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

# Academic Regulations (R23) for B. Tech (Regular-Full time)
**(Effective for the students admitted into I year from the Academic Year 2023-24 onwards)**

## 1. Award of the Degree

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

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

(c) Programs offered by the College:

The following programs are offered at present as specializations for the B. Tech. course from 2023-2024.

| 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 |

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

## 3. Admissions

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

## 4. Program related terms

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

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Credit Definition:

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

***a) Academic Year:*** Two consecutive (one odd + one even) semesters constitute one academic year.
***b) Choice Based Credit System (CBCS):*** The CBCS provides a choice for students to select from the prescribed courses.

5. Semester/Credits:

i) A semester comprises 90 working days excluding mid-semester Examination and End Examination dates.An academic year is divided into two semesters.
ii) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.
iii) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

**6. Structure of the Undergraduate Programme**

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

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

**7. Course Classification:**

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

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

**8. Programme Pattern**

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

specializing in emerging areas within the chosen field of study.

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

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

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

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

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

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

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

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

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

## 9. Evaluation Process

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship &Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks. A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In the case of a mandatory course, he/she should secure 40% of the total marks.

Theory Courses

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

i) For the theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

ii) For practical subjects, the distribution shall be 30 marks for the Internal Evaluation and 70 marks for the End- Examination.

iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with

3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.

iv) If any subject has both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

**a) Continuous Internal Evaluation**

i) For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.

ii) Objective paper shall contain 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of question. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

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

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

iv) The first midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

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

For Example:

Marks obtained in first mid: 25 Marks obtained in second mid: 20

Final Marks: (25x0.8) + (20x0.2) = 24

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

Marks obtained in first mid: Absent Marks obtained in second mid: 25

Final Marks: (25x0.8) + (0x0.2) =20

**b) End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

i) There shall be 6 questions and all questions are compulsory.

ii) Question I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.

iii) There shall be 2 short answer questions from each unit.

a) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Students shall answer any one of them.

iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

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

i) The question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.

ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.

iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Students shall answer any one of them.

iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Practical Courses

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

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

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

d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

- Procedure: 20 marks
- Experimental work & Results: 30 marks
- Viva voce: 20 marks.

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

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

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

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and

20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

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

f) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

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

**10. Skill oriented Courses**

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

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

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

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

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

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

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

**11. Massive Open Online Courses (MOOCs):**

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

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

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

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

**12. Credit Transfer Policy**

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

i) The University shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
iii) The credit transfer policy will be applicable to the Professional & Open Elective courses only.
iv) The concerned department shall identify the courses permitted for credit transfer.
v) The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
vii) The university shall ensure no overlap of MOOC exams with that of the university examination schedule. In case of delay in results, the university will re-issue the marks sheet for such students.
viii) Students pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
ix) The institution shall submit the following to the examination section of the university:
a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
b) Undertaking form filled in by the students for credit transfer.
x) The universities shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

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

## 13. Academic Bank of Credits (ABC)

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

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

## 14. Mandatory Internships

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

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure a minimum of 40% of marks for successful completion. In case a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

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

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

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

**15. Guidelines for offering a Minor.**

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

i) The Minor program requires the completion of 12 credits in Minor stream chosen.

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

iii) Electives (minimum of 2 courses) to complete a total of 12 credits.

**Note:** A total of 4 (Four) Open Electives are offered in the curriculum. A student can complete the requirement for Minor by opting for the courses offered through various verticals/tracks under Open Electives.

**16. Guidelines for offering Honors.**

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is the best choice for academically excellent students having a good academic record and interest towards higher studies and research.

i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

ii) A student shall earn an additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).

iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.

iv) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under the Honors program.

v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.

viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for an Honors degree programme.

x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xi) Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

**Enrolment into Honors:**

i) Students of a Department/Discipline are eligible to opt for Honors program offered by the

same Department/Discipline

ii) The enrolment of students into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7.0 CGPA without any backlog subjects will be permitted to register for Honors.

iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

v) Honors are to be completed simultaneously with a Major degree program.

**Registration for Honors:**

i) The eligible and interested students shall apply through the Head of the Department (HOD) of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.

iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

iv) There is no fee for registration of subjects for Honors program offered offline at the respective institutions.

## 17. Attendance Requirements:

i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects.
b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.

iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.

vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

viii) For induction programme attendance shall be maintained as per AICTE norms.

## 18. Promotion Rules:

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

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

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

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

And in case a student is detained for want of credits for a particular academic year by ii) & iii) above,

the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

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

**19. Grading:**

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

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

**Structure of Grading of Academic Performance**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Award of Class:**

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

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

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

**20. With–holding of Results**

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

**21. Multiple Entry / Exit Option**

**a. Exit Policy:**

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

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

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

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

**b.** Entry Policy:

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

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

**22. Gap Year Concept:**

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for

the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

**23. Transitory Regulations**

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

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

**24. Minimum Instruction Days for a Semester:**

The minimum instruction days including exams for each semester shall be 90 days excluding mid semester examination and End Examination dates.

**25. Medium of Instruction:**

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

**26. Student Transfers:**

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

**27. General Instructions:**

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

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## Academic Regulations (R23) for B. Tech (Lateral Entry Scheme)
## (Effective for the students admitted into II year from the Academic Year 2024-25 onwards)

**1. Award of the Degree**

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

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

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

**3.** Minimum Academic Requirements

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

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

ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.
And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

**4. Course Pattern**

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

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

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

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

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| **SKUCET Curriculum** |
|---|
| **B. Tech Course Structure – R23** |
| **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 | 0-0-6-0 |
| 2 | | Career Counselling | MC | 2-0-2-0 |
| 3 | | Orientation to all branches -- career options, tools,etc. | MC | 3-0-0-0 |
| 4 | | Orientation on admitted Branch -- corresponding labs, tools and platforms | EC | 2-0-3-0 |
| 5 | | Proficiency Modules & Productivity Tools | ES | 2-1-2-0 |
| 6 | | Assessment on basic aptitude and mathematical skills | MC | 2-0-3-0 |
| 7 | | Remedial Training in Foundation Courses | MC | 2-1-2-0 |
| 8 | | Human Values & Professional Ethics | MC | 3-0-0-0 |
| 9 | | Communication Skills -- focus on Listening, Speaking, Reading, Writing skills | BS | 2-1-2-0 |
| 10 | | Concepts of Programming | ES | 2-0-2-0 |

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|---|---|---|---|---|---|
| Dept. of Mechanical Engineering | | | | | |
| I Year I Semester | | | | | |
| **S.No** | **Course Code** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Engineering Chemistry | BS&H | 3-0-0 | 3 |
| **2.** | | Linear Algebra & Calculus | BS&H | 3-0-0 | 3 |
| **3.** | | Basic Electrical & Electronics Engineering | ES | 3-0-0 | 3 |
| **4.** | | Engineering Graphics | ES | 1-0-4 | 3 |
| **5.** | | Introduction to Programming | ES | 3-0-0 | 3 |
| **6.** | | I.T. Workshop | BS&H | 0-0-2 | 1 |
| **7.** | | Electrical & Electronics Engineering Workshop | ES | 0-0-3 | 1.5 |
| **8.** | | Engineering Chemistry Lab | ES | 0-0-2 | 1 |
| **9** | | Introduction to Programming lab | ES | 0-0-3 | 1.5 |
| **10** | | NCC/NSS /Scouts & Guides/Community service | BS&H | 0-0-1 | 0.5 |
| | | | | **Total** | **20.5** |

| **Category** | **CREDITS** |
|---|---|
| Engineering Science Courses | 7.5 |
| Basic Science and Humanities | 12.5 |
| **TOTAL CREDITS** | **20.5** |

| Sri Krishnadevaraya University College of Engineering & Technology | | | | | |
|---|---|---|---|---|---|
| Dept. of Mechanical Engineering | | | | | |
| I Year II Semester | | | | | |
| **S.No** | **Course Code** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Communicative English | BS&H | 2-0-0 | 2 |
| **2.** | | Engineering Physics | BS & H | 3-0-0 | 3 |
| **3.** | | Differential Equations and Vector calculus | ES | 3-0-0 | 3 |
| **4.** | | Basic Civil & Mechanical Engineering | ES | 3-0-0 | 3 |
| **5.** | | Engineering Mechanics | PC | 3-0-0 | 3 |
| **6.** | | Communicative English Lab | BS& H | 0-0-2 | 1 |
| **7.** | | Engineering Physics Lab | BS& H | 0-0-2 | 1 |
| **8.** | | Engineering Workshop | ES | 0-0-3 | 1.5 |
| **9.** | | Engineering Mechanics Lab | PC | 0-0-3 | 1.5 |
| **10.** | | Health & Wellness, YOGA and Sports | BS&H | 0-0-1 | 0.5 |
| | | | | **Total** | **19.5** |

| **Category** | **CREDITS** |
|---|---|
| Basic Sciences and Humanities course | 7.5 |
| Engineering Science Courses | 7.5 |
| Professional Core Courses | 4.5 |
| **TOTAL CREDITS** | **19.5** |

| **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.** | | Numerical Methods & Transform Techniques | BS&H | 3-0-0 | 3 |
| **2.** | | Industrial Management | MGT | 2-0-0 | 2 |
| **3.** | | Thermodynamics | PC | 3-0-0 | 3 |
| **4.** | | Mechanics of Solids | PC | 1-0-4 | 3 |
| **5.** | | Material Science & Metallurgy | PC | 3-0-0 | 3 |
| **6.** | | Computer Aided Machine Drawing Lab | PC | 0-0-3 | 1.5 |
| **7.** | | Mechanic of Solids & Material Science Engineering Lab | PC | 0-0-3 | 1.5 |
| **8.** | | Internet of Things | SC | 0-1-2 | 2 |
| **9** | | Design Thinking & Innovation | BS&H | 0-1-2 | 2 |
| **10** | | Environmental Sciences | MC | 2-0-0 | - |
| | | | | **Total** | **21** |

| **Category** | **CREDITS** |
|---|---|
| Professional Core Courses | 12 |
| Basic Science and Humanities | 5 |
| Skill Oriented Course | 2 |
| Managemnet Course | 2 |
| **TOTAL CREDITS** | **20.5** |

| 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.** | | Universal Human Values-Understanding Harmony | BS&H | 2-1-0 | 3 |
| **2.** | | Complex Variables, Probability and Statistics | BS & H | 3-0-0 | 3 |
| **3.** | | Manufacturing Processes | PC | 3-0-0 | 3 |
| **4.** | | Fluid Mechanics & Hydraulic Machines | PC | 3-0-0 | 3 |
| **5.** | | Theory of Machines | PC | 3-0-0 | 3 |
| **6.** | | Manufacturing Processes Lab | PC | 0-0-3 | 1.5 |
| **7.** | | Fluid Mechanics & Hydraulic Machines Lab | PC | 0-03 | 1.5 |
| **8.** | | Soft Skills | SC | 0-1-2 | 2 |
| | | | | **Total** | **20** |

| **Category** | **CREDITS** |
|---|---|
| Basic Sciences and Humanities course | 6 |
| Skill Oriented Courses | 2 |
| Professional Core Courses | 12 |
| **TOTAL CREDITS** | **20** |

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|---|---|---|---|---|---|
| **Dept. of Mechanical Engineering** | | | | | |
| **III Year I Semester** | | | | | |
| **S.No** | **Course Code** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Machining Processes | PC | 3-0-0 | 3 |
| **2.** | | Thermal Engineering | PC | 3-0-0 | 3 |
| **3.** | | Metrology & Measurements | PC | 3-0-0 | 3 |
| **4.** | | 1. Refrigeration & Air Conditioning<br>2. Tool Design<br>3. Mechanical Behaviour of Materials | PE-1 | 3-0-0 | 3 |
| **5.** | | 1. Non Conventional Sources of Energy<br>2. Automobile Engineering<br>3. IC Engines | OE-1 | 3-0-0 | 3 |
| **6.** | | Thermal Engineering Lab | PC | 0-0-3 | 1.5 |
| **7.** | | Metrology & Measurements Lab | PC | 0-0-3 | 1.5 |
| **8.** | | Machine Tools Lab | SOC | 0-1-2 | 2 |
| **9.** | | Dynamics Lab | ES | 0-0-2 | 1 |
| **10.** | | Evaluation of Community Service Project | PR | - | 2 |
| **TOTAL** | | | | | **23** |

| **Category** | **CREDITS** |
|---|---|
| Professional core Courses | 12 |
| Professional Elective courses | 3 |
| Open Elective Course/Job oriented elective | 3 |
| Skill Enhancement course/soft skill course* | 1.5 |
| Engineering Science | 1.5 |
| Community Service Internship | 2 |
| **TOTAL CREDITS** | **23** |

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| **III Year II Semester** | | | | | |
| **S.No** | **Course Code** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Heat Transfer | PC | 3-0-0 | 3 |
| **2.** | | CAD/CAM | PC | 3-0-0 | 3 |
| **3.** | | Design of Machine Members | PC | 3-0-0 | 3 |
| **4.** | | 1. Introduction to Turbo Machinery<br>2. Operation Research<br>3. Smart Materials | PE-2 | 3-0-0 | 3 |
| **5.** | | 1. Non-Conventional Sources of Energy<br>2. Mechanics & Manufacturing Composite Materials<br>3. Introduction to Hybrid and Electric Vehicles | PE-3 | 3-0-0 | 3 |
| **6.** | | 1. Manufacturing Processes<br>2. Robotics<br>3. Electrical Vehicles | OE-2 | 3-0-0 | 3 |
| **7.** | | Heat Transfer Lab | PC | 0-0-3 | 1.5 |
| **8.** | | CAD/CAM Lab | PC | 0-0-3 | 1.5 |
| **9.** | | 3D Printing | SOC | 0-1-2 | 2 |
| **10.** | | Technical paper writing & IPR | AC | 2-0-0 | 0 |
| Industrial/Research Internship (Mandatory)for8 weeks duration during summer vacation | | | | | |
| **TOTAL** | | | | | **23** |

| **Category** | **CREDITS** |
|---|---|
| Professional core Courses | 12 |
| Professional Elective courses | 6 |
| Open Elective Course/Job oriented elective | 3 |
| Skill Enhancement course/soft skill course* | 2 |
| **TOTAL CREDITS** | **23** |

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| **IV Year I Semester** | | | | | |
| **S.No** | **Course Code** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Automobile Engineering | PC | 3-0-0 | 3 |
| **2.** | | Entrepreneurship & Incubation | MGT | 2-0-0 | 2 |
| **3.** | | 1. Finite Element Methods<br>2. Power Plant Engineering<br>3. Robotics | PE-4 | 3-0-0 | 3 |
| **4.** | | 1. Non-Destructive Testing<br>2. Smart Manufacturing<br>3. Total Quality Management | PE-5 | 3-0-0 | 3 |
| **5.** | | 1. Basic Thermodynamics<br>2. Workshop Technology<br>3. Operation Research | OE-3 | 3-0-0 | 3 |
| **6.** | | 1. Total Quality Management<br>2. Advanced Materials<br>3. 3D Printing Technologies | OE-4 | 3-0-0 | 3 |
| **7.** | | Drone Technologies | SOC | 0-1-2 | 2 |
| **8.** | | Gender Sensitization | AC | 2-0-0 | 0 |
| **9.** | | Evaluation of Industrial Internship | PR | - | 2 |
| **TOTAL CREDITS** | | | | | **21** |

| **Category** | **CREDITS** |
|---|---|
| Professional Core Courses | 3 |
| Management Course | 2 |
| Professional Elective courses | 6 |
| Open Elective Course/Job oriented elective | 6 |
| Skill Enhancement course/soft skill course* | 2 |
| Internship | 2 |
| **TOTAL CREDITS** | **21** |

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| **Dept. of Mechanical Engineering** | | | | | |
| **IV Year II Semester** | | | | | |
| **S.No** | **Course Code** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1. | | Internship | PR | - | 4 |
| 2. | | Project | PR | - | 8 |
| **Total** | | | | | 12 |

| **Category** | **CREDITS** |
|---|---|
| Internship | 4 |
| Project work | 8 |
| **TOTAL CREDITS** | **12** |

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|---|---|---|---|---|---|
| **Dept. of Mechanical Engineering** | | | | | |
| **Honors in Mechanical Engineering** | | | | | |
| S.No. | **CourseCode** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Automotive Thermal Systems | PC | 3-0-0 | 3 |
| **2.** | | Simulation and Modelling of Manufacturing Systems | PC | 3-0-0 | 3 |
| **3.** | | Supply Chain Management | PC | 3-0-0 | 3 |
| **4.** | | Advanced Mechanism Design | PC | 3-0-0 | 3 |
| **5.** | | Biomechanics | PC | 3-0-0 | 3 |
| **6.** | | Automotive Thermal Systems Lab | PC | 0-0-3 | 1.5 |
| **7.** | | Simulation and Modelling of Manufacturing Systems Lab | PC | 0-0-3 | 1.5 |
| | | | | **Total** | **18** |

| **Sri Krishnadevaraya University College of Engineering & Technology** | | | | | |
|---|---|---|---|---|---|
| **Dept. of Mechanical Engineering** | | | | | |
| **Minors in Mechanical Engineering** | | | | | |
| S.No. | **CourseCode** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | CAD/CAM | PC | 3-0-0 | 3 |
| **2.** | | Principles of Manufacturing Processes | PC | 3-0-0 | 3 |
| **3.** | | Fundamentals of Fluid Mechanics & Hydraulic Machines | PC | 3-0-0 | 3 |
| **4.** | | Basic Thermodynamics | PC | 3-0-0 | 3 |
| **5.** | | Robotics | PC | 3-0-0 | 3 |
| **6.** | | Fundamentals of Fluid Mechanics & Hydraulic Machines Lab | PC | 0-0-3 | 1.5 |
| **7.** | | CAD/CAM Lab | PC | 0-0-3 | 1.5 |
| | | | | **Total** | **18** |

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| **Dept. of Mechanical Engineering** | | | | | |
| **I Year I Semester** | | | | | |
| **S.No** | **Course Code** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Engineering Chemistry | BS&H | 3-0-0 | 3 |
| **2.** | | Linear Algebra & Calculus | BS&H | 3-0-0 | 3 |
| **3.** | | Basic Electrical & Electronics Engineering | ES | 3-0-0 | 3 |
| **4.** | | Engineering Graphics | ES | 1-0-4 | 3 |
| **5.** | | Introduction to Programming | ES | 3-0-0 | 3 |
| **6.** | | I.T. Workshop | BS&H | 0-0-2 | 1 |
| **7.** | | Electrical & Electronics Engineering Workshop | ES | 0-0-3 | 1.5 |
| **8.** | | Engineering Chemistry Lab | ES | 0-0-2 | 1 |
| **9** | | Introduction to Programming lab | ES | 0-0-3 | 1.5 |
| **10** | | NCC/NSS /Scouts & Guides/Community service | BS&H | 0-0-1 | 0.5 |
| | | | | **Total** | **20.5** |

| **Category** | **CREDITS** |
|---|---|
| Engineering Science Courses | 7.5 |
| Basic Science and Humanities | 12.5 |
| **TOTAL CREDITS** | **20.5** |

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| Course Code | ENGINEERING CHEMISTRY (Common to Civil, Mechanical Engineering and allied branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

At the end of the course, the students will be able to
CO1: Demonstrate the corrosion prevention methods and factors affecting corrosion.
CO2: Explain the preparation, properties, and applications of thermoplastics & thermosetting, elastomers & conducting polymers.
CO3: Explain calorific values, octane number, refining of petroleum and cracking of oils.
CO4: Explain the setting and hardening of cement.
CO5: Summarize the concepts of colloids, micelle and nanomaterials.

