Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

UNIT - V

Solar passive architecture: Thermal comfort - bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - Radiative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – Energy efficient landscape design - thermal comfort.

Textbooks:

1. Goswami D.Y., Kreider, J. F. and Francis., "Principles of Solar Engineering', Taylor and Francis, 2000.
2. Chetan Singh Solanki, "Solar Photovoltatics – Fundamentals, Technologies and Applications", PHI Learning Private limited, 2011.
3. Sukhatme S.P.,. Nayak.J.P, 'Solar Energy – Principle of Thermal Storage and collection", Tata McGraw Hill, 2008.
4. Solar Energy International, "Photovoltaic – Design and Installation Manual" – New Society Publishers, 2006.
1. Roger Messenger and Jerry Vnetre, "Photovoltaic Systems Engineering", CRC Press, 2010.

Reference Books:

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

- Gain Knowledge on basic concepts of solar radiation and solar collectors
- Illustrate design and operation of solar heating and cooling systems
- Discuss the principles of solar thermo photovoltaics
- Analyze the performance of a solar cell array system

1. Explain Passive heating concepts and passive cooling concepts

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Mechanical Engineering

Course Code	Mechanical Behavior of Materials (Professional Elective-V)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- Explain the structure of material over the effects of mechanical properties.
- Familiarize the defects inside the structure and their effects on the mechanical properties.
- Train the methods for characterization of the mechanical behavior of materials.
- Impart knowledge about strengthening mechanisms of materials.
- Teach mechanisms of failures of materials (fracture, fatigue and creep) and their relationship with the different types of stress.

Course Outcomes (CO):

- After successful completion of this course, the student will be able to
- Apply materials based on their structure and failure modes.
- Characterize materials using different machines.
- Summarize the various strengthening mechanisms with suitable examples.
- Identify the creep in different materials and its influence in selection of materials.

UNIT - I

Elastic and plastic behaviour: Elastic behaviour of materials – Hooke's law, plastic behavior: dislocation theory – Burger's vectors and dislocation loops, dislocations in FCC, HCP and BCC lattice, stress fields and energies of dislocations, forces on and between dislocations, slip and twinning.

UNIT - II

Strengthening mechanisms: Cold Working, Grain Size Strengthening, Solid Solution Strengthening, Martensitic Strengthening, Precipitation Strengthening, Dispersion Strengthening, Fibre Strengthening, Examples. Yield Point Phenomenon, Strain aging and dynamic strain aging.

UNIT - III

Fracture and fracture mechanics: Types of Fracture, Basic Mechanism of Ductile and Brittle Fracture, Griffith's Theory Of Brittle Fracture, Ductile to Brittle Transition Temperature (DBTT), Factors Affecting DBTT, Determination of DBTT. Fracture Mechanics-Introduction, Modes of Fracture, Stress Intensity Factor, Strain Energy Release Rate, Fracture Toughness and Determination of K_{IC}.

UNIT - IV

Fatigue behaviour and testing: Stress Cycles, S-N Curves, Effect of Mean Stress, Factors Affecting Fatigue, Structural Changes Accompanying Fatigue, Cumulative Damage, HCF / LCF, Thermo-mechanical Fatigue, Application of Fracture Mechanics to Fatigue Crack Propagation, Fatigue Testing Machines.

UNIT - V

Creep behaviour and testing: Creep Curve, Stages In Creep Curve And Explanation, Structural Changes During Creep, Creep Mechanisms, Metallurgical Factors Affecting Creep, High Temperature Alloys, Stress Rupture Testing, Creep Testing Machines.

Textbooks:

1. Dieter, G.E., "Mechanical Metallurgy", McGraw-Hill, SI Edition, 1995.
2. Davis. H. E., Troxell G.E., Hauck.G. E. W., "The Testing Of Engineering Materials", McGraw-Hill, 1982.

Reference Books:

1. Wulff, The Structure and Properties of Materials, Vol. III "Mechanical Behavior of Materials", John Wiley and Sons, 1983.
2. Honey Combe R. W. K., "Plastic Deformation of Materials", Edward Arnold Publishers, 1984.
3. Suryanarayana, A. V. K., "Testing of Metallic Materials", Prentice Hall India, 1979.

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Mechanical Engineering

Course Code	MANAGEMENT SCIENCE (Humanities Elective-I)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

The objectives of this course are

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

Course Outcomes (CO):

- Understand the concepts & principles of management and designs of organization in a practical world
- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

UNIT - I **INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - importance of Management. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles – Abraham Maslow's hierarchy theory of needs - Organisational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

UNIT - II **OPERATIONS MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control - Deming's contribution to Quality.

Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Functions of Marketing - Marketing Mix - Channels of Distribution - Marketing Strategies based on Product Life Cycle..

UNIT - III **HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment- Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.

UNIT - IV **STRATEGIC & PROJECT MANAGEMENT**

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis -Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

UNIT - V **CONTEMPORARY ISSUES IN MANAGEMENT**

The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re- engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Textbooks:

1. A.R Aryasri, "Management Science", TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

Reference Books:

1. Koontz &Weihrich, “Essentials of Management”, 6th edition, TMH, 2005.
2. Thomas N.Duening& John M.Ivancevich, “Management Principles and Guidelines”, Biztantra.
3. Kanishka Bedi, “Production and Operations Management”, Oxford University Press, 2004.
4. Samuel C.Certo, “Modern Management”, 9th edition, PHI, 2005

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Mechanical Engineering

Course Code	ENTREPRENEURSHIP & INCUBATION (Humanities Elective-I)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

The objectives of this course are

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

Course Outcomes (CO):

- Understand the concept of Entrepreneurship and challenges in the world of
- competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur/women
- Entrepreneurs.
- Evaluate the role of central government and state government in promoting
- Entrepreneurship.
- Create and design business plan structure through incubations.