**UNIT - I** **Water Technology**

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

**UNIT II** **Electrochemistry and Applications**

Electrodes –electrochemical cell, Nernst equation, cell potential calculations.
Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.
Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

**UNIT - III** **Polymers and Fuel Chemistry**

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization.
Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC Nylon 6,6 and Bakelite.
Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol rubbers.
Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number- alternative fuels- propane, methanol, ethanol and bio fuel-bio diesel.

**UNIT - IV** **Modern Engineering Materials**

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

| **UNIT - V** | **Surface Chemistry and Nanomaterials** | |
|---|---|---|

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

**Textbooks:**

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

**Reference Books:**

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

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

| Course Code | LINEAR ALGEBRA & CALCULUS (Common to All Branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

At the end of the course, the student will be able to
CO1: Develop and use of matrix algebra techniques that are needed by engineers for practical applications.
CO2: Utilize mean value theorems to real life problems.
CO3: Familiarize with functions of several variables which is useful in optimization.CO4: Learn important tools of calculus in higher dimensions.
CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

| UNIT - I | Matrices | |
|---|---|---|

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

| UNIT II | Eigenvalues, Eigenvectors and Orthogonal Transformation | |
|---|---|---|

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

| UNIT - III | Calculus | |
|---|---|---|

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

| UNIT - IV | Partial differentiation and Applications (Multi variable calculus) | |
|---|---|---|

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

| UNIT - V | Multiple Integrals (Multi variable Calculus) | |
|---|---|---|

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

**Textbooks:**

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

**Reference Books:**

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

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

| Course Code | BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to All branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

After the completion of the course students will be able to

**CO1:** Remember the fundamental laws, operating principles of motors, generators, MC and MIinstruments.

**CO2:** Understand the problem-solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.

**CO3:** Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.

**CO4:** Analyze different electrical circuits, performance of machines and measuring instruments.

**CO5:** Evaluate different circuit configurations, Machine performance and Power systems operation.

**PART A: BASIC ELECTRICAL ENGINEERING**

**UNIT I** — **DC & AC Circuits**

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

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

**UNIT II** — **Machines and Measuring Instruments**

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

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

**UNIT - III** — **Energy Resources, Electricity Bill & Safety Measures**

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

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

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

**Textbooks:**

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

**Reference Books:**

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019,Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford UniversityPress, 2017

Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications,2018, Second Edition.

**Web Resources:**

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

## PART B: BASIC ELECTRONICS ENGINEERING

**Course Objectives:**

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

### UNIT I SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics ofPN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

### UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

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

### UNIT III DIGITAL ELECTRONICS

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

**Textbooks:**

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

**Reference Books:**

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

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

| Course Code | ENGINEERING GRAPHICS (Common to All branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 4 | 3 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**UNIT - I**

**Introduction:** Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.
**Curves:** construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.
**Scales:** Plain scales, diagonal scales and vernier scales.

**UNIT II**

**Orthographic Projections**: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.
**Projections of Straight Lines:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the referenceplanes
**Projections of Planes:** regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

**UNIT - III**

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

**UNIT - IV**

**Sections of Solids:** Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.
**Development of Surfaces:** Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone

**UNIT - V**

**Conversion of Views**: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.
**Computer graphics**: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

| **Textbooks:** |
|---|
| 1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016<br>2. Engineering Drawing by K.L. Narayana & P. Kannaiah Tata Mcgrawhill Publications as textbook<br>3. Engineering Drawing - R.K. Dhawan, S Chand Publications |
| **Reference Books:** |
| 1. Engineering Drawing - K.R. Gopala Krishna, Subhas publications, as reference books .<br>2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.<br>3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, TataMcGraw Hill, 2017. |

| Course Code | INTRODUCTION TO PROGRAMMING (Common to All branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

| UNIT - I | Introduction to Programming and Problem Solving | |
|---|---|---|

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program-Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.
Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms

| UNIT II | Control Structures | |
|---|---|---|

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

| UNIT - III | Arrays and Strings | |
|---|---|---|

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

| UNIT - IV | Pointers & User Defined Data types | |
|---|---|---|

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

| UNIT - V | Functions & File Handling | |
|---|---|---|

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

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

| **Textbooks:** |
|---|
| 1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988<br>2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education,1996 |
| **Reference Books:** |
| 1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-HillEducation, 2008.<br>2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition<br>3. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad,CENGAGE, 3rd edition |

| Course Code | IT WORKSHOP (Common to all branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**PC Hardware** & Software Installation

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

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

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

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

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

**Internet & World Wide Web**

**Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

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

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

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

**LaTeX and WORD**

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

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

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

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

**EXCEL**

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

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

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

**LOOKUP/VLOOKUP**

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

**POWER POINT**

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

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

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

**AI TOOLS – ChatGPT**

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

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

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

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

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

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

**Reference Books**:

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

| Course Code | ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP (Common to All branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

**CO1:** Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
**CO2:** Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
**CO3:** Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
**CO4:** Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
**CO5:** Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
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**Activities:**

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

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

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

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

**PART A: ELECTRICAL ENGINEERING LAB**

**List of experiments:**

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

**Reference Books:**

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

**Note:** Minimum Six Experiments to be performed.

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## PART B: ELECTRONICS ENGINEERING LAB

**Course Objectives:**

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

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

**List of Experiments:**

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

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

**References:**

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

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

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

| Course Code | ENGINEERING CHEMISTRY LAB (Common to Civil, Mechanical Engineering & allied branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**I Year 1st Semester**

**Course Objectives:**

Verify the fundamental concepts with experiments.

**Course Outcomes (CO):**

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

**Experiments**

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

**Reference:**

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

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

| Course Code | INTRODUCTION TO PROGRAMMING LAB (Common to All Branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**List of Experiments:**

**UNIT I WEEK 1**

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

**Suggested Experiments/Activities:**

**Tutorial 1:** Problem-solving using Computers.

**Lab1:** Familiarization with programming environment

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

**WEEK 2**

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

**Suggested Experiments /Activities:**

**Tutorial 2:** Problem-solving using Algorithms and Flow charts.

**Lab 1:** Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

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

**WEEK 3**

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

**Suggested Experiments/Activities:**

**Tutorial 3:** Variable types and type conversions:

**Lab 3:** Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object.

**UNIT II WEEK 4**

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

**Suggested Experiments/Activities:**

**Tutorial4:** Operators and the precedence and as associativity:

**Lab4:** Simple computational problems using the operator' precedence and associativity

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

**WEEK 5**

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

**Suggested Experiments/Activities:**

**Tutorial 5:** Branching and logical expressions:

**Lab 5**: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

**WEEK 6**

**Objective:** Explore the full scope of iterative constructs namely while loop, do-while loop and
for loop in addition to structured jump constructs like break and continue including when eachof these statements is more appropriate to use.

**Suggested Experiments/Activities:**

**Tutorial 6:** Loops, while and for loops

**Lab 6:** Iterative problems e.g., the sum of series

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

**UNIT III WEEK 7:**

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

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

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

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

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

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

**UNIT IVWEEK 9:**
**Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array
and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

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

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

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

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

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

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

**Suggested Experiments/Activities:**

**Tutorial 11:** Functions, call by value, scope and extent,

**Lab 11:** Simple functions using call by value, solving differential equations using Eulers theorem.

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

**WEEK 12:**

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

**Suggested Experiments/Activities:**

**Tutorial 12:** Recursion, the structure of recursive calls

**Lab 12:** Recursive functions

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

**WEEK 13:**

**Objective:** Explore the basic difference between normal and pointer variables, Arithmeticoperations using pointers and passing variables to functions using pointers

**Suggested Experiments/Activities:**

**Tutorial 13:** Call by reference, dangling pointers

**Lab 13:** Simple functions using Call by reference, Dangling pointers.

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

**WEEK14:**

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

**Suggested Experiments/Activities:**

**Tutorial 14:** File handling

**Lab 14:** File operations

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

**Textbooks:**

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

**Reference Books:**

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

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

| Course Code | NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE (Common to All branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 1 | 0.5 |

**I Year 1st Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**UNIT I Orientation**

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

**Activities:**

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

**UNIT II Nature &Care Activities:**

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

**UNIT III Community**

**Service Activities:**

i) Conducting One Day Special Camp in a village contacting village-area leaders- Surveyin the village, identification of problems- helping them to solve via media- authorities-experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health,Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

**Reference Books:**



1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;.I, Vidya Kutir Publication, 2021 ( ISBN 978-81-952368-8-6)

2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, DirectorateGeneral of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering",McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to EnvironmentalEngineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

**General Guidelines:**

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

**Evaluation Guidelines:**

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

| Sri Krishnadevaraya University College of Engineering & Technology | | | | | |
|---|---|---|---|---|---|
| Dept. Civil Engineering | | | | | |
| I Year II Semester | | | | | |
| **S.No** | **Course Code** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Communicative English | BS&H | 2-0-0 | 2 |
| **2.** | | Engineering Physics | BS & H | 3-0-0 | 3 |
| **3.** | | Differential Equations and Vector calculus | ES | 3-0-0 | 3 |
| **4.** | | Basic Civil & Mechanical Engineering | ES | 3-0-0 | 3 |
| **5.** | | Engineering Mechanics | PC | 3-0-0 | 3 |
| **6.** | | Communicative English Lab | BS& H | 0-0-2 | 1 |
| **7.** | | Engineering Physics Lab | BS& H | 0-0-2 | 1 |
| **8.** | | Engineering Workshop | ES | 0-0-3 | 1.5 |
| **9.** | | Engineering Mechanics Lab | PC | 0-0-3 | 1.5 |
| **10.** | | Health & Wellness, YOGA and Sports | BS&H | 0-0-1 | 0.5 |
| | | | | **Total** | **19.5** |

| **Category** | **CREDITS** |
|---|---|
| Basic Sciences and Humanities course | 7.5 |
| Engineering Science Courses | 7.5 |
| Professional Core Courses | 4.5 |
| **TOTAL CREDITS** | **19..5** |

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | COMMUNICATIVE ENGLISH (Common to All Branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**I Year 2nd Semester**

**Course Objectives**:

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

**Course Outcomes (CO):**

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

UNIT - I

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

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

UNIT - II

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

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

UNIT - III

**Lesson: BIOGRAPHY: Elon Musk**

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

**UNIT IV**

**Lesson: INSPIRATION: The Toys of Peace by** Saki

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

**Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

**Writing:** Letter Writing: Official Letters, Resumes

**Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice

**Vocabulary:** Words often confused, Jargons

**UNIT V**

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

**Listening:** Identifying key terms, understanding concepts and answering a series ofrelevant questions that test comprehension.

**Speaking:** Formal oral presentations on topics from academic contexts

**Reading:** Reading comprehension.

**Writing:** Writing structured essays on specific topics.

**Grammar:** Editing short texts –identifying and correcting common errors in grammar andusage (articles, prepositions, tenses, subject verb agreement)

**Vocabulary:** Technical Jargons

**Textbooks:**

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

**Reference Books:**

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge,2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge UniversityPress, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building aSuperior Vocabulary. Anchor, 2014.

**Web Resources**:

GRAMMAR:

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

**VOCABULARY**

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

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

| Course Code | ENGINEERING PHYSICS (Common for all branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**I Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**UNIT - I** **Wave Optics**

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

**UNIT - II** **Crystallography and X-ray diffraction**

**Crystallography**: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.
1. **ray diffraction**: Bragg's law - X-ray Diffractometer – crystal structure determination byLaue's and powder methods

**UNIT - III** **Dielectric and Magnetic Materials**

**Dielectric Materials:** Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss
**Magnetic Materials:** Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

**UNIT - IV** **Quantum Mechanics and Free electron Theory**

**Quantum Mechanics:** Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.
**Free Electron Theory**: Classical free electron theory (Qualitative with discussion of merits anddemerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

| **UNIT - V** | **Semiconductors** |
|---|---|
| **Semiconductors:** Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications. | |
| **Textbooks:** | |
| 1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS ArunMurthy, S. Chand Publications, 11th Edition 2019.<br>2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015) | |
| **Reference Books:** | |
| 1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.<br>2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.<br>3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010<br>4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).<br>**Web Resources:** https://www.loc.gov/rr/scitech/selected-internet/physics.html | |

| Course Code | DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common for all branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**I Year 2nd 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 theminto advanced level by handling various real-world applications.

**Course Outcomes (CO):**

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

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

**UNIT - I** **Differential equations of first order and first degree**

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

**UNIT - II** **Partial Differential Equations**

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

**UNIT - III** **Dielectric and Magnetic Materials**

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

**UNIT - IV** **Vector differentiation**

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

**UNIT V** **Vector integration**

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

**Textbooks:**

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

**Reference Books:**

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

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

| Course Code | BASIC CIVIL AND MECHANICAL ENGINEERING (Common to All branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**I Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

After the completion of the course students will be able to

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

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

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

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

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

**PART A: BASIC CIVIL ENGINEERING**

**UNIT I**

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

**UNIT II**

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

**UNIT - III**

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

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

**Textbooks:**

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

**Reference Books:**

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

## PART B: BASIC MECHANICAL ENGINEERING

**Course Objectives:**

The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.

Provide an overview of different thermal and mechanical transmission systems andintroduce basics of robotics and its applications

**Course Outcomes:** On completion of the course, the student should be able toCO1: Understand the different manufacturing processes.

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

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

CO4: Describe the basics of robotics and its applications

| UNIT I | |
|---|---|
| **Introduction to Mechanical Engineering:** Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.<br>**Engineering Materials -** Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials. | |
| **UNIT II** | |
| **Manufacturing Processes:** Principles of Casting, Forming, joining processes, Machining.<br>**Thermal Engineering** – Introduction to Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, Components of Electric and Hybrid Vehicles. | |
| **UNIT III** | |
| **Power plants** – working principle of Steam, Diesel, Hydro, Nuclear power plants.<br>**Introduction to Robotics -** Joints & links, configurations, and applications of robotics. (Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject) | |

**Textbooks:**

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

**Reference Books:**

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, TataMcGraw Hill publications (India) Pvt. Ltd.
5. Elements of Mechanical Engineering, - Sadhu Singh, S Chand Publications,
6. Elements of Mechanical Engineering - R. K. Rajput, Laxmi Publications as textbooks.

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

| Course Code | ENGINEERING MECHANICS (Common to CIVIL & MECH. Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**I Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

CO1: Understand the fundamental concepts in mechanics and determine the frictional forces for bodies in contact.
CO2: Analyze different force systems such as concurrent, coplanar and spatial systems and calculate their resultant forces and moments.
CO3: Calculate the centroids, center of gravity and moment of inertia of different geometric shapes.
CO4: Apply the principles of work-energy and impulse-momentum to solve the problems of rectilinear and curvilinear motion of a particle.
CO5: Solve the problems involving the translational and rotational motion of rigid bodies.

**UNIT I**

Introduction to Engineering Mechanics – Basic Concepts. Scope and Applications Systems of Forces: Coplanar Concurrent Forces– Components in Space–Resultant–Moment of Force and its Application –Couples and Resultant of Force Systems. Friction: Introduction, limiting friction and impending motion, Coulomb'slaws of dry friction, coefficient of friction, Cone of Static friction.

**UNIT II**

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

**UNIT - III**

Centroid: Centroids of simple figures (from basic principles)–Centroids of Composite Figures. Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems.
Area Moments of Inertia: Definition– Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.
Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies.

**UNIT - IV**

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

**UNIT - V**

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

**Textbooks:**

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

**Reference Books:**

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

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**Mechanical Engineering**

| Course Code | COMMUNICATIVE ENGLISH LAB (Common to All Branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**I Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**List of Topics:**

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

**Suggested Software:**

- Walden Infotech
- Young India Films

**Reference Books:**


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


**Web Resources:**
**Spoken English:**

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured

8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

**Voice & Accent:**

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

https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | ENGINEERING PHYSICS LAB (Common to All Branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**I Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**List of Experiments:**

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

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

**References:**


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


**Web Resources**

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

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**Mechanical Engineering**

| Course Code | ENGINEERING WORKSHOP (Common to All branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**I Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**List of Experiments:**

- **Demonstration:** Safety practices and precautions to be observed in workshop.
- **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.
  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:** Familiarity with different types of basic electrical circuits and make the following connections.
  a) Parallel and series b) Two-way switch c) Godown lighting
  d) Tube light e) Three phase motor f) Soldering of wires
- **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
- **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
- **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters**.**

**Textbooks:**


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


**Reference Books:**


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

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

| Course Code | ENGINEERING MECHANICS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**I Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**List of Experiments:**

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

## References:

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

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Mechanical Engineering

| Course Code | HEALTH AND WELLNESS, YOGA AND SPORTS (Common to All branches of Engineering) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 1 | 0.5 |

**I Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**UNIT** I

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

**Activities:**

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

**UNIT II**

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

**Activities:**

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

**UNIT III**

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

**Activities:**

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

**Reference Books:**

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

**General Guidelines:**

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

| **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.** | | Numerical Methods & Transform Techniques | BS&H | 3-0-0 | 3 |
| **2.** | | Industrial Management | MGT | 2-0-0 | 2 |
| **3.** | | Thermodynamics | PC | 3-0-0 | 3 |
| **4.** | | Mechanics of Solids | PC | 1-0-4 | 3 |
| **5.** | | Material Science & Metallurgy | PC | 3-0-0 | 3 |
| **6.** | | Computer Aided Machine Drawing Lab | PC | 0-0-3 | 1.5 |
| **7.** | | Mechanic of Solids & Material Science Engineering Lab | PC | 0-0-3 | 1.5 |
| **8.** | | Internet of Things | SC | 0-1-2 | 2 |
| **9** | | Design Thinking & Innovation | BS&H | 0-1-2 | 2 |
| **10** | | Environmental Sciences | MC | 2-0-0 | - |
| | | | | **Total** | **21** |
| **Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation** | | | | | |

| **Category** | **Credits** |
|---|---|
| Professional Core Courses | 12 |
| Basic Science and Humanities | 5 |
| Skill Oriented Course | 2 |
| Management Course | 2 |
| **TOTAL CREDITS** | **21** |

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | NUMERICAL METHODS &TRANSFORM TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**II Year 1$^{st}$Semester**

**Course Objectives:**

- Introduce numerical methods for solving algebraic and transcendental equations.
- Develop techniques for interpolation and curve fitting using various methods.
- Explore methods for solving initial value problems for ordinary differential equations.
- Understand the application of Laplace and Fourier transforms in solving mathematical problems.

**Course Outcomes (CO):**

- Apply numerical methods to solve algebraic and transcendental equations.
- Derive interpolating polynomials using interpolation formulae.
- Solve differential and integral equations numerically.
- Understand the use of Laplace transform in system modeling, digital signal processing, process control, and solving Boundary Value Problems.
- Apply Fourier series and Fourier transform in communication theory, signal analysis, image processing, filters, data processing, and solving partial differential equations related to gravity.

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

Introduction – Bisection Method – Iterative method, Regula-falsi method, and Newton-Raphson method. System of Algebraic equations: Gauss Elimination, Jacobi, and Gauss-Seidel .

| UNIT II | Interpolation | |
|---|---|---|

Finite differences – Newton's forward and backward interpolation formulae – Lagrange's formulae. Curve fitting: Fitting of a straight line, second-degree, and exponential curve by the method of least squares.

| UNIT - III | Solution of Initial Value Problems for Ordinary Differential Equations |
|---|---|

Numerical solution of Ordinary Differential Equations: Solution by Taylor's series – Picard's Method of Successive Approximations – Euler's and modified Euler's methods – Runge-Kutta methods (second and fourth order).

| UNIT - IV | 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 – Convolution Theorem – Laplace transform of Periodic functions.

| UNIT - V | Fourier Series and Fourier Transforms | |
|---|---|---|

Fourier Series: Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – Fourier series of even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions. Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – complex form of Fourier integral – Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Convolution Theorem.

**Textbooks:**

1. S. S. Sastry, *Introductory Methods of Numerical Analysis*, PHI Learning Private Limited.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 2017, 44th Edition.

**Reference Books:**

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 2018, 10th Edition.
2. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, Alpha Science International Ltd., 2021, 5th Edition (9th reprint).
3. H. K. Das, Er. Rajnish Verma, *Higher Engineering Mathematics*, S. Chand Publications, 2014, Third Edition (Reprint 2021).
4. Alan Jeffrey, *Advanced Engineering Mathematics*, Elsevier.

**Online Learning Resources:**

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma05/preview
3. http://nptel.ac.in/courses/111105090

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

| Course Code | INDUSTRIAL MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**II Year 1st Semester**

**Course Objectives:**

- To provide an understanding of the principles and applications of industrial engineering.
- To introduce concepts related to plant layout, production, and work study methods.
- To explain quality control techniques and the importance of Total Quality Management.
- To familiarize students with financial management concepts, including capital budgeting and financial accounting.

**Course Outcomes (CO):**

- Learn about how to design the optimal plant layout.
- Demonstrate work study methods and their applications.
- Explain Quality Control techniques and their importance in industrial operations.
- Discuss the financial management aspects of capital, budgeting, and accounting.

**UNIT - I** **INTRODUCTION**

Concept of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering. Concept of Management, Importance, and Functions of Management. Theories of management – Taylor's principles, Fayol's principles of management, and Theory X and Theory Y.

**PLANT LAYOUT:**

Factors governing plant location – plant layout: process layout, product layout, combination layout, and fixed position layout, and their applications.

**UNIT II** **PRODUCTION AND WORK STUDY**

Methods of production – Job, batch, and mass production. Need and advantages of Work study – Method study procedure – Flow process charts – String diagrams – Therbligs – Predetermined Motion Time System (P.M.T.S) – Rating techniques – Method Time Measurement (MTM) – Work factor system – Work sampling and principles of Ergonomics.

**UNIT - III** **INSPECTION AND QUALITY CONTROL**

Purpose of inspection – kinds of inspections and Statistical Quality Control (SQC) – sampling inspection – single and double sampling plan – Control charts: X and R – charts, C – charts, and their application.

**Total Quality Management:**

Zero defect concept, quality circles and applications, Six Sigma.

**UNIT - IV** **FINANCIAL MANAGEMENT**

Capital and its significance, classification of capital, working capital, factors affecting working capital. Sources of raising finance – Nature and methods of capital budgeting (payback period, ARR, NPV methods).

**Financial Accounting:**

Double-entry bookkeeping – journal, ledger, trial balance, and final accounts (Trading and Profit & Loss account and Balance sheet).

**Financial analysis through ratios:**

Liquidity, activity, capital structure, and profitability ratios.

**UNIT - V** **HUMAN RESOURCE MANAGEMENT**

Nature of HRM – Functions of HR manager – 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 – Placement – Wage and Salary Administration – Job evaluation and Merit rating.

**Textbooks:**

1. O.P. Khanna, *Industrial Engineering and Management*, Dhanpat Rai Publications (P) Ltd.
2. Martand Telsang, *Industrial Engineering and Production Management*, S. Chand & Company Ltd., New Delhi.

**Reference Books:**

1. Bhattacharya DK, *Industrial Management*, S. Chand, publishers.
2. J.G. Monks, *Operations Management*, 3rd Edition, McGraw Hill Publishers.
3. T.R. Banga, S.C. Sharma, N.K. Agarwal, *Industrial Engineering and Management Science*, Khanna Publishers.
4. Koontz O'Donnell, *Principles of Management*, McGraw Hill Publishers.
5. R.C. Gupta, *Statistical Quality Control*, Khanna Publishers.
6. N.V.S. Raju, *Industrial Engineering and Management*, Cengage India Private Limited.

**Online Learning Sources:**

- NPTEL Course 1
- NPTEL Course 2
- edX - Industrial Engineering
- YouTube Playlist

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

| Course Code | THERMODYNAMICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**II Year 1st Semester**

**Course Objectives:**

- To introduce the fundamental concepts and principles of thermodynamics.
- To enable students to apply thermodynamic laws to various engineering systems like engines, pumps, and compressors.
- To develop skills to analyze different thermodynamic processes and cycles.
- To enhance the understanding of steam properties and their application in power generation systems.

**Course Outcomes (CO):**

- Understand the importance of thermodynamic properties related to the 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 vapor 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 functions, 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 the first kind, first law applied to non-flow and flow processes, limitations of the first law of thermodynamics.

**UNIT II** **Second Law of Thermodynamics**

Kelvin-Planck statement and Clausius statement and their equivalence, corollaries, perpetual motion machines of the 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 – thermodynamic cycles.

**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** **Vapor Power Cycles**

Thermodynamic processes of vapor: constant volume process, constant pressure process, constant temperature process, hyperbolic process, adiabatic process, polytrophic process.
Thermodynamic vapor cycles: Introduction – Carnot cycle with steam as working substances – performance of thermodynamic cycles – Rankine cycle, its efficiency – modified Rankine cycle, its efficiency.

**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, *Thermal Engineering*, 6/e, S. Chand & Co., 2010.

Sri Krishnadevaraya University
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Mechanical Engineering

| Course Code | MECHANICS OF SOLIDS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**II Year 1st Semester**

**Course Objectives:**

- To introduce the basic concepts of stress, strain, and deformation in solids.
- To develop an understanding of the behavior of beams under different loading conditions.
- To enable students to analyze and design components subjected to torsional and bending stresses.
- To familiarize students with the design and analysis of thin, thick cylinders, and springs.

**Course Outcomes (CO):**

- Evaluate stresses and strains in solid materials.
- Draw Shear Force (SF) and Bending Moment (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 and thick-walled cylinders.
- Analyze stresses in curved bars.

**UNIT - I** **Simple Stresses and Strains**

Elasticity and plasticity, Types of stresses & strains, Hooke's law, stress-strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio & volumetric strain, Bars of varying section, composite bars, Temperature stresses, Relation between elastic constants, Strain energy, Resilience, Gradual, sudden, impact, and shock loadings.

**UNIT II** **Shear Force and Bending Moment**

Definition of beam, Types of beams, Concept of shear force and bending moment, SF and BM diagrams for cantilever, simply supported, and overhanging beams subjected to point loads, UDL, uniformly varying loads, and combination of these loads, Point of contra flexure, Relation between SF, BM, and rate of loading at a section of a beam.

**UNIT - III** **Flexural Stresses and Torsion**

Flexural Stresses: Theory of simple bending, Derivation of bending equation, Determination of bending stresses, Section modulus of rectangular, circular, I, and T sections, Design of simple beam sections.
Torsion: Introduction, Derivation of Torsion equation, Torsion of circular shafts, Pure shear, Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

**UNIT - IV** **Deflection of Beams and Springs**

Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, UDL, and UVL. Mohr's theorem and Moment area method. Springs: Introduction, Types, Stresses in helical springs, Deflection of helical springs.

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

Stresses in thin cylindrical shells 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.

**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

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

| Course Code | MATERIAL SCIENCE & METALLURGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**II Year 1st Semester**

**Course Objectives:**

- To introduce the fundamental concepts of materials science and metallurgy.
- To enable students to understand the structure-property relationships in materials.
- To familiarize students with phase diagrams, heat treatment, and the selection of metals and alloys.
- To develop skills for choosing appropriate materials for different engineering applications, including nanomaterials.

**Course Outcomes (CO):**

- Explain the principles of binary phase diagrams.
- Select steels and cast irons for specific engineering applications.
- Apply heat treatment techniques for various uses.
- Utilize non-ferrous metals and alloys in engineering designs.
- Choose appropriate composite materials for different applications.
- Assess the properties and applications of nano-scale materials.

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

Crystal structures: Unit cells, Metallic crystal structures, Imperfections 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 Cast Irons**

Steels: Plain carbon steels, use and limitations, AISI & BIS classification, alloy steels, Microstructure, properties, and applications of alloy steels, stainless steels, and tool steels.
Cast Irons: Microstructure, 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, Spheroidizing, Isothermal transformation diagrams for Fe-$Fe_3C$ alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties. Austempering, Martempering, Case hardening, Carburizing, Nitriding, Cyaniding, Carbo-nitriding, Flame and induction hardening, Vacuum and plasma hardening.

**UNIT - IV** **Non-Ferrous Metals and Alloys**

Microstructure, properties, and applications of copper and its alloys, aluminum and its alloys. Study of Al-Cu phase diagram, Precipitation hardening, Microstructure, properties, and applications of titanium and its alloys.

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

Ceramics: Classification, Properties, and Applications. Ceramic powder preparation, Processing of ceramic parts: Pressing, casting, sintering. Secondary processing: Coatings, Finishing.
Powder Metallurgy: Principles, Manufacture of powders, Steps involved.

**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.

**Reference Books:**

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 | COMPUTER-AIDED MACHINE DRAWING | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**II Year 1st Semester**

**Course Objectives:**

- To introduce students to the conventional representations of machine components using CAD systems.
- To enable students to model and create detailed drawings of riveted, welded, and key joints.
- To develop proficiency in generating solid models and assembling machine parts using 3D CAD software.
- To translate 3D models into production-ready 2D drawings with appropriate limits, fits, and tolerances.

**Course Outcomes (CO):**

- Demonstrate the conventional representations of materials and machine components.
- Model riveted, welded, and key joints using a CAD system.
- Create solid models and sectional views of machine components.
- Generate solid models of machine parts and assemble them.
- Translate 3D assemblies into 2D drawings.

**List of Experiments:**

The following are to be done by any 2D software package:

**Conventional representation of materials and components:**
**Detachable joints:**

- Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint, and foundation bolts.

**Riveted joints:**

- Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

**Welded joints:**

- Lap joint and T joint with fillet, butt joint with conventions.

**Keys:**

- Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

**Couplings:**

- Rigid: Muff, flange;
- Flexible: Bushed pin-type flange coupling, universal coupling, Oldham's coupling.

The following exercises are to be done by any 3D software package:

**Sectional views:**

- Creating solid models of complex machine parts and sectional views.

**Assembly drawings (Any four of the following using solid model software):**

- Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling.

**Production drawing:**

- Representation of limits, fits, and tolerances for mating parts. Use any four parts of the above assembly drawings and prepare manufacturing drawings with dimensional and geometric tolerances.

**Text Books:**

1. Machine Drawing by K.L. Narayana, P. Kannaiah, and K. Venkat Reddy, New Age International Publishers, 3/e, 2014.
2. Machine Drawing by N. Sidheswar, P. Kannaiah, V. V. S. Sastry, TMH Publishers, 2014.

**Reference Books:**

1. Cecil Jensen, Jay Helsel, and Donald D. Voisinet, *Computer-Aided Engineering Drawing*, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, *Engineering Drawing for Manufacture*, Kogan Page Science, 2003.
3. N.D. Bhatt, *Machine Drawing*, Charotar Publishers, 50/e, 2014.

**Online Learning Resources:**

- Machine Drawing
- NPTEL - Machine Drawing

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**Mechanical Engineering**

| Course Code | MECHANICS OF SOLIDS & MATERIAL SCIENCE ENGINEERING LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**II Year 1st Semester**

**Course Objectives:**

- To provide practical exposure to the mechanical behavior of materials under various loading conditions.
- To enable students to understand and apply the principles of tension, compression, bending, and torsion testing.
- To familiarize students with hardness, impact testing, and structural behavior analysis of metals and materials.
- To introduce students to the techniques of microstructural analysis of metals and alloys

**Course Outcomes (CO):**

- By performing various tests, the student will understand the structural behavior of various materials and components when subjected to external load.

**List of Experiments:**

**List of Experiments: Mechanics of Solids**

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.

**List of Experiments: Material Science Engineering Lab**

1. Preparation and study of the microstructure of pure metals.
2. Preparation and study of the microstructure of mild steel, medium carbon steels, and high carbon steels.
3. Study of the microstructures of cast irons.
4. Study of the microstructures of non-ferrous alloys.
5. Study of the microstructures of heat-treated steels.
6. Hardenability of steels by Jominy End Quench Test

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**Mechanical Engineering**

| Course Code | INTERNET OF THINGS | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 2 |

**II Year 1st Semester**

**Course Objectives:**

- • Understand the key components and functionalities of IoT devices, including Raspberry Pi, Arduino, and Node MCU.
  • Apply IoT concepts to build and deploy sensors, interfaces, and control mechanisms in real-world applications.

**Course Outcomes (CO):**

- Demonstrate the ability to set up Raspberry Pi and use it for basic sensor interfacing and control applications.
- Implement IoT experiments using Arduino and Node MCU, focusing on sensor data collection and device interaction.

**List of Experiments:**

**Experiments: (Any 5 experiments from the following)**

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
3. Using Raspberry Pi:
   a. Calculate the distance using a distance sensor.
   b. Basic LED functionality.
4. Raspberry Pi interaction with online services through public APIs and SDKs.
5. Study and Install IDE of Arduino and different types of Arduino.
6. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
7. Calculate the distance using a distance sensor Using Arduino.
8. Basic LED functionality Using Arduino and Node MCU.
9. Calculate the moisture content in the soil using Arduino and Node MCU.
10. Calculate the distance using a distance sensor Using Node MCU.
11. Basic LED functionality Using Node MCU.

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**Mechanical Engineering**

| Course Code | DESIGN THINKING AND INNOVATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 2 |

**II Year 1st Semester**

**Course Objectives:**

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

**Course Outcomes (CO):**

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

**UNIT - I** **Introduction to Design Thinking**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, historyof Design Thinking, New materials in Industry.

**UNIT - II** **Design Thinking Process**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development.

**Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

**UNIT - III** **Innovation**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

**UNIT - IV** **Product Design**

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies.

**Activity:** Importance of modelling, how to set specifications, Explaining their own productdesign.

**UNIT-V Design Thinking in Business Processes**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

**Activity:** How to market our own product, About maintenance, Reliability and plan for startup.

**Textbooks:**

1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

**Reference Books:**

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell,Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

**Online Learning Resources:**

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/previ

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

**II Year 1st 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):**

- Analyze various energy sources and their environmental impacts.
- Understand ecosystem functions and propose biodiversity conservation strategies.
- Identify causes of pollution and recommend control measures.
- Evaluate climate change impacts and suggest mitigation strategies.
- Apply environmental management systems and sustainability practices.

**UNIT - I**

**NATURAL RESOURCES:**

**Energy resources**: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources, non-conventional energy sources; Implications of energy use on the environment.

**Forest resources** – Use and over – exploitation, deforestation, **Water resources** – Use and over utilization of surface and ground water–**Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources

**Introduction to sustainable development**: Sustainable Development Goals (SDGs) - targets and indicators, challenges and strategies for SDGs.

**UNIT - II**

**ECOSYSTEMS**: Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem, Ecological succession. Introduction, types, characteristic features, structure and function of Forest, Grassland, Desert and aquatic ecosystems.

**BIODIVERSITY AND ITS CONSERVATION**: 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

**UNIT - III**

**ENVIRONMENTAL POLLUTION:** Definition, Cause, effects and control measures of Air, Water, Soil, Marine, Noise, Thermal and Nuclear Pollutions.