UNIT - I

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurialmindset and personality - Recent trends in Entrepreneurship

UNIT - II

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors

UNIT - III

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

UNIT - IV

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations

UNIT - V

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

Textbooks:

1. D F Kuratko and T V Rao, "Entrepreneurship" - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)
2. 2 . Nandan H, " Fundamentals of Entrepreneurship", PHI, 2013

Reference Books:
1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012. 2. Rajeev Roy "Entrepreneurship", 2nd Edition, Oxford, 2012. 3. B.Janakiramand M.Rizwana‖ "Entrepreneurship Development: Text &Cases", Excel Books, 2011. **4.** Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

Sri Krishnadevaraya University College of Engineering & Technology
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Mechanical Engineering

Course Code	ORGANISATIONAL BEHAVIOUR (Humanities Elective-I)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

The objectives of this course are

- To make the student understand about the organizational behavior
- To enable them to develop self motivation, leadership and management
- To facilitate them to become powerful leaders
- Impart knowledge about group dynamics
- To make them understand the importance of change and development

Course Outcomes (CO):

- Understand the nature and concept of Organizational behavior
- Apply theories of motivation to analyze the performance problems
- Analyze the different theories of leadership
- Evaluate group dynamics
- Develop as powerful leader

UNIT - I

Organizational Behavior - Introduction to OB - Meaning and definition, scope - Organizing Process – Making organizing effective - Understanding Individual Behavior – Attitude - Perception - Learning - Personality Types

UNIT - II

Motivation and Leading - Theories of Motivation - Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Leading - Leading Vs Managing

UNIT - III

Leadership and Organizational Culture and Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management - Evaluating Leader - Women and Corporate leadership

UNIT - IV

Group Dynamics - Types of groups - Determinants of group behavior - Group process – GroupDevelopment - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization – Conflict resolution

UNIT - V

Organizational Change and Development - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

Textbooks:

1. Luthans, Fred, "Organisational Behaviour" , McGraw-Hill, 12 Th edition 2011 2. P Subba Rao, Organisational Behaviour, Himalya Publishing House 2017

Reference Books:

1. McShane, "Organizational Behaviour", TMH 2009
2. Nelson, "Organisational Behaviour", Thomson, 2009.
3. Robbins, P.Stephen, Timothy A. Judge, "Organisational Behaviour", Pearson 2009.
4. Aswathappa, "Organisational Behaviour", Himalaya, 2009

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Mechanical Engineering

Course Code	(Skill Oriented Course-IV) MAT LAB	L	T	P	C
		3	0	0	3

III Year 2nd Semester

Course Objectives:

- Introduce basics of MATLAB
- Familiarize the fundamentals of optimization
- Explain single variable optimization using various methods
- Implement multi variable optimization using various methods
- Train various evolutionary algorithms.

Course Outcomes (CO):

After completion of this course the student can be able to

- Use optimization terminology and concepts, and understand how to classify an optimization problem.(L4)
- Apply optimization methods to engineering problems.
- Implement optimization algorithms.
- Compare different genetic algorithms.
- Solve multivariable optimization problems.

Introduction to MAT LAB: Overview, MATLAB Preliminaries, Basics of MATLAB, Beyond the Basics of MATLAB, Popular Functions and Commands, Plotting using MATLAB, Optimization with MATLAB.

Single Variable Optimization: Finite difference method, Central difference method, Runge-Kutta method, interval halving method, golden section method with MATLAB code.

Multi Variable Optimization: Conjugate gradient method, Newton's method, Powell's method, Flectcher-Reeves method, Hook and Jeeves method, interior penalty function with MATLAB code.

Evolutionary Algorithms: Overview, Genetic Algorithms: Basics of Genetic Algorithms, Options in MATLAB, Multi Objective Optimization using Genetic Algorithms, Ant Colony Optimization, Simulated Annealing, Particle Swarm Optimization.

Textbooks:

4. 1.Rao V.Dukkipati, MATLAB: An Introduction with Applications, Anshan, 2010.
5. Achille Messac, Optimization in practice with MATLAB, Cambridge University Press, 2015.
6. Jasbir S Arora, Introduction to optimum design, 2/e. Elsevier, 2004.

Reference Books:

3. Cesar Perez Lopez, MATLAB Optimization Techniques, Academic press, Springer publications, 2014.
4. Steven C.Chapra, Applied Numerical Methods with MATLAB for Engineers and scientists, 4/e, McGraw-Hill Education, 2018.

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Mechanical Engineering

Open Electives offered by Dept. of Mech. Engineering (Offered to other Departments)

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Mechanical Engineering

Open Electives offered by Dept. of Mech. Engineering (Offered to other Departments)

1. Manufacturing Process
2. IC Engines
3. Automobile Engineering
4. Non-Conventional Sources of Energy
5. Non-Destructive Evaluation
6. Workshop Technology
7. Total Quality Management
8. Basic Thermodynamics.
9. Robotics

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Mechanical Engineering

Course Code	Manufacturing Process	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

- Working principle of different metal casting processes and gating system.
- Classification of the welding processes, working of different types of welding processes and welding defects.
- Nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Principles of forging, tools and dies, working of forging processes.
- Classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy.

Course Outcomes (CO):

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

- Demonstrate different metal casting processes and gating systems.
- Classify working of various welding processes.
- Evaluate the forces and power requirements in rolling process.
- Apply the principles of various forging operations.
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy.
- Identify different unconventional processes and their applications.

UNIT - I

Introduction: Importance and selection of manufacturing processes.
Casting Processes: Introduction to casting process, process steps; pattern: types, materials and allowance; Cores: , gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: investment casting, die casting, centrifugal casting, casting defects.

UNIT - II

Metal Forming: Introduction, nature of plastic deformation, hot and cold working of metals,Rolling: Principle, types of rolling mill and products,
Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion,
Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: sheet metal working, blanking, piercing, bending, stamping.

UNIT - III

Metal Joining Processes: Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, submerged arc welding, gas tungsten arc welding, gas metal arc welding. applications, advantages and disadvantages of the above processes, Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes.

UNIT - IV

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, injection molding, blow molding
Ceramics: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.
Powder Metallurgy: Principle, manufacture of powders, steps involved.

UNIT - V

Unconventional Machining Processes: Electrical discharge machining (EDM), principle and processes parameters, electro-chemical machining (ECM) Laser beam machining (LBM), and electron beam machining Principles, water jet machining, ultrasonic machining

Textbooks:

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

1. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
3. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st Edition, Springer, 2010.

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Mechanical Engineering

Course Code	IC Engines	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

- Impart the knowledge of IC engines and its components.
- Demonstrate the working of petrol engines and diesel engines.
- Trains about how combustion takes place in the IC engines.
- Explains how the fuels are rated and how to assess the performance of the engines.

Course Outcomes (CO):

- Identify different parts of an IC engine.
- How valves and ports are opened and closed in the IC engines
- Comparisons of cycles used in the IC engines.
- Explain how BP and IP of the IC engines is determined.