**SOLID WASTE MANAGEMENT**: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution.

**UNIT - IV**

**Climate Change**: Impacts, Adaptation and Mitigation:

**Understanding climate change**: Natural variations in climate; Structure of atmosphere; **Anthropogenic climate change from greenhouse gas emissions**– past, present and future; Projections of global climate change

Impacts, vulnerability and adaptation to climate change. Observed impacts of climate change on ocean and land systems.

**Mitigation of climate change**: Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; Energy efficiency measures; Renewable energy sources; Carbon capture and storage.

**UNIT-V**

**Environmental Management**

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.

**Environmental management system**: ISO 14001, Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme.

**TEXTBOOKS:**

Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
Environmental Studies by PalaniSwamy – Pearson education
Environmental Studies by Dr.S.AzeemUnnisa, Academic Publishing Company

**REFERENCES:**

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

| 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.** | | Universal Human Values-Understanding Harmony | BS&H | 2-1-0 | 3 |
| **2.** | | Complex Variables, Probability and Statistics | BS & H | 3-0-0 | 3 |
| **3.** | | Manufacturing Processes | PC | 3-0-0 | 3 |
| **4.** | | Fluid Mechanics & Hydraulic Machines | PC | 3-0-0 | 3 |
| **5.** | | Theory of Machines | PC | 3-0-0 | 3 |
| **6.** | | Manufacturing Processes Lab | PC | 0-0-3 | 1.5 |
| **7.** | | Fluid Mechanics & Hydraulic Machines Lab | PC | 0-03 | 1.5 |
| **8.** | | Soft Skills | SC | 0-1-2 | 2 |
| | | | | **Total** | **20** |

| **Category** | **CREDITS** |
|---|---|
| Basic Sciences and Humanities course | 6 |
| Skill Oriented Courses | 2 |
| Professional Core Courses | 12 |
| **TOTAL CREDITS** | **20** |

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**Mechanical Engineering**

| Course Code | UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 3 |

**II Year 2nd Semester**

**Course Objectives:**

- To help the students appreciate the essential complementary 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 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 behavior and mutuallyenriching interaction with Nature.

**Course Outcomes (CO):**

- Define the terms like Natural Acceptance, Happiness and Prosperity
- Identify oneself, and one's surroundings (family, society nature)
- Apply what they have learnt to their own self in different day-to-day settings in real life
- Relate human values with human relationship and human society.
- Justify the need for universal human values and harmonious existence
- Develop as socially and ecologically responsible engineers

**Course Topics**

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

**UNIT - I**

Introduction to Value Education (6 lectures and 3 tutorials for practice session)
Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity – the Basic Human. Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance.

**UNIT II**

Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

| **UNIT - III** | | |
|---|---|---|

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

| **UNIT - IV** | | |
|---|---|---|

Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

| **UNIT - V** | | |
|---|---|---|

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education PS1 Sharing about Oneself
PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance
Practice Sessions for UNIT II – Harmony in the Human Being PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body
Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence
Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

**Textbook READINGS: Textbook and Teachers Manual**

a. The Textbook
R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics,2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
b. The Teacher's Manual
R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values andProfessional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

**Reference Books:**

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**Mode of Conduct:**

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elementsto help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.
Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions

commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values. It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department. Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

**Online Resources:**

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3- S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional- ethics/62490385

https://onlinecourses.swayam2.ac.in/aic22_ge23/preview.

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

| Course Code | COMPLEX VARIABLES, PROBABILITY, AND STATISTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**II Year 1st Semester**

**Course Objectives:**

- Understand the foundational concepts of complex variables, including limits, continuity, and differentiation, and explore analytic functions and their properties.
- Apply integral theorems in complex analysis to solve complex contour integrals and classify singularities, poles, and residues.
- Grasp the fundamentals of probability theory and apply it to calculate the likelihood of events, random variables, and their properties.
- Develop proficiency in hypothesis testing, estimation, and apply probability distributions to solve real-world engineering problems.

**Course Outcomes (CO):**

- Analyze limit, continuity, and differentiation of functions of complex variables, and understand Cauchy-Riemann equations, analytic functions, and various properties of analytic functions.
- Understand Cauchy's theorem, Cauchy integral formulas, and apply these to evaluate complex contour integrals. Classify singularities and poles, find residues, and evaluate complex integrals using the residue theorem.
- Apply probability theory to find the chances of the occurrence of events.
- Understand various probability distributions and calculate their statistical constants.
- Analyze and test various hypotheses, understand the theory and types of errors for large samples.

| UNIT - I | Complex Variable – Differentiation | |
|---|---|---|

Introduction to functions of complex variables, concept of limit & continuity, differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugates, construction of analytic functions by Milne-Thomson method.

| UNIT II | Complex Variable – Integration | |
|---|---|---|

Line integral, contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, residues, Cauchy Residue theorem (without proof), evaluation of definite integrals involving sine and cosine.

| UNIT - III | Probability Theory |
|---|---|

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

| UNIT - IV | Random Variables & Distributions | |
|---|---|---|

Probability distributions – Binomial, Poisson approximation to the binomial distribution, normal distribution, and their properties.

| UNIT - V | Estimation and Testing of Hypothesis, Large Sample Tests | |
|---|---|---|

Estimation: parameters, statistics, sampling distribution, point estimation, formulation of null hypothesis, alternative hypothesis, critical and acceptance regions, level of significance, two types of errors, and power of the test.

Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence intervals for parameters in one sample and two-sample problems.

**Textbooks:**

1. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 2017, 44th Edition.
2. Miller and Freunds, *Probability and Statistics for Engineers*, 7/e, Pearson, 2008.

**Reference Books:**

1. R.K. Jain and S.R.K. Iyengar, *Advanced Engineering Mathematics*, Alpha Science International Ltd., 2021, 5th Edition (9th reprint).
2. B.V. Ramana, *Higher Engineering Mathematics*, McGraw Hill Publishers.
3. W. Feller, *An Introduction to Probability Theory and its Applications*, 1/e, Wiley, 1968.

**Online Learning Resources:**

1. NPTEL Course on Complex Variables and Probability
2. NPTEL Course on Probability and Statistics

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

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

**II Year 2nd Semester**

**Course Objectives:**

- To introduce students to various manufacturing processes used in industries such as casting, forming, welding, and machining.
- To enable students to understand the design principles involved in manufacturing operations and their selection based on material properties and production needs.
- To provide knowledge of advanced manufacturing technologies, including additive and unconventional machining processes.
- To develop an understanding of the causes of defects in manufacturing and ways to remedy them, ensuring high-quality production.

**Course Outcomes (CO):**

- Demonstrate different metal casting processes and gating systems.
- Classify working of various welding processes.
- Evaluate the forces and power requirements in the 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** **Additive manufacturing**

Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, VAT photopolymerization AM Processes,Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications

**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.

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

| Course Code | FLUID MECHANICS & HYDRAULIC MACHINES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**II Year 2nd Semester**

**Course Objectives:**

- To introduce fundamental concepts of fluid mechanics and their real-world applications.
- To explore fluid statics, kinematics, and dynamics, including the governing laws.
- To understand pipe flow characteristics and analyze losses in fluid systems.
- To study the design and operation of hydraulic machines, including 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 Introduction to hydroelectric power station-heads and efficiencies-Classification of power plants

**UNIT - V** **Hydraulic Turbines**

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

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

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

**II Year 2nd Semester**

**Course Objectives:**

- Understand the principles of different mechanisms and their inversions.
- Calculate velocity and acceleration for various links in mechanisms.
- Analyze the effects of gyroscopic forces in vehicles.
- Evaluate and analyze vibrations in single-degree-of-freedom systems.

**Course Outcomes (CO):**

- 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**

**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- Quick return mechanism,
**Straight line mechanisms**-Scott Russels and Peaucellier Mechanisms, Universal Joint – Steering Gear Mechanism

**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.

**UNIT - III**

**Gyroscope:** Principle of gyroscope, gyroscopic effect in an 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:** definitions,Terminology and Classification of cams and followers- - Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams.

**UNIT - V**

**Vibrations:** Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton 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.

**Text Book(s)**

1. S.S.Rattan ,Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

**References**

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. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009
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.

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

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

**II Year 2nd Semester**

**Course Objectives:**

- Design and create patterns for manufacturing processes.
- Construct mould cavities for single-piece patterns.
- Perform sheet metal operations, including blanking, piercing, and bending.
- Execute various welding techniques and plastic molding processes.

**Course Outcomes (CO):**

- 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)

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

| Course Code | FLUID MECHANICS & HYDRAULICS MACHINES LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**II Year 2nd Semester**

**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.

**List of 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

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

| Course Code | COMMUNITY SERVICE PROJECT<br>……Experiential learning through community engagement | | | | |
|---|---|---|---|---|---|
| | | | | | |

**II Year 2nd Semester**

**INTRODUCTION**

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as asocially responsible institution.

**OBJECTIVE**

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

**Implementation of Community Service Project**

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.

- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall alsobe conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on thejob training.

**Procedure**

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

**EXPECTED OUTCOMES**
**BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**
**Learning Outcomes**

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

**Personal Outcomes**

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others,and build leadership and communication skills.

**Social Outcomes**

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

**Career Development**

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

**Relationship with the Institution**

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

**BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS**

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines orinstitutions
- A stronger commitment to one's research.

**BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES**

- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

**BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY**

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

**SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT**

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

**For Engineering Students**

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods

15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

**Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs**

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social EntrepreneurshipGeneral Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene

11. Hand wash programmes
12. Commemoration and Celebration of important daysPrograms for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality DevelopmentCommon Programs

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –

i. Agriculture
ii. Health
iii. Marketing and Cooperation
iv. Animal Husbandry
v. Horticulture
vi. Fisheries
vii. Sericulture
viii. Revenue and Survey
ix. Natural Disaster Management
x. Irrigation
xi. Law & Order
xii. Excise and Prohibition

**Role of Students:**

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

**Timeline for the Community Service Project Activity Duration: 8 weeks**

**1. Preliminary Survey (One Week)**

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

**2. Community Awareness Campaigns (One Week)**

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

**3. Community Immersion Programme (Three Weeks)**

**Along with the Community Awareness Programmes**, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

**4. Community Exit Report (One Week)**

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to thelocal administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated bythe mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained bythe students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit thestudents and guide them.

**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.** | | Machining Processes | PC | 3-0-0 | 3 |
| **2.** | | Thermal Engineering | PC | 3-0-0 | 3 |
| **3.** | | Metrology & Measurements | PC | 3-0-0 | 3 |
| **4.** | | 1. Refrigeration & Air Conditioning<br>2. Tool Design<br>3. Mechanical Behaviour of Materials | PE-1 | 3-0-0 | 3 |
| **5.** | | 1. Non Conventional Sources of Energy<br>2. Automobile Engineering<br>3. IC Engines | OE-1 | 3-0-0 | 3 |
| **6.** | | Thermal Engineering Lab | PC | 0-0-3 | 1.5 |
| **7.** | | Metrology & Measurements Lab | PC | 0-0-3 | 1.5 |
| **8.** | | Machine Tools Lab | SOC | 0-1-2 | 2 |
| **9.** | | Dynamics Lab | ES | 0-0-2 | 1 |
| **10.** | | Evaluation of Community Service Project | PR | - | 2 |
| **TOTAL** | | | | | **23** |

| **Category** | **CREDITS** |
|---|---|
| Professional core Courses | 12 |
| Professional Elective courses | 3 |
| Open Elective Course/Job oriented elective | 3 |
| Skill Enhancement course/soft skill course* | 1.5 |
| Engineering Science | 1.5 |
| Community Service Internship | 2 |
| **TOTAL CREDITS** | **23** |

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | MACHINING PROCESSES | 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
7. Manufacturing science by Amitab Ghosh and Ashok Kumr Mallik, Tata-McGraw-Hill Publications
8. Production Technology by Pakkirappa - Durga Publications.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

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

**III Year I Semester**

**Course Objectives:**

- To introduce students to the Working of boilers.
- To impart knowledge on different types of condensers.
- 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 nozzles, condensers and cooling towers for different applications.
- Use of p-v and T-s diagrams in gas power cycles and air cycles.
- To provide fundamental concepts of air standard cycles used in IC engines and gas turbines.
- Evaluate the performance of engines

| UNIT – I | Steam Boilers & Steam Condensers | |
|---|---|---|

**Steam Boilers:** Classifications –Mountings and Accessories – Boiler equivalent evaporation, efficiency. **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 Engines | |
|---|---|---|

**Type of nozzles** - Steam nozzles- compressible flow through nozzle- condition for maximum discharge - Nozzle efficiency.
**Steam Engines-** Classifications of steam engines-working of simple steam engines and compound steam engines (Theory only)

| UNIT – III | Power Cycles & Air standard cycles | |
|---|---|---|

Simple gas turbine plant, Brayton cycle, closed cycle and open cycle for gas turbines, condition for optimum pressure ratio, actual cycle- Simple problems, Air standard cycles- types.

| UNIT – IV | Internal Combustion Engines | |
|---|---|---|

IC Engines- classifications, working and comparison of 2-stroke and 4-stroke engines, SI and CI engines-Otto, Diesel and dual cycles with P-V and T -S diagrams - description and efficiencies- simple problems.

| UNIT – V | Testing and Performance of IC engines | |
|---|---|---|

Engine Performance Parameters - Determination of, Brake power, friction power and indicated power – Performance test – Heat balance sheet and chart- Exhaust gas composition – Simple problems on performance and heat balance sheet.

**Textbooks:**

1. Thermal Engineering by RS Khurmi
2. Thermal Engineering by Mahesh V Rathore, Tata McGraw Hill2017
3. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jainbrothers,2014
6. Internal combustion engines by Mathur & Sharma

**Sri Krishnadevaraya University**
**College of Engineering & Technology,Ananthapuramu – 515 003 (A.P) India**
**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, micrometres, 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-run out, lead, pitch backlash, profile, pressure angle, tooth thickness, diameter of gear, constant chord and base tangent method.

**Textbooks:**

| |
|---|
| 1. Mechanical Measurements, D.S Kumar.<br>2. Engineering Metrology by R.K.Jain, Khanna publishers. |
| **Reference Books:** |
| **1.** Instrumentation Measurement & Analysis,B.C.Nakra and K.K Choudhary.TMH |

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

| Course Code | REFRIGERATION & AIR CONDITIONING (Professional Elective-I) | 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
1. Thermal Engineering, R.S.Khurmi, J.K.Gupta, S.CHAND Publications

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

| Course Code | TOOL DESIGN (Professional Elective-I) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**III Year I Semester**

**Course Objectives:**

- **Understand** the fundamentals of tool engineering and the role of tool design in manufacturing.
- **Analyze** the principles of metal cutting and apply them to cutting tool design.
- **Design** various jigs and fixtures using proper locating and clamping principles.
- **Evaluate** and design different types of press tool dies for sheet metal operations.
- **Develop** tooling and fixture strategies suitable for CNC machining systems.

**Course Outcomes (CO):**

- Understand tool design fundamentals, select appropriate materials, and design effective tools to develop durable, precise tools for various manufacturing applications.
- **Apply** the mechanics of metal cutting to design basic cutting tools like single-point, milling, and broaching tools.
- **Demonstrate basic principles of** drill jigs and various fixtures and design the jigs and fixtures by applying principles of location and clamping.
- **Calculate** clearance, cutting forces, and **develop** designs for press tool dies (blanking, piercing, bending, and drawing).
- **Evaluate and Develop** tool holding, fixture systems, and automation features like ATC for CNC machine tools.

**UNIT – I** **INTRODUCTION TO TOOL DESIGN**

Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non-ferrous Tooling Materials- Carbides, Ceramics and Diamond -Non-metallic tool materials-Designing with relation to heat treatment.

**UNIT – II** **DESIGN OF CUTTING TOOLS**

Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle - Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters.

**UNIT – III** **DESIGN OF SHEET METAL BLANKING AND PIERCING**

**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 – IV** **DESIGN OF PRESS TOOL DIES**

Types of Dies –Method of Die operation–Clearance and cutting force calculations- Blanking and Piercing die design – Pilots – Strippers and pressure pads- Presswork materials – Centre of pressure -Strip layout – Short-run tooling for Piercing – Bending dies – Drawing dies-Design and drafting.

**UNIT – V** **TOOL DESIGN FOR CNC MACHINE TOOLS**

Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools- Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine.

**Textbooks:**

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2000.
2. .G.Hoffman,” Jig and Fixture Design”, Thomson Asia Pvt Ltd, Singapore, 2004.

**Reference Books:**

1. P.C.Sharma, A Text book of Production Engineering, S.Chand Publications, 1999.
2. Prakash Hiralal Joshi, “Tooling data”, Wheeler Publishing, 2000
3. Venkataraman K., “Design of Jigs, Fixtures and Presstools”, TMH, 2005.
4. Haslehurst M., “Manufacturing Technology”, The ELBS, 1978.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | MECHANICAL BEHAVIOUR OF MATERIALS (Professional Elective-I) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**III 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):**

- Dictate the elastic behaviour of engineering materials, recall Hooke's law and apply the dislocation theory, forces on and between dislocations.
- Apply dispersion strengthening and fibre strengthening mechanisms, differentiate strain aging and dynamic strain aging and create grain size strengthening and solid solution strengthening
- List various modes of fracture and clarify the basic mechanism of ductile and brittle fracture, Identify importance of Griffith's theory. Calculate factors effecting on DBTT.
- Explain fatigue behaviour and testing. Discuss the factors affecting fatigue. Apply fracture mechanics in design.
- Identify and describe various structural changes during creep. Evaluate and predict the metallurgical factors affecting creep and creep different testing.

**UNIT – I**

**Elastic and plastic behavior**: Elastic behavior 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 KIC.

**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-Paris law- Fatigue Testing Machines.

**UNIT – V**

Creep behavior 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.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | NON CONVENTIONAL SOURCES OF ENERGY (Open Elective-1) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**III Year I Sem**

**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 windmill – Merit & demerits. Wind energy collectors advantages, disadvantages.

**UNIT - V**

**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

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | AUTOMOBILE ENGINEERING (Open Elective-1) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**III 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):**

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.

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

| Course Code | IC ENGINES (Open Elective-1) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**III Year I Semester**

**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** -

.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

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | THERMAL ENGINEERING LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**III Year I Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

After completing this course, the students will be able to:

- Understand the working of compressors.
- Demonstrate knowledge of refrigeration and air-conditioning systems.
- Analyze the performance of engines and heat transfer 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 experiments**

**Sri Krishnadevaraya University**
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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 Objectives**

- To introduce the fundamental concepts of metrology and measurement systems.
- To study the working principles of various measuring instruments and transducers.
- To understand calibration methods used in industrial metrology.

**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 Thermistor
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 vernier calipers, 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 gear 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 experiments**

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**Mechanical Engineering**

| Course Code | MACHINE TOOLS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**III Year I Semester**

**Course Objectives**

- To provide hands-on experience with basic machine tools.
- To study kinematics and dynamics related to machining operations.
- To understand tool geometry and tool performance through practical machining exercises.

**Course Outcomes (CO):**

- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Determine the Mass moment of inertia, Range sensitivity.
- Drawing of Cam profile, determination of torsional, undamped and damped natural frequencies.
- Determining of influence of coefficient and balancing of rotating, reciprocating masses.
- Verify the laws of springs and forced vibration of cantilever beam.

**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. Planning Machine
9. Lathe Tool and Drill Tool Dynamometers

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| **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.** | | Heat Transfer | PC | 3-0-0 | 3 |
| **2.** | | CAD/CAM | PC | 3-0-0 | 3 |
| **3.** | | Design of Machine Members | PC | 3-0-0 | 3 |
| **4.** | | 1. Introduction to Turbo Machinery<br>2. Operation Research<br>3. Smart Materials | PE-2 | 3-0-0 | 3 |
| **5.** | | 1. Non-Conventional Sources of Energy<br>2. Mechanics & Manufacturing Composite Materials<br>3. Introduction to Hybrid and Electric Vehicles | PE-3 | 3-0-0 | 3 |
| **6.** | | 1. Manufacturing Processes<br>2. Robotics<br>3. Electrical Vehicles | OE-2 | 3-0-0 | 3 |
| **7.** | | Heat Transfer Lab | PC | 0-0-3 | 1.5 |
| **8.** | | CAD/CAM Lab | PC | 0-0-3 | 1.5 |
| **9.** | | 3D Printing | SOC | 0-1-2 | 2 |
| **10.** | | Technical paper writing & IPR | AC | 2-0-0 | 0 |
| Industrial/Research Internship (Mandatory)for8 weeks duration during summer vacation | | | | | |
| **TOTAL** | | | | | **23** |

| **Category** | **CREDITS** |
|---|---|
| Professional core Courses | 12 |
| Professional Elective courses | 6 |
| Open Elective Course/Job oriented elective | 3 |
| Skill Enhancement course/soft skill course* | 2 |
| **TOTAL CREDITS** | **23** |

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| 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

**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 | 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:**


2. CAD/CAM, A Zimmers & P.Groover, PE, PHI.
3. CAD/CAM-Principles and applications, P.N. Rao, TMH.
4. P. N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017
5. 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

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

| Course Code | DESIGN OF MACHINE MEMBERS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**III Year II Semester**

**Course Objectives:**

- Understanding of the mechanical engineering design process for static and dynamic loads under various loading conditions.
- Explore the design principles and analysis of bolted and welded joints and butt welds under various loading conditions.
- Study the design principles of power transmission shafts and couplings, focusing on the analysis of shafts subjected loads, as well as the design of various types of couplings.
- Explain the design principles of friction clutches, brakes, and springs, design of different brakes, clutches, helical and leaf springs under various loading conditions.
- Demonstrate the design principles of sliding and rolling contact bearings, gears, spur gears, beam strength, and load considerations.

**Course Outcomes (CO):**

- Apply design principles for components subjected to static and dynamic loads, analyze and design for fatigue failure using relevant criteria
- Design and analyze bolted and welded joints, considering factors such as different types of loads, including eccentric loading scenarios.
- Design power transmission shafts and couplings for fluctuating loads, and selecting appropriate couplings such as flange, bushed pin, and universal couplings.
- Design , brakes, and springs, applying the various theories and analyze the working for mechanical applications.
- Design and analyze the sliding and rolling contact bearings, s, considering beam strength, dynamic, and wear load factors.

**UNIT – I** **Introduction, Design for Static and Dynamic loads**

**Mechanical Engineering Design:** Design process, design considerations.
**Design for Dynamic Loads:** Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure.

**UNIT – II** **Design of Bolted and Welded Joint**

**Design of Bolted Joints:** Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints.
**Welded Joints:** Strength of lap and butt welds, Joints subjected to bending and torsion. Eccentrically loaded welded joints.

**UNIT – III** **Power transmission shafts and Couplings**

**Power Transmission Shafts:** Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.
**Couplings:** Design of flange and bushed pin couplings, universal coupling

**UNIT – IV** **Design of Belts and Gears**

**Design of Belts:** Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes
**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

**UNIT – V** **Design of Sliding Contact Bearings and Rolling Contact Bearings**

**Design of Sliding Contact Bearings:** Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.
**Design of Rolling Contact Bearings:** Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

**Textbooks:**

1. R.L. Norton, Machine Design an integrated approach, 2/e, Pearson Education, 2004.
2. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.

**Reference Books:**

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.
4. K. Mahadevan &K.Balaveera Reddy, Design data handbook, CBS Publications, 4/e, 2018.
5. Dr. N. C. Pandya &Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.

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**Mechanical Engineering**

| Course Code | INTRODUCTION TO TURBO MACHINERY (Professional Elective-II) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**III Year II Semester**

**Course Objectives:**

- Understanding of the principles, classifications, and governing equations of turbo machinery.
- Familiarize of gas turbine cycles including Brayton, regenerative, reheat, and inter-cooling processes, as well as the operation and performance of turboprop, turbojet, and turbofan engines with thrust augmentation techniques.
- Principles of similarity analysis and cascade theory in turbo machinery, for performance evaluation of compressor and turbine blades.
- Design and analysis of axial and centrifugal compressors and pumps, considering different parameters.
- Develop a thorough understanding of axial flow turbine design and performance parameters, and to introduce computational fluid dynamics (CFD) as a tool for analyzing turbo machinery.

**Course Outcomes (CO):**

- Analyze and apply the fundamental concepts of fluid motion in rotating systems to design and evaluate the performance of various turbo machines.
- Compare, Analyze, and evaluate various gas turbine cycles and engine configurations for optimum propulsion and power generation applications.
- Apply similarity principles and cascade analysis techniques to evaluate blade performance, estimate aerodynamic losses, and optimize turbo machine blade designs.
- Design, analyze, and evaluate the performance of axial and centrifugal compressors and pumps, and thermodynamic principles for improved efficiency and functionality
- Create and evaluate axial flow turbines and apply CFD techniques to simulate and analyze fluid flow and thermal behavior in turbo machinery systems.

**UNIT – I**

Introduction and Classification: Axial flow, radial flow and mixed flow machines, the equations of motion in rotating frame of reference, effects of Coriolis and Centrifugal forces, momentum and energy equation, Euler work and illustrative examples.

**UNIT – II**

Gas Turbine Cycle: Brayton Cycle, regenerative cycle, reheat, inter-cooling, turboprop, turbojet and turbofan engine, thrust augmentation and illustrative examples.

**UNIT – III**

Similarity Analysis: Similarity rules, specific speed, Cordier diagram and illustrative examples. Cascade Analysis: Two-dimensional cascade theory, lift and drag, blade efficiency, estimation of loss, compressor and turbine cascade, blade geometry and illustrative examples.

**UNIT – IV**

Axial Flow Compressor: Two-dimensional pitch line design and analysis, h-s diagram, degree of reaction, the effect of Mach number, performance and efficiency, three-dimensional flow, tip clearance, losses, compressor performance and illustrative examples.

Centrifugal Pump and Compressor: Theoretical analysis and design, the effect of circulation and Coriolis forces, reversal eddies, slip factor, head and efficiency, diffuser, introduction to the combustion system and illustrative examples.

**UNIT – V**

Axial Flow Turbine: Two-dimensional pitch line design, stage loading capacity, degree of reaction, stage efficiency, turbine performance, blade cooling, and illustrative examples.. CFD Applied to Turbomachinery Flows: Governing equations, numerical methods, and test cases illustrating flow and heat transfer related to turbo machines.

**Textbooks:**

1. Fluid Mechanics and Thermodynamics of Turbomachinery, S. L. Dixon and C. A. Hall, Butterworth-Heinemann, Seventh Edition, 2014.

2. Gas Turbine Theory, H. Cohen, GFC Rogers and HIH Saravanamuttoo, Addison Wesley Longman Limited, 4th Edition, 1996.

**Reference Books:**

1. Fundamentals of Turbomachinery, Venkanna B. K Prentice Hall India Learning Private Limited, 2009.
2. Principles of Turbomachinery, Seppo A. Korpela, 2nd Edition, (2019) John Wiley and Son's, USA.

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**Mechanical Engineering**

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

**III Year 2nd Semester**

**Course Objectives:**

- Understanding of OR, focusing on model classification, formulation, and solution techniques for LP problems.
- Knowledge and techniques for formulating and solving transportation and assignment problems, and the Traveling Salesman Problem.
- Fundamentals of game theory and job sequencing, including optimal strategies, and scheduling techniques.
- Demonstrate of queuing theory, queuing models based on Poisson arrivals and exponential service times, and the analysis of single and multichannel systems with various queue lengths.
- Familiarize replacement and maintenance strategies, fundamentals of dynamic programming and its applications in optimization problems.

**Course Outcomes (CO):**

- Build and compare different mathematical models of the real time situations by using different Research models. Solve the LP problems and find Multiple Optimal Solutions.
- Implement Transportation and Assignment problems to solve the real time industry needs.
- Choose the best strategy of Game theory and capable of identifying the suitable techniques .Solve the Job Sequencing Problem.
- Apply different Queuing models to optimize the queuing length. Define the queuing and inventory terminology to solve the different inventory and queuing problems.
- Apply concepts of replacement and maintenance analysis and solve optimization problems using dynamic programming techniques.

**UNIT – I** **Introduction to OR**

**Introduction to Operations Research (OR):** OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models

**Linear Programming(LP):** Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem

**UNIT – II** **Transportation and Assignment Problems**

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution –North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, Degenerate Problem. Assignment Problem – Formulation, Hungarian Method for Solving Assignment Problems, Traveling Salesman problem.

**UNIT – III** **Game theory & Job Sequencing**

**Game theory:** Optimal solution of two person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies. Reduction by principles of dominance, arithmetic, algebraic method and graphical method.

**Job Sequencing:** Introduction to Job shop Scheduling and flow shop scheduling, Solution of Job Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

**UNIT – IV** **Queuing Theory & Inventory Control**

**Queuing Theory:** Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with infinite and finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with infinite queue length.

**Inventory Control:** Introduction, Deterministic models – EOQ model with and without shortages, Production model, Buffer stock and discount inventory models with single price breaks. Selective inventory control.

**UNIT – V** **Replacement and Maintenance Analysis & DP**

**Replacement and Maintenance Analysis:** Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model. **Dynamic Programming (DP):** Introduction –Bellman's Principle of Optimality – Applications of Dynamic Programming – Shortest Path Problem – Capital Budgeting Problem – Solution of Linear Programming Problem by DP.

**Textbooks:**

1. Sharma S.D., Operations Research: Theory, Methods and Applications, 15/e, Kedar Nath Ram Nath, 2010
2. Taha H.A., Operations Research, 9/e, Prentice Hall of India, New Delhi, 2010.

**Reference Books:**

1. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7/e, Tata McGraw Hill, 2010.
2. Sharma J.K., Operations Research: Theory and Applications, 4/e, Laxmi Publications, 2009.
3. Prem kumar Gupta and Hira, Operations Research, 3/e, S Chand Company Ltd., New Delhi, 2003.
4. Pannerselvam R., Operations Research, 2/e, Pentice Hall of India, New Delhi, 2006.
5. Sundaresan.V, and Ganapathy Subramanian.K.S, Resource Management Techniques: Operations Research, A.R Publications, 2015.

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**Mechanical Engineering**

| Course Code | SMART MATERIALS (Professional Elective-II) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**III Year II Semester**

**Course Objectives:**

- Fundamental characteristics of different metals and provide an understanding of smart materials, their classification and real-world applications.
- Knowledge of various types of smart materials and electro rheological fluids, and shape memory materials.
- Processing techniques of various smart materials, and smart fluids, with a focus on synthesis and fabrication methods such as metallization and UV curing.
- Understanding of various types of sensors, and advanced sensors such as carbon nanotube and polymer-based sensors.
- Principles, types, and applications of actuators used in smart systems, and electro thermal actuators.

**Course Outcomes (CO):**

- Understand and distinguish between traditional engineering materials and smart materials and identify appropriate smart materials for various engineering applications.
- Explain the working principles, properties, and applications of different smart materials and evaluate their suitability for specific engineering and technological applications.
- Understand and apply suitable processing and fabrication techniques for different smart materials in engineering applications.
- Identify, describe, and equate different sensor technologies and select appropriate sensors for engineering applications.
- Demonstrate the working mechanisms of various actuators compare and select suitable actuation methods for different smart materials for create system applications.

**UNIT – I**

Characteristics of metals, polymers and ceramics. Introduction to smart materials. Classification of smart materials, Components of a smart System, Applications of smart material.

**UNIT – II**

Smart Materials Piezoelectric materials, Electro strictive Materials, Magnetostrictive materials, Magnetoelectric materials, Magnetorheological Electrorheological fluids, Shape Memory materials.

**UNIT – III**

Processing of Smart Materials Semiconductors and their processing, Metals and metallization techniques, Ceramics and their processing, Polymers and their synthesis, UV radiation curing of polymers, fluids.

**UNIT – IV**

Sensors Introduction, Conductometric sensors, Capacitive sensors, Piezoelectric sensors, Magnetostrictive sensors, Piezoresistive sensors, Optical sensors, Resonant sensors, semiconductor-based sensors, Acoustic sensors, polymerize sensors, Carbon nanotube sensors.

**UNIT – V**

Actuators Introduction, Electrostatic transducers, Electromagnetic transducers, Electrodynamic transducers, Piezoelectric transducers, Electro-strictive transducers, Magneto-strictive transducers, Electro thermal actuators, Comparison of actuation, Applications

**Textbooks:**


1. Smart Material Systems and MEMS: Design and Development Methodologies, V. K. Varadan, K. J. Vinoy, S. Gopalakrishnan, John Wiley and Sons, England, 2006.
2. Smart Structures and Materials, Brain Culshaw, Artech House, London, 1996.
3. Smart Materials and Structures, Mukesh V. Gandhi, Brian S. Thompson, , Springer, May- 1992.


**Reference Books:**


1. Smart Structures: Analysis and Design, A. V. Srinivasan, Cambridge University Press, Cambridge, New York, 2001.
2. Smart Structures, P. Gauenzi, Wiley, 2009.

3. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, Berlin, New York, 2002.
4. Analysis and Performance of Fiber Composites, B. D. Agarwal and L. J. Broutman, John Wiley & Sons.
5. Engineering aspects of Shape memory Alloys, T. W. Duerig, K. N. Melton, D. Stockel,C.
6. Mayman, Butterworth – Heinemann, 1990.

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**Mechanical Engineering**

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

**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 windmill **–** Merit & demerits. Wind energy collectors' advantages, disadvantages.
**Geothermal Energy:** Introduction – nature of geothermal fields – geothermal sources – hybrid systems –merits and demerits- applications.

**UNIT – V**

**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

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

| Course Code | MECHANICS AND MANUFACTURING OF COMPOSITE MATERIALS (Professional Elective-III) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**III Year II Semester**

**Course Objectives:**

- Fundamentals of composite materials, including their classification, and to familiarize them with various fiber-reinforced plastic processing techniques used in manufacturing.
- Understanding of the micro- and macro-mechanical behavior of composite laminas.
- Equip theoretical and analytical tools for evaluating the strength and mechanical behavior of composite laminates
- Introduce metal matrix composites (MMCs), focusing on reinforcement materials, base metal selection, fabrication techniques.
- Deep understanding of micromechanics-based failure analysis in unidirectional composite laminas, and the selection of appropriate failure criteria.

**Course Outcomes (CO):**

- Classify and describe the characteristics of different types of composite materials and explain and apply various fiber-reinforced plastic processing methods.
- Evaluate the elastic moduli of composite laminas, apply Hooke's law to different material types and solve numerical problems.
- Analyze the failure of composite laminates and perform macro-mechanical analysis using Classical Laminate Theory (CLT), for various laminate configurations through numerical problem-solving.
- Identify and select appropriate reinforcements and base metals for MMCs, understand and apply various fabrication processes.
- Analyze and evaluate the failure mechanisms of unidirectional lamina using micromechanical models and apply suitable failure theories through practical examples.

**UNIT – I** **Introduction to Composite Materials**

Introduction to Composite Materials: Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites. **Applications:** Automobile, Aircrafts. missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

**Fiber Reinforced Plastic Processing:** Lay-up and curing, fabricating process, open and closed mould process, hand lay-up techniques; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding.

**UNIT – II** **Micro Mechanical Analysis of a Lamina:**

**Micro Mechanical Analysis of a Lamina:**

Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture, Numerical problems.

**Macro Mechanics of a Lamina:** Hooke's law for different types of materials, Number of elastic constants, Two - dimensional relationship of compliance and stiffness matrix. Hooke's law for two-dimensional angle lamina, engineering constants - Numerical problems. Stress-Strain relations for lamina of arbitrary orientation, Numerical problems.

**UNIT – III**

**Biaxial Strength Theories**

Maximum stress theory, Maximum strain theory, Tsai-Hill theory, Tsai, Wu tensor theory, Numerical problems.

**Macro Mechanical Analysis of Laminate**

Introduction, code, Kirchoff hypothesis, CL T, A, B, and D matrices (Detailed derivation) , Special cases of laminates, Numerical problems.

**UNIT – IV**

**Metal Matrix Composites:**

Metal Matrix Composites: Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC's and its application.