UNIT - I

I.C.Engines: Energy conversion– basic engine components - Working principle of two stroke and four stroke engines - comparison of two stroke and four stroke, SI and CI engines – Classification of I.C. Engines, application of I.C Engines.

UNIT - II

Power Cycles: Carnot cycle, Air standard cycles -Description and representation of Otto cycle, Diesel cycle & Dual cycles on P–V and T-S diagram -Thermal Efficiency – Simple problems on Otto, Diesel and Dual cycles

UNIT - III

Engine Systems: Working principle of Magneto & Battery Ignition System - Simple Carburetor – Common rail fuel Injection System
Engine Performance Parameters

UNIT - IV

Engine Cooling System-Air & Thermostat cooling system - Petrol & Pressure Lubrication system.
Super Charging: Introduction, advantages and limitations of supercharging.

UNIT - V

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.SI Engine-Combustion Chambers, requirements, types - Rating of S.I Engine fuels.
CI Engine-Combustion chambers (DI & IDI), requirements, types- Rating of C.I Engine fuels.

Textbooks:

I.C. Engines / V. GANESAN- TMH
2. Thermal Engineering / R.K Rajput / Lakshmi Publications.

Reference Books:

I.C Engines – Mathur & Sharma – Dhanpath Rai & Sons.
2. Engineering fundamentals of I.C Engines – Pulkrabek / Pearson /PHI

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Mechanical Engineering

Course Code	Automobile Engineering	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

- Impart the knowledge of vehicle structure and its components.
- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

Course Outcomes (CO):

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

- Identify different parts of automobile.
- Explain the working of various parts like engine, transmission, clutch, brakes.
- Describe the working of steering and the suspension systems.
- Summarize the environmental implications of automobile emissions.
- Outline the future developments in the automobile industry.

UNIT - I

Introduction to vehicle structure and engine components: Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves.

UNIT - II

Lubrication system - Types - Oil pumps - Filters - Cooling system - Types - Water pumps - Radiators - Thermostats - Anti-freezing compounds.

Ignition, fuel supply and emission control system: Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - -

UNIT - III

Automobile Emissions - Source of formation – Effects on human health and environment - Control techniques - Exhaust Gas Recirculation (EGR) - Catalytic converter - Emission tests and standards (Indian and Europe) .

UNIT - IV

Transmission system: Clutches - Function - Types - Single plate, Multiple plate and Diaphragm Clutch – Fluid coupling - Gearbox - Manual - Sliding - Constant - Synchromesh - Overdrive – Automatic transmission - Universal joint - Propeller shaft -Differential

UNIT - V

Steering, suspension and braking system: Principle of steering - Steering Geometry and wheel alignment Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - Brakes - Needs – Classification –Drum and Disc Mechanical

Textbooks:

1. William.H.Crouse, Automotive Mechanics, 10/e Edition, McGraw-Hill, (2006).
2. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, (2009).
3. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International (2004).

Reference Books:

1. Bosch, Automotive Hand Book, (2007), 6/e SAE Publications year.
2. K. Newton and W. Steeds, The motor vehicle, 13/e Butterworth-Heinemann Publishing Ltd. (year).
3. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications year.

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Mechanical Engineering

Course Code	Non-Conventional Sources of Energy	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

The main objectives of this course are to make the student

- Familiarize with basics of solar radiation, available solar energy and its measurement.
- Familiarize with solar collectors, construction and operation of solar collectors.
- Understand solar energy conversion systems, applications and power generation.

Course Outcomes (CO):

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

- Gain Knowledge on basic concepts of solar radiation and solar collectors
- Design of a community Biogas plant
- Know solar heating/cooling technique, solar distillation and drying.

UNIT - I

Principles of Solar Radiation : Introduction - solar constant - Role and potential of new and renewable source, Environmental impact of solar power, physics of the sun, instruments for measuring solar radiation .

UNIT - II

Solar Energy Collectors : Introduction – type - Flat plate and concentrating (Parabolic) collectors - Merits & Demerits of Flat plate and Concentrating (Parabolic) Collectors.

UNIT - III

Solar Energy Storage and Applications: Introduction - Different methods - Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion- photovoltaic

UNIT - IV

Wind Energy: Introduction – Basic Principle of wind energy conversion - Basic components – classification – Horizontal & Vertical Axis wind mill – Merit & demerits. Wind energy collectors advantages, disadvantages.

UNIT - V

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Geothermal Energy: Introduction – nature of geothermal fields – geothermal sources – merits and demerits-applications.

Ocean Energy: Introduction – OTEC – Energy from Tides – components – Operating methods – Ocean waves – wave energy conversion devices.

Biomass: Principles of Bio-Conversion - Anaerobic/Aerobic Digestion – Design of a community Biogas plant for a village-classification of biomass gasifiers- up draught, down draught & cross draught gasifiers.

Textbooks:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Renewable Energy Sources /Twidell & Weir.
3. Non-Conventional Energy Sources /G.D. Rai

Reference Books:

1. Solar Energy /Sukhatme.
2. Solar Power Engineering / B.S Magal Frank Kreith & J.F Kreith

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Mechanical Engineering

Course Code	Non-Destructive Evaluation	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

- Introduce basic concepts of non destructive testing.
- Familiarize with characteristics of ultrasonic test.
- Describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- Explain the principles of Radiographic Inspection.
- Impart NDE and its applications in pressure vessels, casting and welded constructions.

Course Outcomes (CO):

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

- Explain various methods of non-destructive testing.
- Apply relevant non-destructive testing method for different applications.
- Outline the limitations and disadvantages of NDE.

UNIT - I

Introduction: An Overview, Factors influencing the Reliability of NDE, Defects in materials, Defects in composites. NDT methods used for evaluation of materials and composites.
Visual Inspection: Basic principle and applications.

UNIT - II

Liquid Penetrant Testing: Principle, scope. Equipment & techniques, Tests stations, Advantages, types of penetrant and developers. Illustrative examples – Heavy castings of large size, frame of jet engine, porosity testing of nickel alloys, leak testing. Zyglo test.

UNIT - III

Radiographic Inspection: Principles of X – ray radiography, equipment, Absorption, Scattering, X-ray film processing, General radiographic procedures, Reading and Interpretation of Radiographs.

UNIT - IV

Ultrasonic Testing: Principle of wave propagation, Ultrasonic equipment, Basic methods: Pulse Echo and Through Transmission, Types of scanning.
Applications of UT: Testing of products, Welding Inspection, Tube Inspection, Thickness Measurement, Elastic Constant Determination.