**Fabrication Process For MMC's:** Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.

**Study Properties Of MMC's:** Physical Mechanical, Wear, machinability and Other Properties. Effect of size, shape and distribution of particulate on properties.

| **UNIT – V** | | |
|---|---|---|

**Failure Theories**

Micromechanics of Failure of Unidirectional Lamina, Anisotropic Strength and Failure Theories, Importance of Shear Strength, Choice of Failure Criteria, Examples.

**Textbooks:**

1. K.K. Chawla, Composite Materials, Springer-Verlag, New York, 1998.
2. B.T. Astrom, Manufacturing of Polymer Composites, Chapman & Hall, 1997.
3. Stuart M Lee, J. Ian Gray, Miltz, Reference Book for Composites Technology, CRC press, 1989.

**Reference Books:**

1. Frank L Matthews and R D Rawlings, Composite Materials: Engineering and Science, Taylor and Francis, 2006.
2. D. Hull and T.W. Clyne, Introduction to Composite Materials, Cambridge University Press, 1996.
3. M.R. Piggott, Load Bearing Fibre Composites, Pergamon press, Oxford, 1998.
4. F. Ashby and D.R.H. Jones, Engineering Materials, Pergamon press, 1999.
5. R.W. Davidge and A. Kelly, Mechanical behavior of ceramics, Cambridge university press, 1999.
6. Andrew C. Marshall, Composite Basics, Marshall Consulting. Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination, 1998.Engineering aspects of Shape memory Alloys, T. W. Duerig, K. N. Melton, D. Stockel,C.
7. Mayman, Butterworth – Heinemann, 1990.

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

| Course Code | INTRODUCTION TO HYBRID & ELECTRIC VEHICLES (Professional Elective-III) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**III Year II Semester**

**Course Objectives:**

- Foundational and applied knowledge of electric vehicle systems, battery technologies, and battery management systems.
- U Understanding of electric vehicle power plants, and drive control techniques essential for efficient electric vehicle propulsion.
- Knowledge of hybrid and electric vehicle technologies, including their historical evolution and energy efficiency optimization.
- Provide comprehensive knowledge of electric and hybrid electric vehicle systems, and real-world applications ranging from passenger cars to heavy-duty and fuel cell vehicles.
- Demonstration of hybrid and electric vehicle design, energy management strategies for efficient and sustainable vehicle operation.

**Course Outcomes (CO):**

- Analyze and design electric vehicle propulsion and energy storage systems, evaluate battery performance and management strategies
- Implement electric machine operation, design and analyze control power electronic converters, and apply drive control strategies in electric vehicle applications.
- Analyze hybrid and electric drivetrain configurations, evaluate and create various electric motor drives and hybrid vehicle propulsion systems.
- Compare hybrid and electric vehicle architectures, understand control strategies for various drive systems, and evaluate the role of emerging technologies in improving vehicle efficiency and sustainability.
- Design and evaluate hybrid and electric vehicle systems and applying control and communication principles across various electric and hybrid vehicle architectures.

**UNIT – I** **Electric Vehicle Propulsion and Energy Sources**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Li polymer battery.

**UNIT – II** **Electric Vehicle Power Plant and Drives**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives- PWM, current control method. Switch reluctance machine drives - voltage control, current control.

**UNIT – III** **Hybrid and Electric Drive Trains**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

**UNIT – IV** **Electric and Hybrid Vehicles - Case Studies**

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

**UNIT – V** **Electric and Hybrid Vehicle Design**

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

**Textbooks:**

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.

**Reference Books:**

1. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, Wiley-Blackwell, 2018.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.

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**College of Engineering & Technology,Ananthapuramu – 515 003 (A.P) India**
**Mechanical Engineering**

| Course Code | MANUFACTURING PROCESS (Open Elective-2) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**III Year II Semester**

**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.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | ROBOTICS (Open Elective-2) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**III Year II 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.

**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 overview 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

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**Mechanical Engineering**

| Course Code | ELECTRICAL VEHICLES (Open Elective-2) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**III Year II Semester**

**Course Objectives:**

- To introduce the fundamentals of hybrid and electric vehicle systems.
- To understand battery technologies, charging methods, and management systems.
- To learn about electric drives, propulsion systems, and power electronics in EVs.
- To familiarize students with design, control, and case studies of electric vehicles.

**Course Outcomes (CO):**

After completing the course, the student will be able to,

- Explain the basic structure and working principles of hybrid and electric vehicles.
- Understand types of batteries, charging methods, and management systems.
- Analyze electric drive systems and power electronic converters used in EVs.
- Evaluate performance and efficiency through real-world EV case studies.

**UNIT - I** **Introduction to Electric Vehicles**

Overview of electric mobility – types of electric vehicles – basic vehicle mechanics – energy sources – battery characteristics, capacity, and ratings – battery management systems.

**UNIT - II** **Electric Vehicle Powertrain and Drives**

Electric propulsion system – electric motors used in EVs (DC, induction, PMSM, BLDC) – power converters and controllers – regenerative braking – charging methods.

**UNIT - III** **Hybrid Vehicles**

Concept and classification of hybrid vehicles – series and parallel hybrids – energy flow and efficiency – case studies of hybrid vehicles.

**UNIT - IV** **Electric Vehicle Design and Components**

Design considerations – motor sizing – battery selection – power electronics integration – communication systems – safety and standards in EVs.

**UNIT - V** **Case Studies and Emerging Trends**

Study of commercial EVs (Nissan Leaf, Tesla Model 3, Tata Nexon EV, Toyota Prius) – EV infrastructure – future trends: solar and fuel-cell electric vehicles.

**Textbooks:**

1. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press.
2. Mehrdad Ehsani et al., Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press.

**Reference Books:**

1. James Larminie & John Lowry, Electric Vehicle Technology Explained, Wiley.
2. John G. Hayes & Abas Goodarzi, Electric Powertrain: Energy Systems and Drives, Wiley.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | HEAT TRANSFER LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**III Year 2nd 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

**List of Experiments**

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. Emissivity measurement
9. Drop wise and film vise apparatus
10. Counter flow and parallel flow heat exchangers apparatus.
11. Study the pool boiling phenomenon and different regimes of pool boiling.
12. Experiment on pool boiling
13. Determine the heat transfer rate coefficient in fluidized bed apparatus.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

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

**III Year II Semester**

**Course Objectives**

- To introduce the fundamentals of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM).
- To provide knowledge of geometric modelling and transformation techniques in CAD.
- To understand the working principles of NC, CNC, and DNC machine tools.
- To develop skills in manual part programming and computer-aided part programming.

**Course Outcomes (CO):**

- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modelling 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 iso metric from the given orthographic views using Autocad.
6. To creating 3-D modeling from the given or-tho graphic views using Autocad 3-D commands.
7. **Part Modelling:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation.

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**Mechanical Engineering**

| Course Code | 3 D PRINTING (Skill Oriented Course-IV) | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |

**III Year II Semester**

**Course Objectives:**

- To introduce the fundamentals of 3D printing and additive manufacturing processes.
- To familiarize students with various 3D printing techniques and materials.
- To provide hands-on experience in modeling, slicing, and printing of 3D components.
- To develop the ability to analyze process parameters and identify printing defects.

**Course Outcomes (CO):**

- Explain different types of 3d Printing techniques.
- Identify parameters for powder binding and jetting process
- Determine effective use of ABS material for 3D Printing
- Apply principles of mathematics to evaluate the volume of material require.

**List of Experiments:**

1. Introduction to Prototyping, Working of 3D Printer, Types of 3D printing Machines:
   Exp 1: Modelling of Engineering component and conversion of STL format.
   Exp 2: Slicing of STL file and study of effect of process parameter like layer thickness, orientation, and infill on build time using software.
   Exercise 1 : Component-1
   Exercise 2 : Component-2

2. Exp 1 : 3D Printing of modelled component by varying layer thickness.
   Exp 2 : 3D Printing of modelled component by varying orientation.
   Exp 3: 3D Printing of modelled component by varying infill.

3. Study on effect of different materials like ABS, PLA, Resin etc, and dimensional accuracy.
4. Identifying the defects in 3D Printed components.
5. Exp1: Modelling of component using 3D Scanner of real life object of unknown dimension in reverse engineering**.**
   Exp 2: 3D Printing of above modelled component.

**References:**

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e, World Scientific Publishers, 2003.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | TECHNICAL REPORT WRITING & IPR | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | - |

**III Year II Semester**

**Course Objectives:**

- To enable the students to practice the basic skills of research paper writing
- To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
- To practice the basic skills of performing quality literature review
- To help them in knowing the significance of real life practice and procedure of Patents.
- To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

**Course Outcomes (CO):**

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

- Identify key secondary literature related to their proposed technical paper writing.
- Explain various principles and styles in technical writing
- Use the acquired knowledge in writing a research/technical paper
- Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.
- Evaluate different forms of IPR available at national & international level
- Develop skill of making search of various forms of IPR by using modern tools and techniques

**UNIT – I** **Principles of Technical Writing**

**Principles of Technical Writing**: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing .

**UNIT – II** **Technical Research Paper Writing**

**Technical Research Paper Writing**: Abstract- Objectives-Limitations-Review of Literature-Problem sand Framing Research Questions- Synopsis

**UNIT – III** **Process of research**

**Process of research:** publication mechanism: types of journals- indexing-seminars- conferences-proof reading –plagiarism style; seminar & conference paper writing;
Methodology-discussion-results- citation rules

**UNIT – IV Introduction to Intellectual property**

**Introduction to Intellectual property**: Introduction, types of intellectual property, international nizations, agencies and treaties, importance of intellectual property rights
Trademarks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

**UNIT – V** **Law of copy rights**

**Law of copy rights:** Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law
**Law of patents:** Foundation of patent law, patent searching process, ownership rights and transfer.Patent law, intellectual property audits.

**Textbooks:**

1.Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013
2.Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and practices.Oxford.

**Online Learning Resources:**

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/

5. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
6. https://lawbhoomi.com/intellectual-property-rights-notes/
7. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

**Sri Krishnadevaraya University**
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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.** | | Automobile Engineering | PC | 3-0-0 | 3 |
| **2.** | | Entrepreneurship & Incubation | MGT | 2-0-0 | 2 |
| **3.** | | 1. Finite Element Methods<br>2. Power Plant Engineering<br>3. Robotics | PE-4 | 3-0-0 | 3 |
| **4.** | | 1. Non-Destructive Testing<br>2. Smart Manufacturing<br>3. Total Quality Management | PE-5 | 3-0-0 | 3 |
| **5.** | | 1. Basic Thermodynamics<br>2. Workshop Technology<br>3. Operation Research | OE-3 | 3-0-0 | 3 |
| **6.** | | 1. Total Quality Management<br>2. Advanced Materials<br>3. 3D Printing Technologies | OE-4 | 3-0-0 | 3 |
| **7.** | | Drone Technologies | SOC | 0-1-2 | 2 |
| **8.** | | Gender Sensitization | AC | 2-0-0 | 0 |
| **9.** | | Evaluation of Industrial Internship | PR | - | 2 |
| **TOTAL CREDITS** | | | | | **21** |

| **Category** | **CREDITS** |
|---|---|
| Professional Core Courses | 3 |
| Management Course | 2 |
| Professional Elective courses | 6 |
| Open Elective Course/Job oriented elective | 6 |
| Skill Enhancement course/soft skill course* | 2 |
| Internship | 2 |
| **TOTAL CREDITS** | **21** |

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**Mechanical Engineering**

| Course Code | AUTOMOBILE ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV Year 1st 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.

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

| Course Code | ENTREPRENEURSHIP & INCUBATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV Year 1st Semester**

**Course Objectives:**

- 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 entrepreneurial mindset and personality-Recent trends in Entrepreneurship

**UNIT - II**

Starting the New Venture - Generating business idea – Sources of new ideas & methods ofgeneratingideas-Opportunityrecognition-Feasibilitystudy-Marketfeasibility, 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 Facultymay visit : login.cengage.com)
2. Nandan H, “Fundamentals of Entrepreneurship”, PHI, 2013

**Reference Books:**

1. VasantDesai,“SmallScaleIndustriesandEntrepreneurship”,HimalayaPublishing2012.

2. RajeevRoy"Entrepreneurship",2nd Edition,Oxford,2012.
3. B.Janakiram and M.Rizwana‖ "Entrepreneurship Development: Text &Cases", Excel Books, 2011.
4. StuartRead,Effectual"Entrepreneurship",Routledge,2013.

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

| Course Code | FINITE ELEMENT METHODS (Professional Elective-IV) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV Year I Semester**

**Course Objectives:**

- Learn basic principles of finite element analysis procedure.
- Gain knowledge of the concepts of Nodes and elements
- Know the theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, and dynamic problems.
- Develop the knowledge and skills to evaluate finite element analyses and apply design analysis Effectively.

**Course Outcomes (CO):**

- Understand the concepts behind formulation methods in FEA
- Explain the concepts of Nodes and elements used in the analysis of beams and solve the simple problems
- Understand the 2D stress analyses of the FEM method and solve the strain triangles.
- Apply Suitable boundary conditions to a global structural equation and reduce it to a solvable form.

**UNIT - I** **Introduction to finite element methods**

Introduction to finite element methods for solving field problems, applications, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, Rayleigh-Ritz method, Formulation of Finite Element Equations.

**One dimensional Problems:** Finite element modelling of ID bar elements coordinates and shape functions. Requirements for Convergence and Interpolation functions, Pascal's Triangle, Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions

**UNIT - II** **1D Analysis of Trusses and Beams**

**Analysis of trusses:** Stiffness Matrix for 1D truss element, Stress Calculations and Problems with maximum of three elements.

**Analysis of beams:** Element Stiffness Matrix and Load vector for 1 D beam element, Hermite shape functions and simple problems.

**UNIT - III** **2D Analysis**

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses.

Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

**UNIT - IV** **Quadrilateral Elements & Thermal Analysis**

**Quadrilateral Elements:** Isoparametric, Sub parametric and Super parametric elements, Modelling of 4 noded and 8 noded quadrilateral elements and simple problems. Numerical Integration.

**Steady state heat transfer analysis:** One dimensional analysis of composite slab and fin.

**UNIT - V** **Dynamic analysis**

Analysis of a 1D uniform shaft subjected to torsion – Simple problems

**Dynamic analysis:** Formulation of finite element model, element – mass matrices, evaluation of Eigen values and Eigen vectors for a bar and shaft.

**Textbooks:**


1. T. Chandraputla, Ashok Belegundu, Introduction to Finite Element in Engineering, Pearson Publications 2011.
2. S.S.Rao, The Finite Element Methods in Engineering, Elsevier Butterworth -Heinemann, 2/e, 2011.
3. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993.


**Reference Books:**


1. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3/e, John Wiley, New York, 1989.
2. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, 1982.
3. G.LakshmiNarasaiah, Finite Element Analysis, 1/e, B.S. Publications, 2008.
4. O C Zienkiewicz and R L Taylor, the Finite Element Method, 3/e. McGraw-Hill, 1989.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

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

**IV Year 1st Semester**

**Course Objectives:**

- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- Understand the working mechanism of diesel and gas turbine power plants.
- Impart types of nuclear power plants, and outline working principle and advantages and hazards..
- Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations

**Course Outcomes (CO):**

- Outline sources of energy, power plant economics, and environmental aspects.
- Describe working components of a steam power plant.
- Illustrate the working mechanism of diesel and gas turbine power plants.
- Summarize types of renewable energy sources and their working principle.
- Demonstrate the working principle of nuclear power plants.

**UNIT – I**

**Introduction to the Sources Of Energy** - Resources and Development of Power in India. Convectional and non- conventional energy sources, 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, Construction, Plant lay out 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 Plant: Types - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

**UNIT - V**

**Power from Non-Conventional Sources:** Utilization of Solar Collectors- Working Principle, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation.
Nuclear Power Station: Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.
**Types of Reactors:** Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

**Textbooks:**

1. P.K. Nag, “Power Plant Engineering”, 3rd edition, TMH, 2013.
2. 2. Wakil, “Power plant technology”, M.M.EI TMH Publications.

**Reference Books:**

1. Rajput, "A Text Book of Power Plant Engineering:, 4th edition, Laxmi Publications, 2012.
2. Ramalingam, "Power plant Engineering", Scietech Publishers, 2013
3. P.C. Sharma, "Power Plant Engineering", S.K. Kataria Publications, 2012.
4. Arora and S.Domakundwar, "A course in Power Plant Engineering", Dhanpat Rai & Co (p) Ltd, 2014.

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

| Course Code | ROBOTICS (Professional Elective-IV) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV Year 1st 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 overview 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.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | NON-DESTRUCTIVE TESTING (Professional Elective-V) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV Year 1st 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):**

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.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | SMART MANUFACTURING (Professional Elective-V) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV Year 1st Semester**

**Course Objectives:**

- **Understand** the fundamental concepts of Smart Manufacturing, Industry 4.0 and IoT in Manufacturing.
- **Understand** the fundamental concepts of Data Analytics and Artificial Intelligence in Manufacturing
- Know about Smart Sensors, RFID, and Block chain in Manufacturing
- **Explain the techniques of** Digital Twin & Simulation in Manufacturing
- **Familiarize** Sustainable and Green Manufacturing

**Course Outcomes (CO):**

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

- Define and explain the evolution of Smart Manufacturing, Industry 4.0 and IoT in Manufacturing
- Concepts of Data Analytics and Artificial Intelligence in Manufacturing
- Apply knowledge of Smart Sensors, RFID, and Block chain in Manufacturing
- **Summarise the techniques of** Digital Twin & Simulation in Manufacturing
- Importance of Sustainable and Green Manufacturing.

**UNIT - I**

**Introduction to Smart Manufacturing**
Definition, Evolution, and Importance of Smart Manufacturing, Industry 4.0 and Its Impact on Manufacturing, Traditional vs. Smart Manufacturing, Key Technologies in Smart Manufacturing
**Cyber-Physical Systems & Industrial IoT (IIoT)**
Basics of Cyber-Physical Systems (CPS), Internet of Things (IoT) in Manufacturing, Smart Sensors and Actuators Communication Protocols (MQTT, OPC-UA, Modbus),

**UNIT - II**

**Data Analytics and Artificial Intelligence in Manufacturing**
Role of Big Data in Manufacturing, Machine Learning & Deep Learning for Smart Manufacturing, Predictive Maintenance and Anomaly Detection, Digital Twin Technology
**Automation & Robotics in Smart Manufacturing**
Industrial Automation: PLCs, SCADA, and DCS, Autonomous Robots and Cobots (Collaborative Robots), Additive Manufacturing (3D Printing), Case Studies of Smart Factories.

**UNIT - III**

**Cloud Computing and Edge Computing in Manufacturing**
Introduction to Cloud Computing for Manufacturing, Edge and Fog Computing in Real-time Manufacturing Systems, Cloud-based Manufacturing Execution Systems (MES)
**Smart Sensors, RFID, and Block chain in Manufacturing**
Role of Smart Sensors and RFID in Inventory Management, Blockchain for Secure Supply Chains Smart Contracts and Decentralized Manufacturing Systems

**UNIT – IV**

**Digital Twin & Simulation in Manufacturing**
Digital Twin Technology and Virtual Prototyping, Simulation Software for Smart Manufacturing, Augmented Reality (AR) and Virtual Reality (VR) in Industry 4.0
**Cybersecurity in Smart Manufacturing**
Threats and Risks in Smart Manufacturing, Cybersecurity Frameworks for Industrial Systems, Best Practices for Securing IoT and IIoT Devices

**UNIT – V**

**Sustainable and Green Manufacturing**
Energy Efficiency in Smart Manufacturing, Sustainable Supply Chain Management, Role of AI in Green Manufacturing
**Case Studies and Future Trends**

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|---|
| Case Studies of Leading Smart Manufacturing Companies, Emerging Technologies in Smart Manufacturing, Future of Industry 5.0 and Beyond |
| **Textbooks:** |
| 1. Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013<br>2. Smart manufacturing by Kamalakar Mutalik The Righte order (2023) |
| **Reference Books:** |
| 1. Introduction To Smart Manufacturing And Automation Dr. Rajkumar. E Namya Press (29 March 2024); 213, Vardan Hosue 7/28 Ansari Road Daryganj Delhi 110002.<br>2. Smart Manufacturing by Michael Deng (Author), Colin Koh Kindle Edition (2023) |

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**Mechanical Engineering**

| Course Code | TOTAL QUALITY MANAGEMENT (Professional Elective-V) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV Year 1st Semester**

**Course Objectives:**

- **To introduce** the fundamental concepts, definitions, and dimensions of quality and Total Quality Management (TQM).
- **To explore** the evolution of quality management through historical perspectives and contributions of quality gurus.
- **To explain** the core principles of TQM including customer satisfaction, employee involvement, and continuous improvement.
- **To analyze** the various TQM tools such as Benchmarking, QFD, FMEA, Six Sigma, and their role in quality enhancement.
- **To provide** an understanding of quality systems like ISO 9000, ISO 14000, QS 9000, and the processes for their implementation.

**Course Outcomes (CO):**

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

- Define and explain the basic concepts of quality, quality costs, and the scope of Total Quality Management.
- Summarize the philosophies and contributions of TQM pioneers and evaluate barriers and enablers for TQM implementation.
- Apply TQM principles such as employee empowerment, customer satisfaction, and supplier partnerships to real-world business scenarios.
- Analyze the application of tools like QFD, FMEA, Six Sigma, and Benchmarking in improving product and process quality.
- Evaluate and formulate quality systems like ISO 9000 and ISO 14000, and design documentation and auditing processes.

**UNIT - I**

Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

**UNIT - II**

**Historical Review:** Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

**UNIT - III**

**TQM Principles:** Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies.

**UNIT – IV**

**TQM Tools:** Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

**UNIT – V**

**Quality Systems:** Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

**Textbooks:**

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.

3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

**Reference Books:**

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | BASIC THERMODYNAMICS (Open Elective-3) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV YEAR I SEMESTER**

**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:**

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

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

| Course Code | WORKSHOP TECHNOLOGY (Open Elective-3) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV YEAR I SEMESTER**

**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

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**Mechanical Engineering**

| Course Code | OPERATION RESEARCH (Open Elective-3) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |

**IV YEAR I SEMESTER**

**Course Objectives:**

- Understanding of OR, focusing on model classification, formulation, and solution techniques for LP problems.
- Knowledge and techniques for formulating and solving transportation and assignment problems, and the Traveling Salesman Problem.
- Fundamentals of game theory and job sequencing, including optimal strategies, and scheduling techniques.
- Demonstrate of queuing theory, queuing models based on Poisson arrivals and exponential service times, and the analysis of single and multichannel systems with various queue lengths.
- Familiarize replacement and maintenance strategies, fundamentals of dynamic programming and its applications in optimization problems.

**Course Outcomes (CO):**

- Build and compare different mathematical models of the real time situations by using different Research models. Solve the LP problems and find Multiple Optimal Solutions.
- Implement Transportation and Assignment problems to solve the real time industry needs.
- Choose the best strategy of Game theory and capable of identifying the suitable techniques. Solve the Job Sequencing Problem.
- Apply different Queuing models to optimize the queuing length. Define the queuing and inventory terminology to solve the different inventory and queuing problems.
- Apply concepts of replacement and maintenance analysis and solve optimization problems using dynamic programming techniques.

| UNIT – I | Introduction to OR |
|---|---|

**Introduction to Operations Research (OR):** OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models
**Linear Programming(LP):** Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two-Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem

| UNIT – II | Transportation and Assignment Problems |
|---|---|

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution –North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, Degenerate Problem. Assignment Problem – Formulation, Hungarian Method for Solving Assignment Problems, Traveling Salesman problem.

| UNIT – III | Game theory & Job Sequencing |
|---|---|

**Game theory:** Optimal solution of two person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies. Reduction by principles of dominance, arithmetic, algebraic method and graphical method.
**Job Sequencing:** Introduction to Job shop Scheduling and flow shop scheduling, Solution of Job Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

| UNIT – IV | Queuing Theory & Inventory Control |
|---|---|

**Queuing Theory:** Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with infinite and finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with infinite queue length.
**Inventory Control:** Introduction, Deterministic models – EOQ model with and without shortages, Production model, Buffer stock and discount inventory models with single price breaks. Selective inventory control.

| UNIT – V | Replacement and Maintenance Analysis & DP |
|---|---|

**Replacement and Maintenance Analysis:** Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model. **Dynamic Programming (DP):** Introduction –Bellman's Principle of Optimality – Applications of Dynamic Programming – Shortest Path Problem – Capital Budgeting Problem – Solution of Linear Programming Problem by DP.

**Textbooks:**

1. Sharma S.D., Operations Research: Theory, Methods and Applications, 15/e, Kedar Nath Ram Nath, 2010
2. Taha H.A., Operations Research, 9/e, Prentice Hall of India, New Delhi, 2010.

**Reference Books:**

1. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7/e, Tata McGraw Hill, 2010.
2. Sharma J.K., Operations Research: Theory and Applications, 4/e, Laxmi Publications, 2009.
3. Prem kumar Gupta and Hira, Operations Research, 3/e, S Chand Company Ltd., New Delhi, 2003.
4. Pannerselvam R., Operations Research, 2/e, Pentice Hall of India, New Delhi, 2006.
5. Sundaresan.V, and Ganapathy Subramanian.K.S, Resource Management Techniques: Operations Research, A.R Publications, 2015.

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

| Course Code | TOTAL QUALITY MANAGEMENT (Open Elective-IV) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV YEAR I SEMESTER**

**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 feedback - Customer complaints - Customer retention - Service quality. Employee involvement – Employee motivation - Maslow's hierarchy of needs - Herzberg theory - Empowerment and teamwork.

**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:**

1. Joel E. Rose, *Total Quality Management*, 2nd Edition, Kogan Page Ltd., USA 1993.
2. 2. Srinath, L. S., *Reliability Engineering*, Affiliated East West Press, New Delhi 1995.

**Reference Books:**

1. 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. 3. Zeiri, *Total Quality Management for Engineers*, Wood Head Publishers, 1991

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**Mechanical Engineering**

| Course Code | ADVANCED MATERIALS (Open Elective-IV) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV YEAR I SEMESTER**

**Course Objectives:**

- To understand the structure, properties, and classification of advanced engineering materials.
- To study composites, ceramics, polymers, and smart materials used in modern engineering.
- To learn the processing and applications of nano and biomaterials.
- To explore the latest trends in material development for mechanical applications.

**Course Outcomes (CO):**

- Explain the mechanical, thermal, and electrical properties of advanced materials.
- Classify and describe composites, ceramics, polymers, and smart materials.
- Identify the applications of nanomaterials and biomaterials in engineering.
- Select suitable materials for advanced mechanical and industrial applications.

| UNIT - I | Introduction to Advanced Materials |
|---|---|

Classification of engineering materials – traditional vs advanced materials – structure-property relationship – crystal imperfections – strengthening mechanisms.

| UNIT - II | Composite Materials |
|---|---|

Types of composites – particulate, fiber-reinforced, laminated composites – matrix materials – fabrication methods – properties and applications.

| UNIT - III | Polymers and Ceramics |
|---|---|

Structure and properties of polymers – thermoplastics and thermosets – ceramics and their mechanical properties – applications in high-temperature environments.

| UNIT - IV | Smart and Functional Materials |
|---|---|

Shape memory alloys, piezoelectric materials, magnetostrictive materials, and conducting polymers – principles, behavior, and applications in sensors and actuators.

| UNIT - V | Nano and Biomaterials |
|---|---|

Introduction to nanotechnology – synthesis and characterization of nanomaterials – mechanical behavior at nanoscale – biomaterials and their applications in medical devices.

**Textbooks:**

1. V. Raghavan, *Materials Science and Engineering*, Prentice Hall of India.
2. K. G. Budinski & M. K. Budinski, *Engineering Materials: Properties and Selection*, Pearson Education.

**Reference Books:**

1. William D. Callister, *Materials Science and Engineering: An Introduction*, Wiley.
2. Donald R. Askeland, *The Science and Engineering of Materials*, Cengage Learning.
3. M. F. Ashby & D. R. H. Jones, *Engineering Materials*, Elsevier.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | 3D PRINTING TECHNOLOGIES (Open Elective-IV) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**IV YEAR I SEMESTER**

**Course Objectives:**

- Understand the fundamental concepts of prototyping and distinguish between traditional and rapid prototyping methods.
- Demonstrate the working principles, materials, and applications of solid-, liquid-, and powder-based rapid prototyping systems.
- Define the processes and classifications of rapid tooling and reverse engineering techniques.
- Identify common errors in 3D printing and evaluate pre-processing, processing, and post-processing issues.
- Familiarize with RP-related software and its role in applications such as design, manufacturing, and medical fields.

**Course Outcomes (CO):**

- Define and explain the evolution and need for rapid prototyping in modern product development.
- Compare and contrast various 3D printing technologies based on working principles, materials, and limitations.
- Apply knowledge of rapid tooling and reverse engineering techniques for industrial and design applications.
- Diagnose and interpret different types of errors encountered in 3D printing processes and recommend suitable solutions.
- Use RP-specific software tools to manipulate STL files and prepare models for printing in real-world scenarios.

**UNIT - I** **Introduction to 3D Printing**

Introduction to Prototyping, Traditional Prototyping vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

**UNIT - II** **Solid and Liquid Based RP Systems**

Working Principle, Materials, Advantages, Limitations, and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereolithography (SLA), Direct Light Projection System (DLP), and Solid Ground Curing (SGC).

**UNIT - III** **Powder Based and Other RP Systems**

Powder-Based RP Systems: Working Principle, Materials, Advantages, Limitations, and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS), and Electron Beam Melting (EBM).
Other RP Systems: Working Principle, Materials, Advantages, Limitations, and Applications of Three Dimensional Printing (3DP), Ballistic Particle Manufacturing (BPM), and Shape Deposition Manufacturing (SDM).

**UNIT - IV** **Rapid Tooling and Reverse Engineering**

Rapid Tooling: Conventional Tooling vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling Methods.
Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE – Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development

**UNIT - V** **Errors in 3D Printing and Applications**

Pre-processing, Processing, and Post-processing Errors, Part Building Errors in SLA, SLS, etc.
Software: Need for Software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc. Preparation of CAD Models, Problems with STL Files, STL File Manipulation, RP Data Formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.
Applications: Design, Engineering Analysis and Planning, Rapid Tooling, Reverse Engineering, and Medical Applications of RP.

**Textbooks:**

1. Chee Kai Chua and Kah Fai Leong, *3D Printing and Additive Manufacturing Principles and Applications*, 5th Edition, World Scientific Publications, 2017.
2. Ian Gibson, David W. Rosen, and Brent Stucker, *Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing*, 2nd Edition, Springer, 2010.

**Reference Books:**

1. Frank W. Liou, *Rapid Prototyping and Engineering Applications*, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, *Rapid Prototyping: Principles and Applications in Manufacturing*, John Wiley & Sons, 2006.

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

| Course Code | INTRODUCTION TO DRONE TECHNOLOGIES (Skill Oriented Course) | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |

**IV Year 1st Semester**

**Course Objectives:**

- To learn and understand the fundaments of design, fabrication and programming of drone
- To teach technical characteristics of the Drone parts and its functions
- To impart the knowledge of an flying and operation of drone
- To know about the various applications of drone
- To understand the safety risks and guidelines of fly safely

**Course Outcomes (CO):**

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

- Know about a various type of drone technology, drone fabrication and programming.
- Execute the suitable operating procedures for functioning a drone
- Select appropriate sensors and actuators for Drones
- Develop a drone mechanism for specific applications
- Create the programs for various drones

**UNIT - I**

**INTRODUCTION TO DRONE TECHNOLOGY**

Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability.

**UNIT - II**

**DRONE DESIGN, FABRICATION AND PROGRAMMING**

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations - The methods of programming drone- Download program -Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection

**UNIT - III**

**DRONE FLYING AND OPERATION**

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications

**UNIT – IV**

**DRONE COMMERCIAL APPLICATIONS**

Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution - Drones in filming and panoramic picturing

**UNIT – V**

**FUTURE DRONES AND SAFETY**

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms

**Textbooks:**

1. Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc.
2. Terry Kilby and Belinda Kilby, “Make:Getting Started with Drones “,Maker Media, Inc,

**Reference Books:**

1. John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016

2. Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.

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

| Course Code | GENDER SENSITIZATION (Audit Course) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 |

**IV Year 1st Semester**

**Course Objectives:**

To enable students to understand the gender related issues, vulnerability of women and men

- To familiarize them about constitutional safeguard for gender equality
- To expose the students to debates on the politics and economics of work
- To help students reflect critically on gender violence
- To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.

**Course Outcomes(CO):**

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

- Understand the basic concepts of gender and its related terminology
- Identify the biological , sociological, psychological and legal aspects of gender

**UNIT-I** **UNDERSTANDING GENDER**

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

**UNITII** **GENDER ROLES AND RELATIONS**

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio-Demographic Consequences-Gender Spectrum -

**UNIT-III** **GENDER AND LABOUR**

Division and Valuation of Labour-Housework: The Invisible Labor- ―My Mother doesn‘t Work.‖ ―Share the Load.‖-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work - Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

**UNIT-IV** **GENDER-BASED VIOLENCE**

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

**UNIT-V** **GENDER AND CULTURE**

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature-Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships

**Textbooks:**

1. A.Suneetha, Uma Bhrugubanda, et al. *Towards a World of Equals: A Bilingual Textbook on Gender*‖, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity.* UK Paperback Edn. March 1990

**Reference Books:**

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India,*London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), *Women in Developing Countries, Assessing Strategies for Empowerment,* London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., *Gender and Governance,* New Delhi, Rawat Publication, 2007

Online Resources:

**1. Understanding Gender**

chrome-extension://kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf

https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

**2. Gender Roles and Relations**

https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes

https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408
https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

**3. Gender and Labour**

https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed https://onlinecourses.nptel.ac.in/noc23_mg67/preview

4. **GENDER-BASED VIOLENCE**
https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en

https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls
https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

5. **GENDER AND CULTURE**
https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/

https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/

https://archive.nptel.ac.in/courses/109/106/109106136/

Abdulali Sohaila. ―I Fought For My Life…and Won.‖Available online (at:
http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

**Sri Krishnadevaraya University**
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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 | PR | - | 4 |
| 2. | | Project | PR | - | 8 |
| **Total** | | | | | 12 |

| **Category** | **CREDITS** |
|---|---|
| Internship | 4 |
| Project work | 8 |
| **TOTAL CREDITS** | **12** |

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**Mechanical Engineering**

| Sri Krishnadevaraya University College of Engineering & Technology | | | | | |
|---|---|---|---|---|---|
| **Dept. of Mechanical Engineering** | | | | | |
| **Honors in Mechanical Engineering** | | | | | |
| S.No. | **CourseCode** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | Automotive Thermal Systems | PC | 3-0-0 | 3 |
| **2.** | | Simulation and Modelling of Manufacturing Systems | PC | 3-0-0 | 3 |
| **3.** | | Supply Chain Management | PC | 3-0-0 | 3 |
| **4.** | | Advanced Mechanism Design | PC | 3-0-0 | 3 |
| **5.** | | Biomechanics | PC | 3-0-0 | 3 |
| **6.** | | Automotive Thermal Systems Lab | PC | 0-0-3 | 1.5 |
| **7.** | | Simulation and Modelling of Manufacturing Systems Lab | PC | 0-0-3 | 1.5 |
| | | | | **Total** | **18** |

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**Mechanical Engineering**

| Course Code | AUTOMOTIVE THERMAL SYSTEM | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**HONORS IN MECH.**

**Course Objectives:**

- Understand basic heat transfer and thermodynamics concepts in automotive systems.
- Learn engine thermal management and methods to improve efficiency.
- Study automotive climate control and cabin thermal comfort.
- Learn about heat exchangers and cooling system design.
- Explore thermal management in electric vehicles.

**Course Outcomes (CO):**

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

- Apply heat transfer and thermodynamics principles to automotive systems.
- Analyze engine heat balance and improve thermal performance.
- Design and evaluate automotive climate control systems.
- Select and design heat exchangers and cooling components.
- Understand and manage thermal issues in electric vehicle systems.