UNIT - V

Magnetic Particle Inspection: Methods of generating magnetic field, Demagnetization of materials, Magnetic particle test: Principle, Test Equipment and Procedure.
Eddy Current Testing: Principle of eddy current, Factors affecting eddy currents, Test system and test arrangement, Standardization and calibration, Application and effectiveness.

Textbooks:

1. Non-Destructive Testing by Baldev Raj et. al., Narosa Publishing House.
2. J Prasad, GCK Nair , Non destructive test and evaluation of Materials, Tata mcgraw-Hill Education Publishers, 2008.
3. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag, 1983.
4. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

Reference Books:

1. Non-Destructive Testing by P. Halmshaw
2. Metals Handbook Vol.II, Nondestructive inspection and quality control
3. Non-Destructive Testing by Warren J.Mcgomnagle, Mc Grawhill
4. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007.
5. ASTM Standards, Vol 3.01, Metals and alloys

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Mechanical Engineering

Course Code	Workshop Technology	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

- To impart basic knowledge of casting processes
- To impart basic knowledge of fabrication processes
- To impart basic knowledge of milling,Lathe and Drilling processes

Course Outcomes (CO):

- Gain the knowledge of various casting processes
- Know the fabrication processes
- Identify the various operations on lathe,milling, drilling.

UNIT - I

Casting Process: Casting, casting terms, pattern materials, types of patterns, pattern allowances, color code for patterns, Molding sands, core sands, properties of moldings and its ingredients, different types of molding machines, use of chaplets, chills, riser and gating system.

UNIT - II

Fabrication Process: Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding - Gas metal arc welding

UNIT - III

Milling machine – Principles of working – specifications – classifications and principle features of milling machines – machining operations, Types and geometry of milling cutters– methods of indexing.

UNIT - IV

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

UNIT - V

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

Textbooks:

1. Hajra Choudhury,"Elements of Workshop Technology, Vol. I and II", Media Promoters Pvt. Ltd., Mumbai,
2. P.N. Rao,"Manufacturing Technology", Tata McGraw-Hill Publishing Limited,
3. Workshop Technology – Vol II, B.S. Raghuvamshi.
4. Production Technology by R.K Jain

Reference Books:

1. P.C. Sharma, "A text book of production technology", S.Chand and Company,
2. Begman, 'Manufacturing Process", John Wilely & Sons,
3. Manufacturing science by Amitab Ghosh and Ashok Kumr Mallik, Tata-McGraw-Hill Publications

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Mechanical Engineering

Course Code	Total Quality Management	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

- To understand the concept of Quality
- To understand the Implication of Quality on Business
- To Implement Quality Implementation Programs
- To have exposure to challenges in Quality Improvement Programs

Course Outcomes (CO):

- To realize the importance of significance of quality
- Manage quality improvement teams
- Identify requirements of quality improvement programs

UNIT - I

Basic Concepts : Evolution of total quality Management - Definition of quality - Comparison between traditional approach and TQM, Deming – Crosby – Juran - Taguchi, Ishikawa theories - Quality costs - Product quality Vs Service quality Strategic planning - Goal setting - Steps involved in strategic planning - TQM implementation.

UNIT - II

TQM Principles: Customer Satisfaction – Types of customers, customer supplier chain, Customer perception of quality customer feed back - Customer complaints - Customer retention - Service quality. Employee involvement – Employee motivation - Maslow's hierarchy of needs - Herzberg theory - Empowerment and team work.

UNIT - III

Basic Tools: Introduction to seven basic tools – Check sheets, histograms - Control charts, Pareto diagram - Cause and effect diagram – Stratification - Scatter diagrams.

UNIT - IV

Advanced Tools: Affinity diagram - Relations diagram - Tree diagram - Matrix diagram - Matrix data analysis diagram – Process decision program chart - Arrow diagram.

UNIT - V

.**Advanced QC tools:** Advanced QC tools like QFD - Root cause analysis - Taguchi method - Mistake proofing (poka-yoke) - Failure mode and effects analysis (FMEAs), failure mode and effects criticality analysis (FMECAs) and Fault tree analysis (FTAs) etc. - Quality Management Systems.

Textbooks:

Joel E. Rose, *Total Quality Management*, 2nd Edition, Kogan Page Ltd., USA 1993.
2. Srinath, L. S., *Reliability Engineering*, Affiliated East West Press, New Delhi 1995.

Reference Books:

Balagurusamy, E., *Reliability Engineering* Tata McGraw Hill publishing Co., New Delhi, 1984.
2. Greg Bound, et.al, *Beyond Total Quality Management towards the emerging paradigm*, McGraw Hill
3. Zeiri, *Total Quality Management for Engineers*, Wood Head Publishers, 1991

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Mechanical Engineering

Course Code	Basic Thermodynamics	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

- To introduce the concepts of heat, work, energy and governing rules for conversion of one form
- to other.
- To explain relationships between properties of matter and basic laws of thermodynamics.
- To teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To introduce the concept of available energy for maximum work conversion.
- To impart knowledge on steam properties.
- To impart knowledge on steam power cycles.

Course Outcomes (CO):

After completing the course, the student will be able to:

- Understand the importance of thermodynamic properties related to conversion of heat energy into work.
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.
- Utilize steam properties to design steam based components.
- Analyze thermodynamic relations and vapour power cycles.

UNIT - I

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics and Temperature measurement.
first law of thermodynamics, corollaries-perpetual motion machines of first kind, limitations of first law of thermodynamics.

UNIT - II

Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

UNIT - III

Clausius inequality - Concept of Entropy- entropy equation for different processes and systems. Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

UNIT - IV

Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry. Energy equation, Joule Thompson coefficient Clausius - Clapeyron equation.

UNIT - V

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Vapour power cycle, simple Rankine cycle, mean temp of heat addition, thermodynamic variables effecting efficiency, Rankine cycle – reheating and regeneration.

Textbooks:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

Reference Books:

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015

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Mechanical Engineering

Course Code	Robotics	L	T	P	C
		3	0	0	3

Open Elective for non-MECH Students

Course Objectives:

- The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.
- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students to understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

Course Outcomes (CO):

After completing the course, the student will be able to,

- To understand the basic components of robots.
- Differentiate types of robots and robot grippers.
- Model forward and inverse kinematics of robot manipulators.
- Analyze forces in links and joints of a robot.
- Programme a robot to perform tasks in industrial applications

UNIT - I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

UNIT - II

Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT - III

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric &stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors. Robot Applications in Manufacturing, welding, Assembly and Inspection.

UNIT - IV

Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.
Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT - V

Differential transformation and manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.
Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages.

Textbooks:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.
3. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey , Industrial Robotics — Mc Graw Hill, 1986.
4. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.

Reference Books:

1. Robotics / Fu K S/ McGraw Hill.
2. An Introduction to Robot Technology, / P. Coiffet and M. Chaironze / Kogam Page Ltd. 1983 London.

Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

HONOURS IN MECH

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Honors Degree in Mechanical Engineering

Note
1.A student can opt any Four subjects @ 4 credits per subject
2.Concerned BoS can add or delete the subjects as per the decision of the board.
3.Prerequisites to be defined by the board for each course.
4.Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each

S.No.	Course Code	Course Name	L	T	P	Credits
1.		Advanced Thermodynamics	3	1	0	4
2.		Advanced Manufacturing Methods	3	1	0	4
3.		Product Design	3	1	0	4
4.		Robotics Modeling Analysis & Control	3	1	0	4
5.		Computational Fluid Dynamics	3	1	0	4
6		Alternative Energy Sources for Automobiles	3	1	0	4
7		MOOC course (8 weeks duration)				2
8		MOOC course (12 weeks duration)				2

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Advanced Thermodynamics	L	T	P	C
		3	1	0	4

HONOURS IN MECH

UNIT - I

THERMODYNAMIC RELATIONS: Introduction-Helmhotz free energy function-Gibbs free energy function-coeffficient of volumetric expansion-isothermal compressibility-differential relation for U,H,G&FMasxwell re;;atopms. GENERALIZED RELATIONS: Generalized relation for Cp, Cv ,K, B-relations for internal energy and enthalpy-the various Tds equation-clapeyron equation-gas tables-enthalpy and internal energy- pressure ratiovolume ratio-change of entropy-Introduction to third law of thermodynamics.

UNIT - II

EXERGY: Introduction-availability of heat –availability of a closed system-availability function of the closed system-availability of steady flow system- availability function of open system. IRREVERSIBILITY: Introduction-irreversibility for closed and open system-steady flow process effectivenesssecond law analysis of the power plant

UNIT - III

NONREACTIVE GAS MIXTURES: Introduction-basic definitions for gas mixtures-PVT relations ship for mixtures of ideal gases-properties of mixtures of ideal gases-entropy change due to mixing – mixtures of perfect gases at different initial pressure and temperatures.

UNIT - IV

GAS SPOWER CYCLES: Introduction-air standard cycles-carnot cycle-ottocycle –disel cycle-dual cycles-comparison between Otto,Diesel, dual cycles-variations between the air standard Otto cycle and actual cycle-Sterlling cycle-Erickson cycle-Atkinson cycle-Brayton cycle- Lenoir cycle.

UNIT - V

VAPOUR POWER CYCLES: Introduction-the carnot vapor cycle-rankine cycle-effects of operation condition on efficiency-principles of increasing the thermal efficiency- method of increasing thermal efficiency

Books:

1. Advanced Thermodynamics:Van Wyllan, TMGH
2. Engineering Thermodynamics:P.K.Nag,TMGH
3. Advanced Thermodynamics:Ray & Sarao,Central Publishers.

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Advanced Manufacturing Modern Methods	L	T	P	C
		3	1	0	4

HONOURS IN MECH

Course Objectives:

- To make the students to understand the advanced manufacturing techniques evolved in manufacturing scenario.
- To learn about the advanced manufacturing techniquesUSM,AJM,ECM,CM,EDM,PM,EBM,LSB

Course Outcomes (CO):

- the applications of electron beam and laser beam in manufacturing environment, accuracy, machining speed and etc, with respect to all non-traditional machining processes.
- students are able to understand importance of non-traditional machining processes, features, classifications and applications of non-traditional methods.
- students are able to understand the processes of USM and AIM, process parameters, application and limitations.

UNIT - I

NEED FOR MODERN MANUFACTURING METHODS: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications. Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT - II

Ultrasonic machining - Elements of the process, mechanics of material removal, process parameters, applications and limitations. Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

UNIT - III

ELECTRO - CHEMICAL PROCESSES: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.
CMEMICAL MACHINING: Fundamentals of chemical machining- Principle of material removal-maskants - etchants- process variables, advantages and applications.

UNIT - IV

THERMAL METAL REMOVAL PROCESSES: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improve surface finish and machining accuracy - Applications of different processes and their limitations. PLASMA MACHINING: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

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 - process mechanics, parameters, applications and limitations.
LASER BEAM MACHINING: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Textbooks:

1. Advanced machining processes, VK Jain, Allied publishers.
2. Modern Machining Process , Pandey P.C. and Shah H.S., TMH

Reference Books:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984
2. Manufacturing Technology, Ka1pakzian,Pearson
3. Manufacturing processes for engineering materials by SeropeKalpakjian and Steven R Schmid.

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Product Design	L	T	P	C
		3	1	0	4

HONOURS IN MECH

Course Objectives:

- Competence with a set of tools and methods for product design and development.
- Confidence in your own abilities to create a new product.
- Awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).
- Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective.

Course Outcomes (CO):

- Use the Product Design and Development Process, as a means to manage the development of an idea from concept through to production.
- Employ research and analysis methodologies as it pertains to the product design process, meaning, and user experience.
- Apply creative process techniques in synthesizing information, problem-solving and critical thinking.
- Demonstrate and employ hand drawing and drafting principles to convey concepts.

UNIT - I

Introduction to product design- Product development -Examples of product development process-theories and methodologies-Product development teams- Product development planning process-Technical and business concerns. Understanding customer needs-Customer satisfaction -gathering customer needsOrganising and prioritizing customer needs.

UNIT - II

Establishing product function-Functional decomposition, Modeling process, Function trees, Creating function structure, Auguementation, Functional common basis.

UNIT - III

Product teardown and experimentation-Teardown process, Teardown methods, Post teardown reporting-Applications of product teardown.

UNIT - IV

Benchmarking and establishing engineering specifications- Benchmarking approach, examples, Support tools, Setting product specifications-Product portfolios architecture types, theory, platforms. Product architecture - Types and examples, Product modularity, Modular design and methods.

UNIT - V

Generating, selection and embodiment of concepts: Concept generation process, methodsBasic and advanced-Morphological analysis, Concept selection process, Factors, Design evaluation, Information quality, Feasibility-Basic and advanced methods, Concept embodiment: General process, advanced methods Modeling of product metrics: Model selection, Model preparation, Mathematical modeling, Construction of product models.

Textbooks:

Kevin N. Otto and Kristin L. Wood - Product Design Pearson Education 2001

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Robotics Modeling Analysis & Control	L	T	P	C
		3	1	0	4

HONOURS IN MECH

Course Objectives:

- To provide knowledge on the various robotic systems with the help of mathematical models.
- To introduce the control aspects of non-linear systems.
- To learn the concepts of non-linear observer design.

Course Outcomes (CO):

- The course gives the foundation for developing robotic systems, modeling and designing manipulators. It provides comprehensive discussion of problems of service robotics and tasks encountered in outdoor environment. Applications are industrial robots, remotely operated manipulators for space and under water operations, service robots in unstructured environment.

UNIT - I

Robotics: Definition, Classification of Robots - Geometric classification and Control classification, Laws of Robotics, Robot Components, Coordinate Systems, Power Source. Robot anatomy, configuration of robots, joint notation schemes, work volume, manipulator kinematics, position representation, forward and reverse transformations, homogeneous transformations in robot kinematics, D-H notations, kinematics equations, introduction to robot arm dynamics.

UNIT - II

Robot Simulation: Methods of robot programming, Simulation concept, Off-line programming, advantages of offline programming. Robot Applications: Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Limitation of usage of robots in processing operation. Robot cell design and control, Robot cell layouts-Multiple robots & Machine interference.

UNIT - III

Basics of Computer-Aided Process Control: Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer–Aided Process Control System Computer Aided Process–control Architecture: Centralized Control Systems, Distributed control Systems, Hierarchical Computer control Systems. Economics of Computer-Aided Process control. Benefits of using Computers in a Process control. Process related Interfaces: Analog Interfaces, Digital Interfaces, Pulse Interfaces, Standard Interfaces

UNIT - IV

Process Modelling for computerized Process control: Process model, Physical model, Control Model, Process modelling. Modelling Procedure: Goals Definition, Information Preparation, Model Formulation, Solution Finding, Results Analysis, Model Validation.

UNIT - V

Introduction to modeling and simulation: Introduction to modeling, Examples of models, modeling of dynamic system, Introduction to simulation, MATLAB as a simulation tool, Bond graph modeling,

Textbooks:

1. An Introduction to Robot Technology, by Coifet Chirroza, Kogan Page.
2. Robotics for Engineers, by Y. Koren, McGraw Hill.
3. Robotic: Control, Sensing, Vision and Intelligence, by Fu, McGraw Hill.
4. Introduction to Industrial Robotics, by Nagrajan, Pearson India.

Reference Books:

1. C. L. Smith, “Digital computer Process Control”, Ident Educational Publishers.
2. 2. C. D. Johnson, “Process Control Instrumentation Technology”, PHI.
3. Robert L. Woods, Kent L. Lawrence, “Modeling and simulation of dynamic systems”, Person, 1997.

Sri Krishnadevaraya University College of Engineering & Technology
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Mechanical Engineering

Course Code	Computational Fluid Dynamics	L	T	P	C
		3	1	0	4

HONOURS IN MECH

Course Objectives:

- The concepts of grid generation techniques for simple and complex domains to model fluid flow problems.
- The aspects of numerical discretization techniques such as finite volume and finite difference methods.
- The mathematical modeling of different classes of partial differential equations to show their impact on computational fluid dynamics.
- The characteristics of different turbulence models and numerical schemes for estimating the criteria of stability, convergence, and error of fluid flow problem.

Course Outcomes (CO):

Upon successful completion of this course you should be able to

- Demonstrate the methods of finite control volume and infinitesimal fluid element in both forms such as moving with the fluid and fixed in space solves governing equations.
- Develop the fundamental aspects of numerical discretization of the governing equations and differentiate the integral and differential forms of the governing flow equations suitable for computational fluid dynamics.
- Illustrate the CFD aspects of the hyperbolic, parabolic, and elliptic equations in aerodynamic and other physical problems for understanding mathematical behavior.
- Make use of range of influence and domain of dependence for low-subsonic, subsonic, supersonic, and hypersonic flows.
- Demonstrate the finite volume discretization and its general formulation of a numerical scheme in the finite volume method

UNIT - I

Introduction to Computational Fluid Dynamics and Principles of Conservation: Conservation of mass, linear momentum: Navier-Stokes equation, Conservation of Energy, General scalar transport equation, Reynolds transport theorem, Classification of Partial Differential Equations and Physical Behaviour: Elliptic, parabolic and hyperbolic partial differential equations

Approximate Solutions of Differential Equations: Error Minimization Principles, Approximate solutions of differential equations, variational approach, Weighted residual approach: trial function and weighting function, Essential and natural boundary conditions, Least square method, Galerkin's method, Rayleigh-Ritz method

UNIT - II

Fundamentals of Discretization: Pre-processing, Solution, Post processing, Finite Element Method, Finite difference method, Well posed boundary value problem, Conservativeness, Boundedness, Transportiveness, Finite volume method (FVM), 1-D steady state heat conduction without and with constant source term.

Finite Volume Method: FV Discretization of a 1-D steady state diffusion type problem, Composite material with position dependent thermal conductivity, Source term linearization, Implementation of boundary conditions, 1-D unsteady state diffusion problems: implicit, fully explicit and Crank-Nicholson scheme

UNIT - III

.**Solution techniques for systems of linear algebraic equations**: Elimination, Iteration and Gradient Search method, L-U decomposition technique, Tridiagonal matrix algorithm (TDMA):

Thomas algorithm Iteration methods: Generalized analysis of the iterative methods, Sufficient condition for convergence, Scarborough criteria of for convergence Relaxation methods, Preferential characteristics of iterative methods, Multigrid method, Line by line TDMA, Alternating direction implicit method, Gradient search methods: Steepest descent method, Conjugate gradient method

UNIT - IV

Discretization of Convection-Diffusion Equations: A Finite Volume Approach: Central difference scheme, Upwind scheme, Exponential scheme and Hybrid scheme, Power law scheme, Generalized convection-diffusion formulation, The concept of false diffusion, QUICK scheme.

Discretization of Navier Stokes Equations: Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variable approach, Staggered grid and Collocated grid, SIMPLE Algorithm, SIMPLER Algorithm

UNIT - V		
Introduction to Turbulence Modeling: Vorticity transport equation, Homogeneous turbulence and isotropic turbulence, Reynolds average Navier stokes (RANS) equation, Necessity of turbulence modeling, Turbulence model: Eddy viscosity, Mixing length, The κ-ε model, RNG κ-ε model, κ-ω model, Reynolds stress model (RSM),Large eddy Simulation (LES),Direct numerical simulation (DNS) **The basic structure of a CFD code**: Pre-processor, Solver and Postprocessor, User-defined-subroutines, Solution to some basic problems in heat transfer and fluid flow.		
Textbooks:		
1. Computational Fluid Dynamics, John Anderson, McGraw Hill Publication		
Reference Books:		
1. Computational Fluid Dynamics, Jiynan Tu, Butter Worth Henman. 1998 2. Computational Fluid and Heat Transfer, Anderson & Tannehill, Taylor & Francis Publication. 1997 3. Computational Methods for Fluid Dynamics, Joel H. Ferziger, Springer Publication. 2009 Computational Heat Transfer, Jaluria Y., Taylor and Francis Publication. 1996		

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Alternative Energy Sources for Automobiles	L	T	P	C
		3	1	0	4

HONOURS IN MECH

Course Objectives:

- To present a problem oriented in depth knowledge of Alternate fuel and energy system.
- To address the underlying concepts and methods behind alternate fuel and energy system.

Course Outcomes (CO):

- The student can identify different areas of alternate fuels and energy system.
- Can find the applications of all the areas in day to day life.

UNIT - I

Need for Alternative Fuels: Effects of constituents of Exhaust gas emission on environmental condition of earth (N2 , CO2, CO, NOx, SO2, O2) Pollution created by Exhaust gas emission in atmosphere. Green house effect, Factors affecting green house effect. Study of Global Carbon Budget, Carbon foot print and Carbon credit calculations. Emission norms as per Bharat Standard up to BS – IV and procedures for confirmation on production

UNIT - II

Bio Diesels: Base materials used for production of Bio Diesel (Karanji oil, Neemoil, Sunflower oil, Soyabeen oil, Musturd oil, Palm oil, Jatropha seeds). Process of separation of Bio Diesel. Properties Diesel blended with vegetable oil, and difference in performance of Engine.

UNIT - III

Hydrogen: Hydrogen as a substitute fuel. Study Properties, Sources and methods of Production of Hydrogen, Storage and Transportation of hydrogen. Also, the economics of Application and Advantages of hydrogen (Liquid hydrogen) as fuel for IC engine/ hydrogen car. Layout of a hydrogen car. Fuel Cells: Concept of fuel cells based on usage of Hydrogen and Methanol. Power rating, and performance. Heat dissipation, Layout of fuel cell vehicle.

UNIT - IV

Electric & Hybrid Vehicles: Layout of an electric vehicles, advantages & limitations. Systems components, electronic controlled systems, high energy and power density batteries. Types of hybrid vehicles.

UNIT - V

Solar Power: Solar cells for energy collection. Storage batteries, layout of solar powered automobiles. Advantages and limitations.

Textbooks:

1. Alternate Fuels by Dr. S. Thipse, Jaico Publications o “Automotive Emission Control” by Crouse, AND Anglin – McGraw Hill. o “Alternative Fuels Guidebook” by Bechtold R.. o SAE Paper nos. 840367, 841333, 841334. o
2. “Internal Combustion Engines” by Ganeshan – Tata McGraw Hill. o “Internal Combustion Engines” by Heywood John. o The properties and performance of modern alternative fuels” – SAE Paper no. 841210.

Reference Books:

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Minor Degree in Thermal Engineering

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Minor Degree in Thermal Engineering

Note

1.A student can opt any Four subjects @ 4 credits per subject
2.Concerned BoS can add or delete the subjects as per the decision of the board.
3.Prerequisites to be defined by the board for each course.
4.Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

S.No.	Course Code	Course Name	L	T	P	Credits
1.		Production Engineering	3	1	0	4
2.		Mechanical Technology	3	1	0	4
3.		Introduction to Thermodynamics	3	1	0	4
4.		Thermal Engineering	3	1	0	4
5.		Automobile Engineering	3	1	0	4
7		MOOC course (8 weeks duration)				2
8		MOOC course (12 weeks duration)				2

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Production Engineering	L	T	P	C
		3	0	0	3

MINOR IN MECH

Course Objectives:

- To impart basic knowledge of casting processes
- To impart basic knowledge of fabrication processes
- To impart basic knowledge of milling,Lathe and Drilling processes

Course Outcomes (CO):

- Gain the knowledge of various casting processes
- Know the fabrication processes
- Identify the various operations on lathe,milling, drilling.

UNIT - I

Casting Process: Casting, casting terms, pattern materials, types of patterns, pattern allowances, color code for patterns, Molding sands, core sands, properties of moldings and its ingredients, different types of molding machines, use of chaplets, chills, riser and gating system.

UNIT - II

Fabrication Process: Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding - Gas metal arc welding

UNIT - III

Milling machine – Principles of working – specifications – classifications and principle features of milling machines – machining operations, Types and geometry of milling cutters– methods of indexing.

UNIT - IV

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

UNIT - V

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

Textbooks:

5. Hajra Choudhury,"Elements of Workshop Technology, Vol. I and II", Media Promoters Pvt. Ltd., Mumbai,
6. P.N. Rao,"Manufacturing Technology", Tata McGraw-Hill Publishing Limited,
7. Workshop Technology – Vol II, B.S. Raghuvamshi.
8. Production Technology by R.K Jain

Reference Books:

4. P.C. Sharma, "A text book of production technology", S.Chand and Company,
5. Begman, 'Manufacturing Process", John Wilely & Sons,
6. Manufacturing science by Amitab Ghosh and Ashok Kumr Mallik, Tata-McGraw-Hill Publications

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Mechanical Technology	L	T	P	C
		3	0	0	3

MINOR IN MECH

Course Objectives:

- To introduce students to the Working of boilers.
- To impart knowledge on different types of condensors.
- To familiarize concepts of thermodynamic cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.
- To familiarize concepts of thermodynamic cycles used in air standard cycles

Course Outcomes (CO):

- Understand the working of steam boilers and condensers.
- Select condensers and cooling towers for different applications.
- Use T-s diagram in gas power cycles.
- To provide fundamental concepts of air standard cycles used in IC engines and gas turbines.
- Evaluate the relative performance of different steam turbines
- Select appropriate refrigerant for different applications.

UNIT - I

Classification - Working of Cochran and Babcock Wilcox Boilers - Modern High Pressure Boilers - Lamont, Loeffler and Benson Boilers.

UNIT - II

Steam Turbines - Impulse (De Laval) and Reaction Turbines. Internal Combustion (I.C) Engines - Working principle of petrol and Diesel Engines - Four stroke and two stroke Cycles.

UNIT - III

Refrigeration - Principle of Vapour Compression and Vapour absorption Systems - Refrigerants Air Conditioning - Terminology - Classifications - Summer Air Conditioning for Hot and Dry weather - Window Room Air Conditioniner.

UNIT - IV

Patterns - Basic principles of moulding - Simple examples of mould making - Making of Cast Iron - Crucible furnace and Cupola - Working principles - Casting defects.

UNIT - V

Principles of Welding - Fundamentals of Arc Welding - Gas Welding and Gas Cutting - Thermit Welding - Soldering and Brazing.

Textbooks:

1. Thermal Engineering, Mahesh V Rathore, Tata McGraw Hill 2017
2. Workshop Technology by Hazira chowdhary

Reference Books:

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Introduction to Thermodynamics	L	T	P	C
		3	0	0	3

MINOR IN MECH

Course Objectives:

- To introduce the concepts of heat, work, energy and governing rules for conversion of one form
- to other.
- To explain relationships between properties of matter and basic laws of thermodynamics.
- To teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To introduce the concept of available energy for maximum work conversion.
- To impart knowledge on steam properties.
- To impart knowledge on steam power cycles.

Course Outcomes (CO):

After completing the course, the student will be able to:

- Understand the importance of thermodynamic properties related to conversion of heat energy into work.
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.
- Utilize steam properties to design steam based components.
- Analyze thermodynamic relations and vapour power cycles.

UNIT - I

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics and Temperature measurement.
first law of thermodynamics, corollaries-perpetual motion machines of first kind, limitations of first law of thermodynamics.

UNIT - II

Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

UNIT - III

Clausius inequality - Concept of Entropy- entropy equation for different processes and systems. Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

UNIT - IV

Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry. Energy equation, Joule Thompson coefficient Clausius - Clapeyron equation.

UNIT - V -

Vapour power cycle, simple Rankine cycle, mean temp of heat addition, thermodynamic variables effecting efficiency, Rankine cycle – reheating and regeneration.

Textbooks:

3. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
4. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

Reference Books:

3. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
4. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015

Sri Krishnadevaraya University College of Engineering & Technology
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Mechanical Engineering

Course Code	Thermal Engineering	L	T	P	C
		3	1	0	4

MINOR IN MECH

Course Objectives:

- To introduce students to the Working of boilers.
- To impart knowledge on different types of condensors.
- To familiarize concepts of thermodynamic cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.
- To familiarize concepts of thermodynamic cycles used in air standard cycles.

Course Outcomes (CO):

- After completing this course, the students can
- Understand the working of steam boilers and condensers.
- Select condensers and cooling towers for different applications.
- Use T-s diagram in gas power cycles.
- To provide fundamental concepts of air standard cycles used in IC engines and gas turbines.
- Evaluate the relative performance of different steam turbines
- Select appropriate refrigerant for different applications.

UNIT - I

Steam Boilers : Classification based on Working principles –Mountings and Accessories – Boiler equivalent evaporation, efficiency. Draught: classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney.
Steam Condensers: Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency, cooling towers and types of cooling towers.

UNIT - II

ype of nozzles - gas and steam nozzles.Compressible flow through nozzle- condition for maximum discharge - Nozzle efficiency.
Steam Turbines - impulse turbine and reaction turbine – compounding of impulse turbines - velocity diagrams in impulse and reaction turbines.

UNIT - III

,Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles.

UNIT - IV

Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles.

UNIT - V

Refrigeration: Bell-Coleman cycle - vapour compression cycle, sub cooling and super heating-vapour absorption cycle, properties of common refrigerants.
Principles of Psychrometry and Air Conditioning: Psychometric properties, psychometric processes, summer and winter air conditioning systems

Textbooks:

1. Thermal Engineering, Mahesh V Rathore, Tata McGraw Hill 2017
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014

Sri Krishnadevaraya University College of Engineering & Technology
Ananthapuramu – 515 003 (A.P) India

Mechanical Engineering

Course Code	Automobile Engineering	L	T	P	C
		3	0	0	3

MINOR IN MECH

Course Objectives:

- Impart the knowledge of vehicle structure and its components.
- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

Course Outcomes (CO):

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

- Identify different parts of automobile.
- Explain the working of various parts like engine, transmission, clutch, brakes.
- Describe the working of steering and the suspension systems.
- Summarize the environmental implications of automobile emissions.
- Outline the future developments in the automobile industry.

UNIT - I

Introduction to vehicle structure and engine components: Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves.

UNIT - II

Lubrication system - Types - Oil pumps - Filters - Cooling system - Types - Water pumps - Radiators - Thermostats - Anti-freezing compounds.

Ignition, fuel supply and emission control system: Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - -

UNIT - III

Automobile Emissions - Source of formation – Effects on human health and environment - Control techniques - Exhaust Gas Recirculation (EGR) - Catalytic converter - Emission tests and standards (Indian and Europe) .

UNIT - IV

Transmission system: Clutches - Function - Types - Single plate, Multiple plate and Diaphragm Clutch – Fluid coupling - Gearbox - Manual - Sliding - Constant - Synchromesh - Overdrive – Automatic transmission - Universal joint - Propeller shaft -Differential

UNIT - V

Steering, suspension and braking system: Principle of steering - Steering Geometry and wheel alignment Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - Brakes - Needs – Classification –Drum and Disc Mechanical

Textbooks:

4. William.H.Crouse, Automotive Mechanics, 10/e Edition, McGraw-Hill, (2006).
5. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, (2009).
6. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International (2004).

Reference Books:

4. Bosch, Automotive Hand Book, (2007), 6/e SAE Publications year.
5. K. Newton and W. Steeds, The motor vehicle, 13/e Butterworth-Heinemann Publishing Ltd. (year).
6. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications year.