**UNIT - I**

**Fundamentals and Systematic Approach to Heat Transfer Concepts**

Energy, Heat & Work, First Law of Thermodynamics, Heat Engines, Refrigerators, and Heat Pumps, Second Law of Thermodynamics, Carnot Cycle, Conduction, Convection-Parallel flow on a Isothermal Plate, A cylinder in cross flow, Flow in Ducts, Free Convection, Radiation. Formulation of Thermal System Design-Requirement and Specifications, Design Variables, Constraints. Designing a workable system, Optimization methods -overview and significance

**UNIT - II**

**Automotive Engine Thermal Management**

Fundamentals of First & Second Law of Thermodynamics to the engine performance (Volumetric efficiency and Thermal Efficiency), heat balance equation, Fundamentals of Exergy, Energy analysis, Thermal Models and Operating Strategy- smart valve, variable speed pump, variable speed fan. Applications of Thermoelectric generators and Thermoelectric coolers, Applications of heat pipes and heat sink.

**UNIT - III**

**Fundamentals of Automotive Climate Control**

Psychrometric properties, Use of psychrometric chart, coefficient of performance, Refrigerants – Types of refrigerants, Properties and Selection of refrigerants, Factors affecting the air flow, Types of fans, Axial and Centrifugal fans, Load calculations, Winter air-conditioning, Two-phase flow effects in the Evaporator and Condenser, air side heat transfer on the Evaporator and Condenser, System mass effects, Simplified cabin thermal model. Convective thermal interaction-cabin air and atmosphere.

**UNIT – IV**

**Fundamentals- Heat Exchangers**

Functions of radiator, compressor, Functions of condenser, evaporator, expansion valve, Classification of heat exchangers – According to transfer process, Number of fluids, surface compactness, Construction features, flow arrangements, heat transfer mechanisms, Selection and design of heat exchangers based on – Types, heat transfer rate, cost, pumping power, size and materials. Coolant- function, types, and required properties. Advanced cooling system with smart valve, variable speed pump, variable speed fan, engine block, radiator, and sensors (temperature, mass flow rate and power).

**UNIT – V**

**Thermal management in EV systems**

Temperature sensitivity and heat generation of batteries- electro-thermal, Internal heat generation, Rate of Discharge, Battery ageing, Thermal runaway, battery heat transfer medium. Role of thermal management in power electronics and controllers, heat sink design and configuration, Application of microfluidics and nano fluids.

**Textbooks:**

1. Yunus A Cengel, Afshin J Ghajar, ―Heat and Mass Transfer‖., Tat McGraw Hill Education Private Limited, New Delhi,2018
2. W. F. Stoecker Design of Thermal Systems Third Edition, McGraw – Hill, New york, 1989
3. HoSung Lee ―Thermal Design: Heat Sinks, Thermoelectrics, Heat Pipes, Compact Heat Exchangers, and Solar Cells‖ 2011 John Wiley & Sons, Inc
4.

**Reference Books:**

1. Jaluria, Yogesh.Design and optimization of thermal systems 2nd Edition CRC Press, Taylor & Francis Group 2018.
2. Quansheng Zhang ―Automotive Air Conditioning Optimization, Control and Diagnosis‖ Springer International Publishing AG 2016
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2012.
4. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003 8. ―Bosch‘ Automotive Handbook‖, 8thEdition

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

| Course Code | SIMULATION AND MODELLING OF MANUFACTURING SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**HONORS IN MECH.**

**Course Objectives:**

- Understand the basics of simulation, system modeling, and types of models.
- Learn to build, verify, and validate simulation models.
- Understand random variable generation and simulation languages.
- Analyze simulation output and interpret results for decision-making.

**Course Outcomes (CO):**

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

- Explain simulation concepts, model types, and system analysis methods.
- Build and validate credible simulation models for various systems.
- Generate random variables and use simulation software effectively.
- Analyze output data and make steady-state or transient conclusions.

**UNIT - I**

System – ways to analyze the system – Model – types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages. Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1& 2 errors – Framing – strong law of large numbers

**UNIT - II**

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

**UNIT - III**

Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – weibull – normal Bernoullie – Binomial – uniform – poisson. Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.

**UNIT – IV**

Output data analysis – Types of Simulation w.r.t output data analysis – warmup period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

**UNIT – V**

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

**Textbooks:**

1. Law, A.M. & Kelton, ―Simulation Modelling and Analysis‖, McGraw Hill, 2nd Edition, New York, 1991.
2. Narahari and M. Vishwanathan Prentice hall England wood Cliffs, ―Performance modelling of automated manufacturing systems‖. NJ USA 1992.

**Reference Books:**

1. Carrie A. / Wiley, NY, ―Simulation of Manufacturing Systems‖, 1990.
2. Ross, S.M., McMillan, NY, ―A Course in Simulation‖, 1990. Simulation Modelling

and SIMNET / Taha H.A / PH, Englewood Cliffs, NJ, 1987.
3. Banks J. & Carson J.S., PH, —Discrete Event System Simulation‖, Englewood Cliffs, NJ, 1984

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

| Course Code | SUPPLY CHAIN MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**HONORS IN MECH.**

**Course Objectives:**

- Understand the fundamentals of supply chain management and its strategic importance.
- Learn design and management of distribution networks and transportation systems.
- Analyze sourcing, procurement, and pricing strategies in supply chains.
- Study logistics, demand management, and customer service in supply chain systems.

**Course Outcomes (CO):**

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

- Explain supply chain concepts, objectives, decision phases, and strategic fit.
- Design and evaluate distribution networks and transportation options.
- Apply sourcing, procurement, and pricing strategies effectively.
- Analyze logistics systems, demand management, and customer service metrics.
- Understand and apply emerging trends in supply chain management for modern businesses.

**UNIT - I**

**Introduction to Supply Chain Management**

Supply chain - objectives - importance - decision phases - process view -competitive and supply chain strategies - achieving strategic fit – supply chain drivers - obstacles – framework - facilities - inventory-transportation-information-sourcing-pricing.

**UNIT - II**

**Designing the distribution network**

Role of distribution - factors influencing distribution - design options - e-business and its impact – distribution networks in practice –network design in the supply chain - role of network -factors affecting the network design decisions modeling for supply chain. Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs tailored transportation.

**UNIT - III**

**Supply Chain Analysis.**

Sourcing - In-house or Outsource - 3rd and 4th PLs - supplier scoring and assessment, selection - design collaboration - Procurement process - Sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

**UNIT – IV**

**Dimensions of Logistics**

A macro and micro dimension - logistics interfaces with other areas - approach to analyzing logistics systems - logistics and systems analysis - techniques of logistics system analysis - factors affecting the cost and importance of logistics. Demand Management and Customer Service Outbound to customer logistics systems - Demand Management –Traditional Forecasting - CPFRP - customer service - expected cost of stock outs - channels of distribution.

**UNIT – V**

**Recent Trends in Supply Chain Management**-Introduction, New Developments in Supply Chain Management, Outsourcing Supply Chain Operations, Co-Maker ship, The Role of E-Commerce in Supply Chain Management, Green Supply Chain Management, Distribution Resource Planning, World Class Supply Chain Management

**Textbooks:**

1. Sunil Chopra and Peter Meindl, Supply Chain Management – ―Strategy, Planning and Operation‖, 3rd Edition, Pearson/PHI, 2007.

2. Supply Chain Management by Janat Shah Pearson Publication 2008.

**Reference Books:**

1. A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, Cengage Learning, 1/e
2. Donald J Bowersox, Dand J Closs, M Bixby Coluper, ―Supply Chain Logistics Management‖, 2nd edition, TMH, 2008.
3. Wisner, Keong Leong and Keah-Choon Tan, ―Principles of Supply Chain Management A Balanced Approach‖, Cengage Learning, 1/e
4. David Simchi-Levi et al, ―Designing and Managing the Supply Chain‖ – Concepts.

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

| Course Code | ADVANCED MECHANISM DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**HONORS IN MECH.**

**Course Objectives:**

- Understand the fundamentals of kinematics and types of mechanisms.
- Analyze planar and complex mechanisms for position, velocity, and acceleration.
- Learn synthesis methods for mechanisms to achieve desired motion or function.
- Study static and dynamic force analysis of planar mechanisms.

**Course Outcomes (CO):**

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

- Explain kinematics concepts, mobility, and classification of mechanisms.
- Analyze planar mechanisms for position, velocity, and acceleration using analytical methods.
- Perform synthesis of mechanisms for function generation and optimum transmission.
- Conduct static and dynamic force analysis of planar mechanisms.

**UNIT - I**

Introduction – review of fundamentals of kinematics - analysis and synthesis – terminology, definitions and assumptions – planar, spherical and spatial mechanisms‟ mobility – classification of mechanisms – kinematic Inversion – Grashoff`s law Position and displacement – complex algebra solutions of planar vector equations – coupler curve generation velocity – analytical methods - vector method – complex algebra methods – Freudenstein‟s theorem

**UNIT - II**

Planar complex mechanisms - kinematic analysis - low degree complexity and high degree complexity, Hall and Ault`s auxiliary point method – Goodman‟s indirect method for low degree of complexity mechanisms Acceleration – analytical methods – Chase solution - Instant centre of acceleration. Euler-Savory equation - Bobillier construction

**UNIT - III**

Synthesis of mechanisms: Type, number and dimensional synthesis – function generation – two position synthesis of slider crank and crankrocker mechanisms with optimum transmission angle – three position synthesis – structural error – Chebychev spacing - Cognate linkages – Robert- Chebychev theorem – Block‟s method of synthesis, Freudenstein‟s equation

**UNIT – IV**

Static force analysis of planar mechanism – static force analysis of planar mechanism with friction – method of virtual work Dynamic force analysis of planar mechanisms - Combined static and inertia force analysis

**UNIT – V**

Kinematic analysis of spatial revolute-Spherical-Spherical-Revolute mechanism – Denavit- Hartenberg parameters – forward and inverse kinematics of robotic manipulators

**Textbooks:**

1. Amitabh Ghosh and Ashok Kumar Mallik, ―Theory of Mechanisms and Machines, ‖,3e,EWP, 1999
2. Arthur G. Erdman and G.N. Sandor, ―Advanced Mechanism Design: Analysis and Synthesis‖, Vol. II, PHI, 1984.

**Reference Books:**

1. Shighley Joseph Edwards and Uicker John Joseph, ―Theory of Machines and Mechanism‖, 2e, McGraw Hill,1985.

2. Arthur G. Erdman and G.N. Sandor, ―Advanced Mechanism Design: Analysis and Synthesis‖, Vol. I, PHI, 1984.

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**Mechanical Engineering**

| Course Code | BIO MECHANICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**HONORS IN MECH.**

**Course Objectives:**

- Understand the fundamentals of mechanics and the human body as a biomechanical system.
- Analyze kinematics and forces in muscles and joints, especially in the upper limb.
- Study the human body as a multi-link mechanical system for movement analysis.
- Learn biomechanics of joints, gait, postural stability, and mechanics of hard tissues..

**Course Outcomes (CO):**

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

- Explain basic mechanics concepts and the human body as a biomechanical system.
- Analyze forces, stresses, and motion in muscles and upper limb joints.
- Model human movement using forward kinematics and multi-link chain analysis.
- Evaluate biomechanics of major joints, gait patterns, and mechanical behavior of bones.

**UNIT - I**

Introductory Mechanics – Statics and Dynamics – Basic Principles. The human body as a biomechanical system – basic terminologies.

**UNIT - II**

Kinematics of muscles and joints - free-body diagrams and equilibrium, forces and stresses in joints Biomechanical analysis of joints of upper limb - Shoulder, Elbow, wrist, hand and fingers.

**UNIT - III**

Upper limb as a mechanical system – analysis of reaching as movement of a multi-link serial chain – forward kinematics, analysis of fingertip forces as a parallel manipulator

**UNIT – IV**

Biomechanical analysis of joints – Spine, Hip, Knee, Ankle. Introduction to Postural stability and Gait analysis. Gait analysis in health and disease - basics. Mechanics of Hard Tissues - Definition of Stress and Strain, Deformation Mechanics, structure and mechanical properties of bone - cortical and cancellous bones, Wolff‘s law of bone remodeling.

**UNIT – V**

Soft Tissues - Structure, functions, material properties – tendon function, elasticity in a tendon, models of non-linear elasticity in a tendon – physiological and non-physiological regimes, Davis‘ law of soft tissue remodeling. Visco-elastic properties of soft tissues, Models of visco-elasticity: Maxwell & Voight models. Basic Biofluid mechanics - Flow properties of blood in the intact human cardiovascular system.

**Textbooks:**

1. David A. Winter, Biomechanics and Motor Control of Human Movement .
2. Margareta Nordin and Victor H. Frankel, Basic Biomechanics of the Musculoskeletal System.

**Reference Books:**

1. Francisco Valero-Cuevas, Fundamentals of Neuromechanics.
2. Susan Hall, Basic Biomechanics.
3. Irving Hermann, Physics of Human Body.

**Sri Krishnadevaraya University**
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**Mechanical Engineering**

| Course Code | AUTOMOTIVE THERMAL SYSTEMS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**HONORS IN MECH.**

**Course Objectives:**

- To familiarize students with various thermal systems used in automotive applications.
- To understand the principles of heat transfer and thermal management in engines and EVs.
- To analyze the performance of radiators, heat exchangers, and vehicle air-conditioning systems.
- To provide hands-on experience in measuring and interpreting thermal parameters.

**Course Outcomes (CO):**

After successful completion of this lab, the student will be able to:

- Conduct performance tests on automotive heat exchangers and radiators.
- Analyze and evaluate vehicle air-conditioning and refrigeration systems.
- Determine heat transfer coefficients in different configurations.
- Apply thermodynamic and heat transfer principles to practical automotive systems.

**List of Experiments**

1. Performance test on automobile radiator.
2. Determination of heat transfer coefficient in forced convection.
3. Determination of emissivity of a given surface.
4. Study of heat transfer in natural convection.
5. Performance test on vapour compression refrigeration system.
6. Study of air-conditioning system of a car.
7. Determination of heat transfer rate in counter-flow and parallel-flow heat exchangers.
8. Study of heat transfer through a composite wall.
9. Determination of heat transfer rate in a pin-fin apparatus.
10. Study of Stefan–Boltzmann law apparatus.
11. Measurement of heat transfer in fluidized bed system.
12. Study of engine cooling and lubrication systems.

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**Mechanical Engineering**

| Course Code | SIMULATION AND MODELLING OF MANUFACTURING SYSTEMS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**HONORS IN MECH.**

**Course Objectives:**

- To introduce simulation tools for analyzing manufacturing systems.
- To develop models for production, assembly, and inventory control systems.
- To understand stochastic modeling and statistical analysis in manufacturing.
- To enable students to optimize system parameters through simulation results.

**Course Outcomes (CO):**

After successful completion of this lab, the student will be able to:

- Construct discrete-event simulation models of manufacturing systems.
- Perform statistical validation and analysis of simulation outputs.
- Evaluate system performance under varying production conditions.
- Apply simulation-based optimization to real-world industrial problems.

**List of Experiments**

1. Introduction to system simulation and modeling software (e.g., ARENA / FlexSim / SIMUL8).
2. Development of a simple queuing model for a single-machine system.
3. Simulation of a multi-machine production line.
4. Study of bottlenecks and their effect on production rate.
5. Modeling and simulation of flexible manufacturing system (FMS).
6. Simulation of job-shop scheduling problem.
7. Study of assembly line balancing using simulation.
8. Simulation of inventory management systems.
9. Simulation of automated material handling and conveyor systems.
10. Analysis of system throughput and resource utilization.
11. Validation and verification of simulation models.
12. Mini project: Simulation and optimization of a real-time manufacturing problem.

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**Mechanical Engineering**

| **Sri Krishnadevaraya University College of Engineering & Technology** | | | | | |
|---|---|---|---|---|---|
| **Dept. of Mechanical Engineering** | | | | | |
| **Minors in Mechanical Engineering** | | | | | |
| S.No. | **CourseCode** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| **1.** | | CAD/CAM | PC | 3-0-0 | 3 |
| **2.** | | Principles of Manufacturing Processes | PC | 3-0-0 | 3 |
| **3.** | | Fundamentals of Fluid Mechanics & Hydraulic Machines | PC | 3-0-0 | 3 |
| **4.** | | Basic Thermodynamics | PC | 3-0-0 | 3 |
| **5.** | | Robotics | PC | 3-0-0 | 3 |
| **6.** | | Fundamentals of Fluid Mechanics & Hydraulic Machines Lab | PC | 0-0-3 | 1.5 |
| **7.** | | CAD/CAM Lab | PC | 0-0-3 | 1.5 |
| | | | **Total** | | **18** |

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**Mechanical Engineering**

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

**MINORS IN MECH.**

**Course Objectives:**

- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modelling 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:**

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

| Course Code | PRINCIPLES OF MANUFACTURING PROCESS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**MINORS IN MECH.**

**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.<br>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.<br>2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.<br>**3.** Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st Edition, Springer, 2010. |

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

| Course Code | FUNDAMENTALS OF FLUID MECHANICS & HYDRAULIC MACHINES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**MINORS IN MECH.**

**Course Objectives:**

- To introduce fundamental concepts of fluid mechanics and their real-world applications.
- To explore fluid statics, kinematics, and dynamics, including the governing laws.
- To understand pipe flow characteristics and analyze losses in fluid systems.
- To study the design and operation of hydraulic machines, including 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:** Streamline, 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 Introduction to hydroelectric power station-heads and efficiencies-Classification of power plants

**UNIT - V** **Hydraulic Turbines**

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

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

| Course Code | BASIC THERMODYNAMICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**MINORS 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:**

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:**

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,Ananthapuramu – 515 003 (A.P) India**
**Mechanical Engineering**

| Course Code | ROBOTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**MINORS IN MECH.**

**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.

**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 overview 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.

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

| Course Code | FUNDAMENTALS OF FLUID MECHANICS & HYDRAULICS MACHINES LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |
| MINORS IN MECH. | | | | | |

**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.

**List of 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

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

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

**III Year II Semester**

**Course Objectives**

- To introduce the fundamentals of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM).
- To provide knowledge of geometric modelling and transformation techniques in CAD.
- To understand the working principles of NC, CNC, and DNC machine tools.
- To develop skills in manual part programming and computer-aided part programming.

**Course Outcomes (CO):**

- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modelling 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 iso metric from the given orthographic views using Autocad.
6. To creating 3-D modeling from the given or-tho graphic views using Autocad 3-D commands.
7. **Part Modelling:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation.