ACADEMIC REGULATIONS
COURSE STRUCTURE
AND DETAILED SYLLABUS

MECHANICAL ENGINEERING

B.TECH. FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2011-12)
# ACADEMIC REGULATIONS FOR AUTONOMOUS STREAM
(2011-2012 Batch)

(Common to all branches)

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1. INTRODUCTION

Academic Programmes of the institute are governed by rules and regulations approved by the Academic Council, which is the highest Academic body of the Institute. These academic rules and regulations are applicable to the students admitted during academic year 2010-11 into first year of four year undergraduate programme offered by the college leading to Bachelor of Technology (B.Tech) degree in the disciplines viz., Computer Science and Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Information Technology, Mechanical Engineering.

1.1 Lakireddy Balireddy College of Engineering, Mylavaram, an autonomous institution, follows Semester pattern for all four years of its undergraduate B.Tech programmes with internal and external evaluation.

1.2 Semester Pattern: Each academic year shall be divided into two semesters, each of 20 week duration, including instruction, evaluation, etc. Each semester consists of a minimum of 90 instruction days with at least 35 to 40 contact periods per week.

2. PROGRAMMES OFFERED (UNDERGRADUATE)

Presently, the college is offering Under Graduate Programmes in the following disciplines:

- Aero Space Engineering (AE)
- Computer Science and Engineering (CS)
- Electronics and communication Engineering (EC)
- Electrical and Electronics Engineering (EE)
- Electronics and instrumentation Engineering (EI)
- Information Technology (IT)
- Mechanical Engineering (ME)

3. ELIGIBILITY CRITERIA FOR ADMISSION

* The eligibility criteria for admission into 1st year B.Tech programme shall be as mentioned below:
* Admissions in each programme in the Institution are classified into CATEGORY - A (70% of intake) and CATEGORY- B (30% of intake).

3.1 CATEGORY – A SEATS:

* The candidate shall be of Indian National

* The candidate should have completed 16 years of age as on 31st December of the Academic year for which the admissions are being conducted.
The candidate should have passed the qualifying examination (10+2) or equivalent on the date of his/her counseling for admission and secured the rank at the Common Entrance Test conducted by the State and also satisfy other conditions laid down in the G.O.s.

The candidate should satisfy Local/Non-Local status requirement as laid down in the Andhra Pradesh Educational Institutions (Regulation of Admissions) Order, 1974 as subsequently amended.

3.2.1 CATEGORY - B SEATS:

* The candidate shall be of Indian National or a Non-Resident Indian.

* The candidate should have completed 16 years of age as on 31st December of the Academic year for which the admissions are being conducted.

* Category B Seats shall be thrown open for admission to all the eligible candidates on the basis of merit from within the state, other states, Union territories and NRI/NRI sponsored candidates.

* Out of the 30% quota of Category B Seats, seats not exceeding 15% of the sanctioned intake in each course shall be filled on merit basis with NRI/NRI sponsored candidates (vide G.O.Ms.140 HE Dept Dt:31.07.08), who have passed qualifying examination with not less than 50% of aggregate marks or Cumulative Grade Point Average (CGPA) equivalent to 5 on a scale of 10.

* The remaining 15% of seats and the leftover seats after filling NRI/NRI sponsored candidates shall be filled with candidates from within state as per the merit order (EAMCET/AIEEE) interpreted by a Division Bench of Hon’ble High Court of AP in W.P. No.17385/2009 dt.:18-09-2009, which is put on website. Only thereafter if any still remain unfilled the colleges can fall back upon the option of filling up such vacant seats with candidates who have qualified at the qualifying examination.

3.3 CATEGORY: LATERAL ENTRY

* The candidates should have passed the qualifying exam.(B.Sc. graduation & Diploma holders) shall be admitted into the II nd year 1st semester directly, based on the rank secured by the candidate at Engineering Common Entrance Test (ECET (FDH)) in accordance with the instructions received from the Convener, ECET and Government of Andhra Pradesh. The candidate shall also satisfy any other eligibility requirements stipulated by the JNT University and / or the Government of Andhra Pradesh from time to time.
4. **AWARD OF B.TECH DEGREE**

A student will be declared eligible for the award of the B.Tech. by JNTUK Degree if he/she fulfills the following academic regulations:

(i) Pursued a course of study for not less than four academic years and not more than eight academic years.

(ii) Registered for 220 credits and secured 212 credits with specified compulsory subjects

**COMPULSORY SUBJECTS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Specified Particulars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>All the first year subjects</td>
</tr>
<tr>
<td>2.</td>
<td>All Practical Subjects</td>
</tr>
<tr>
<td>3.</td>
<td>Internship</td>
</tr>
<tr>
<td>4.</td>
<td>Comprehensive viva-voce</td>
</tr>
<tr>
<td>5.</td>
<td>Seminar</td>
</tr>
<tr>
<td>6.</td>
<td>Project Work</td>
</tr>
<tr>
<td>7.</td>
<td>Mini Project</td>
</tr>
</tbody>
</table>

5. **DURATION OF THE PROGRAMME**

Students, who fail to fulfill all the academic requirements for the award of the degree within minimum of eight academic years shall forfeit their seat in B.Tech course.

6. **SEMESTER –WISE DISTRIBUTION OF CREDITS**

**TABLE 1 SEMESTER-WISE CREDITS DISTRIBUTION**

<table>
<thead>
<tr>
<th>SEMESTER</th>
<th>CSE</th>
<th>IT</th>
<th>ECE</th>
<th>EIE</th>
<th>EEE</th>
<th>ME</th>
<th>AE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>24</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>II</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>28</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>III</td>
<td>28</td>
<td>28</td>
<td>29</td>
<td>29</td>
<td>29</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>IV</td>
<td>30</td>
<td>30</td>
<td>29</td>
<td>29</td>
<td>29</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>V</td>
<td>30</td>
<td>28</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>VI</td>
<td>28</td>
<td>30</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>VII</td>
<td>32</td>
<td>32</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>VII</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>220</strong></td>
<td><strong>220</strong></td>
<td><strong>220</strong></td>
<td><strong>220</strong></td>
<td><strong>220</strong></td>
<td><strong>220</strong></td>
<td><strong>220</strong></td>
</tr>
</tbody>
</table>
(i) There shall be an internship of four weeks duration (summer vacation) in an industry/ top academic institutes or R & D centers of excellence at the end of the VI semester.

(ii) The internships shall be supervised by a competent faculty member of the institute who in turn shall be in touch with the respective division head of the industry. The internships are compulsory and are credit based.

(iii) All the seminars, Term Paper and mini projects are credit based

7. DISTRIBUTION AND WEIGHTAGE OF MARKS:

(i) In each semester the course of study consists of 5 theory subjects + 3 laboratories or 6 theory subjects + 2 laboratories. However, in the VIII semester there shall be only 3 theory subjects in addition to the project work and comprehensive viva-voce.

(ii) 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. In addition, internship, seminar, Term Paper, Project work and Comprehensive Viva-Voce shall be evaluated for 50, 50, 50, 200 and 100 marks respectively.

(iii) For each theory subject the distribution shall be 25 (20+5 marks for attendance) marks for Internal Evaluation and 75 marks for the end semester examination.

(iv) For each theory subject, during each semester there shall be 2 tests, for a duration of 90 minutes. One descriptive test to be conducted in 1 – 2 units and the second test be conducted in 3 – 5 units thereby. However, 75% weightage for the best and 25% for the other first test shall be considered for awarding sessional marks.

(v) The question paper for internal examinations shall contain 3 questions and each question consists of internal choice.

(vi) For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks (10 marks for day-to-day work, 10 marks for Internal test and 5 marks for attendance) and 75 end examination marks. The end examination shall be conducted by the teacher concerned and another external member.

(vii) For the subject having design and / or drawing (such as Engineering Graphics, machine Drawing), and estimation, the distribution shall be 25 marks for internal evaluation (10 marks for day-to-day work, 10 marks for Internal tests and 5 marks for attendance) and 75 marks for end examination. There shall be one internal test in a Semester.

(viii) All project works / internships / mini projects shall be evaluated by the committee. The committee consists of, head of the department, the supervisor of mini project and a senior faculty member of the department along with duly approved / recognized external examiner.
(ix) There shall be seminars in the III semester and V semester and Term Paper in VII semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Department committee consisting of Head of the department, seminar supervisor and a senior faculty member. The Term Paper / Seminar report shall be evaluated for 50 marks.

(x) Out of a total 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project. The End Semester Evaluation (viva-voce) shall be conducted by the same committee appointed for internship evaluation. The topics for mini project, seminar and project work shall be different from each other. The topic for Term Paper and Project work can be same. The evaluation of project work shall be conducted at the end of the VIII Semester.

(xi) The comprehensive viva shall be conducted for 100 marks both in VI semester and VIII Semesters. The comprehensive viva shall be evaluated in the topics covering the core aspects of the subject in which the candidate is likely to graduate.

8. **ATTENDANCE REGULATIONS AND CONDONATION:**

(i) A student shall be eligible to appear for end semester examinations, if acquired a minimum of 75% of attendance in aggregate of all the subjects.

(ii) Condonation of shortage of attendance in aggregate up to 10% on medical grounds (65% and above and below 75%) in each semester may be granted by the College Academic Committee. However, the subject of granting is purely at the discretion of the College Academic Committee or competent authority.

(iii) A Student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester as applicable. They may seek re-admission for that semester as and when offered next.

(iv) Due weightage in each of the subjects shall be given to the attendance. Marks not exceeding 5 shall be given to all such candidates who satisfies the following criteria

<table>
<thead>
<tr>
<th>% of attendance</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;= 90</td>
<td>5</td>
</tr>
<tr>
<td>85 to &lt;90</td>
<td>4</td>
</tr>
<tr>
<td>80 to &lt; 85</td>
<td>3</td>
</tr>
<tr>
<td>&gt;75 to &lt; 80</td>
<td>2</td>
</tr>
<tr>
<td>=75</td>
<td>1</td>
</tr>
</tbody>
</table>
(v) Shortage of Attendance below 65% in aggregate shall in no case be condoned.

(v) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that particular semester and their registration for examination shall stands cancelled.

(vi) A stipulated fee shall be payable towards condonation of shortage of attendance.

(vii) Attendance may also be condoned for those who participate in prestigious sports, co- and extracurricular activities provided their attendance is in the minimum prescribed range for the purpose and recommended by the concerned authority.

9. **MINIMUM ACADEMIC REQUIREMENTS:**

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

(i) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical design or drawing subject or project if he/she secures not less than a minimum of 40% of marks exclusively at the end semester examinations in each of the subjects in which candidate had appeared. However, the candidate should have secured minimum of 40% marks in both external and internal components put together to be eligible for passing in the subject.

(ii) A student will be promoted to next semester, if he satisfies the minimum attendance requirement.

(iii) Only such candidates who had completed their II Semester to III Semester of study and had obtained at least 40 credits (50% of the total credits up to III Semester) are eligible to study V Semester.

(iv) To be eligible to study VII Semester, the candidate should have secured a minimum of 68 credits (50% of the total credits up to V Semester).

(v) There shall be supplementary examinations along with the regular even semester examinations enabling the students to give a fair chance to appear in the subject if failed any.

(vi) However, an advanced supplementary examination shall be conducted for all such students who had failed in only one subject at the VII Semester of their study. Such an examination is applicable only for those students pursuing VIII semester.

(vii) Students who fail to earn 212 credits as indicated in the course structure including compulsory subjects as indicated in table – I within eight academic years from the year of their admission shall forfeit their seat in B.Tech course and their admission shall stand cancelled.
10. **COURSE PATTERN:**

(i) The entire course of study is of four academic years. Each academic year shall have two semesters.

(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 as and when conducted.

(iii) All admitted students’ are to study 4 electives during their course of four year study at the institute. The following shall be the programme of study of electives.

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>No. of electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

(iv) During the VIII semester, it is mandatory that departments offer 3 theory subjects and a comprehensive viva (covering all core subjects of engg) along with project work.

(v) When a student is detained due to lack of credits / shortage of attendance, he may be re-admitted when the semester is offered after fulfillment of academic regulations. Whereas the academic regulations hold good with the regulations he/she first admitted.

11. **AWARD OF GRADE:**

After a student has satisfied the requirement prescribed for the award of B.Tech. Degree, he/she shall be placed in one of the following four grades. The award of the degree is based on CGPA on a grade point of scale 4. The grade points are awarded as follows:

<table>
<thead>
<tr>
<th>CGPA</th>
<th>Award Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;=3</td>
<td>First Class with Distinction</td>
</tr>
<tr>
<td>&gt;=2.4 and &lt;3</td>
<td>First division</td>
</tr>
<tr>
<td>&gt;2 and &lt;2.4</td>
<td>Second division</td>
</tr>
<tr>
<td>&gt;=1.6 and &lt; 2</td>
<td>Pass division</td>
</tr>
<tr>
<td>&lt; 1.6</td>
<td>Fail</td>
</tr>
</tbody>
</table>
Based on the performance of the candidate, the following shall be the criteria for the award of letter grades at the end of each semester in the subjects in which the candidate appeared for the examination.

<table>
<thead>
<tr>
<th>Percentage of Marks Scored</th>
<th>Letter Grades</th>
<th>Grade points</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;=90</td>
<td>S</td>
<td>4.00</td>
</tr>
<tr>
<td>&gt;=85 to &lt;90</td>
<td>A +</td>
<td>3.67</td>
</tr>
<tr>
<td>&gt;=80 and &lt;85</td>
<td>A</td>
<td>3.33</td>
</tr>
<tr>
<td>&gt;=75 and &lt;80</td>
<td>B +</td>
<td>3.00</td>
</tr>
<tr>
<td>&gt;=70 and &lt;75</td>
<td>B</td>
<td>2.67</td>
</tr>
<tr>
<td>&gt;=65 and &lt;70</td>
<td>C +</td>
<td>2.33</td>
</tr>
<tr>
<td>&gt;=60 and &lt;65</td>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>&gt;=55 and &lt;60</td>
<td>D +</td>
<td>1.67</td>
</tr>
<tr>
<td>&gt;=50 and &lt;55</td>
<td>D</td>
<td>1.33</td>
</tr>
<tr>
<td>&gt;=40 and &lt;50</td>
<td>E</td>
<td>1.00</td>
</tr>
<tr>
<td>&lt;40</td>
<td>F</td>
<td>0</td>
</tr>
</tbody>
</table>

11.1 Calculation of Grade Points Average (GPA)* for semester

The performance of each student at the end of each semester is indicated in terms of GPA. The GPA is calculated as below:

\[ \text{GPA} = \frac{\sum (CR \times GP)}{\sum CR} \]

Where \( CR \) = Credits of a course
\( GP \) = Grade points awarded for a course

* GPA is calculated for the candidates who passed all the courses in that year/semester.

11.2 Calculation of Cumulative Grade Point Average (CGPA) for Entire Programme.

The CGPA is calculated as below:

\[ \text{CGPA} = \frac{\sum (CR \times GP)}{\sum CR} \]

(for entire programme)

Where \( CR \) = Credits of a course
\( GP \) = Grade points awarded for a course
12. **MINIMUM INSTRUCTION DAYS:**

The minimum instruction for each semester shall be 90 instruction days excluding examination days.

13. **GENERAL:**

(a) Where the words “he” “him” “his”, occur in the regulations, they include “she”, “her”.

(b) The academic regulation should be read as a whole for the purpose of any interpretation.

(c) In the case of any doubts or ambiguity in the interpretation of the above rules, the decision of the Director is final.

(d) The Institute may change or amend the academic regulations or syllabi at any time duly approved by Academic council and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

14. **CHANGE OF BRANCH**

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

15. **TRANSITORY REGULATIONS**

A candidate, who is detained or discontinued in the semester, on readmission shall be required to do all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed in such courses, which he/she had passed in the earlier semester(s) he/she was originally admitted into.

15.1 A student who is following the JNTU, Kakinada curriculum, detained due to lack of academics/attendance at the end of the first semester of second year, shall join the autonomous batch of III Semester. Such students will study all the courses prescribed for that batch, in which the student joins. The first year marks shall not be converted in to course credits. However, the student has to clear all his first year backlog subjects by appearing the supplementary examinations, conducted by JNTU, Kakinada and courses prescribed in Autonomous stream for the award of Degree. The class will be awarded based on the academic performance of a student. Such candidates will be considered on par with lateral entry candidates of autonomous stream and will be governed by the regulations applicable to lateral entry candidates category.

15.2 A student who is following the JNTU, Kakinada curriculum, detained due to lack of academics/attendance at the end of the second semester of second year and also at the subsequent semesters, shall join with the autonomous batch at the
appropriate semester. Such candidates shall be required to pass in all the courses in the programme prescribed by concerned BOS for such batch of students, to be eligible for the award of degree. However, exemption will be given in all those courses of the semester(s) of the batch, which the candidate joins now, which he/she had passed earlier. The student has to clear all his backlog subjects by appearing the supplementary examinations, conducted by JNTU, Kakinada and College(Autonomous stream) for the award of Degree. The class will be awarded based on the academic performance of a student in the autonomous Pattern.

16. COURSE CODE AND COURSE NUMBERING SCHEME

Course Numbers are denoted by six digit unique alpha numeric characters. First two digits are described in Table 2.

<table>
<thead>
<tr>
<th>First Two Digits</th>
<th>Name of the Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE</td>
<td>Aerospace Engineering Department</td>
</tr>
<tr>
<td>CS</td>
<td>Computer Science and Engineering Department</td>
</tr>
<tr>
<td>EC</td>
<td>Electronics &amp; Communication Engineering Department</td>
</tr>
<tr>
<td>EE</td>
<td>Electrical &amp; Electronics Engineering Department</td>
</tr>
<tr>
<td>EI</td>
<td>Electronics and Instrumentation Engineering Department</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology Department</td>
</tr>
<tr>
<td>ME</td>
<td>Mechanical Engineering Department</td>
</tr>
</tbody>
</table>

TABLE 2 : FIRST AND SECOND DIGITS DESCRIPTION

Third digit represents semester of offering as mentioned in Table No. 3. Fourth digit represents the type description (Theory/Lab.) of the course.

<table>
<thead>
<tr>
<th>THIRD DIGIT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Semester</td>
</tr>
<tr>
<td>2</td>
<td>Second Semester</td>
</tr>
<tr>
<td>3</td>
<td>Third Semester</td>
</tr>
<tr>
<td>4</td>
<td>Fourth Semester</td>
</tr>
<tr>
<td>5</td>
<td>Fifth Semester</td>
</tr>
<tr>
<td>6</td>
<td>Sixth Semester</td>
</tr>
<tr>
<td>7</td>
<td>Seventh Semester</td>
</tr>
<tr>
<td>8</td>
<td>Eight Semester</td>
</tr>
</tbody>
</table>

TABLE 3: THIRD DIGIT DESCRIPTION
Fourth digit represents course type, as per Table No. 4

<table>
<thead>
<tr>
<th>FOURTH DIGIT</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>0</td>
<td>Theory course</td>
</tr>
<tr>
<td>5</td>
<td>Lab course</td>
</tr>
</tbody>
</table>

**TABLE 4 : COURSE TYPE DESCRIPTION**

Fifth digit represents course number of the respective semester as described in Figure 1 below.

For example, **CS105** course, the course is offered in the first semester (1), the course is of theory type (0) and the course number in that semester (5).

**FIGURE. 1 : COURSE CODE DESCRIPTION FOR COURSES**

For example, **CS 451** course, the course is offered in Computer Science and Engineering Department (CS); offered in the fourth semester (4), the course is of lab type (5) and the course number is (1), as given in figure.2 below.

**FIGURE. 2 : COURSE CODE DESCRIPTION FOR COURSES**

17. **MEDIUM OF INSTRUCTION**

The medium of instruction and evaluation is English.
18. **AMENDMENTS TO REGULATIONS**

The Academic council from time to time may revise, amend, or change the regulations, schemes of examinations, and/or syllabi.

19. **ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME)**

(i) The students have to acquire 168 credits from III Semester to VIII Semester of B.Tech Programme (Regular) for the award of the degree

(ii) Students, who fail to fulfill the requirement for the award of the degree in 7 consecutive academic years from the year of admission, shall forfeit their seat.

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

19.1 **Rules For Promotion into Next Higher Class:** (VI Semester to VII Semester)

A student shall be promoted from VI Semester to VII Semester only if he fulfills the academic requirements of 42 credits up to V semester.

19.2. **Award of Grade in each semester:**

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

Based on the performance of every candidate, the following shall be the criteria for the award of grades at the end of each semester:

<table>
<thead>
<tr>
<th>Percentage of Marks Scored</th>
<th>Letter Grades</th>
<th>Grade points</th>
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<tbody>
<tr>
<td>&gt;=90</td>
<td>S</td>
<td>4.00</td>
</tr>
<tr>
<td>&gt;=85 to &lt;90</td>
<td>A⁺</td>
<td>3.67</td>
</tr>
<tr>
<td>&gt;=80 and &lt;85</td>
<td>A</td>
<td>3.33</td>
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<tr>
<td>&gt;=75 and &lt;80</td>
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<td>&gt;=65 and &lt;70</td>
<td>C⁺</td>
<td>2.33</td>
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<td>&gt;=60 and &lt;65</td>
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<td>2.00</td>
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<td>&gt;=55 and &lt;60</td>
<td>D⁺</td>
<td>1.67</td>
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<tr>
<td>&gt;=50 and &lt;55</td>
<td>D</td>
<td>1.33</td>
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<td>&gt;=40 and &lt;50</td>
<td>E</td>
<td>1.00</td>
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<tr>
<td>&lt;40</td>
<td>F</td>
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</table>

Passed on the aggregate marks secured for the best 161 Credits (Lateral Entry).
The aggregate marks secured for 168 Credits. (i.e. III Semester to VIII Semester)
20. **GRADE CARD**

The grade card issued shall contain the following:

a) The credits for each course offered for that semester
b) The letter grade obtained in each course
c) The SGPA/CGPA
d) Total number of credits earned by the student up to the end of that semester

21. **CONDUCT AND DISCIPLINE**

(a) Students shall conduct themselves within and outside the premises of the Institute in a manner befitting the students of our Institution.

(b) As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.

(c) The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

   (i) Lack of courtesy and decorum; indecent behavior anywhere within or outside the campus.

   (ii) Willful damage or distribution of alcoholic drinks or any kind of narcotics or of fellow students/citizens.

(d) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

(e) Mutilation or unauthorized possession of library books.

(f) Noisy and unseemly behavior, disturbing studies of fellow students.

(g) Hacking in computer systems (such as entering into other person’s areas without prior permission, manipulation and/or damage of computer hardware and software or any other cyber crime etc.

(h) Usage of camera cell phones in the campus.

(i) Plagiarism of any nature.

(j) Any other act of gross indiscipline as decided by the academic council from time to time.

(k) Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debarment from a examination, disallowing the use of certain facilities of the Institute, rustication for a specified
period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

(l) For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief Warden, the Head of the Department and the principal respectively, shall have the authority to reprimand or impose fine.

(m) Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the principal for taking appropriate action.

(n) All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the Academic council.

(o) The Institute Level Standing Disciplinary Action Committee constituted by the academic council, shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

(p) The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the Programmes Committee in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved by the academic council earlier, shall be reported to the academic council for ratification.

(q) “Grievance and Redressal Committee” (General) constituted by the principal shall deal with all grievances pertaining to the academic / administrative /disciplinary matters.

(r) All the students must abide by the code and conduct rules of the college.

22. MALPRACTICES

(a) The Principal shall refer the cases of malpractices in internal assessment tests and Semester-End Examinations, to a Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the erring students basing on the recommendations of the committee.

(b) Any action on the part of candidate at an examination trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing/keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.
23. **AWARD OF RANK**

The rank shall be awarded based on the following:

1.1 Only such candidates who pass the Final Semester examination at the end of the eighth semester (Final Semester) after admission as regular final year students along with the others in their batch and become eligible for the award of the Degree shall be eligible for the award of rank. Candidates, who lose one or more Semesters of study for any reason whatsoever are not eligible for the award of rank.

1.2 Ranks shall be awarded in each branch of study for the top five students appearing for the Regular Examinations.

1.3 Award of prizes, scholarships, or any other Honors shall be based on the rank secured by a candidate, consistent with the guidelines of the Donor, wherever applicable.
## COURSE STRUCTURE (2011-2012 Admitted Batch)

### I-SEMESTER

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Name of the Course</th>
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### VII - SEMESTER

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### VIII - SEMESTER

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**TOTAL CREDITS : 220**

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<td>32</td>
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<tr>
<td>VIII Semester</td>
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UNIT - I


UNIT - II

Linear differential equations of second and higher order with constant coefficients and with variable coefficients, method of variation of parameters and their simple applications to Simple Harmonic Motion and Electrical Circuits.

UNIT - III

Generalized Mean Value theorems (without proof), Functions of several variables, Maxima and Minima of functions of two variables with constraints and without constraints. Lagrangian Multiplier method.

UNIT - IV

Curve tracing – Cartesian curves. Applications of Integration to Lengths, Volumes and Surface areas of revolution in Cartesian Coordinates. Multiple integrals - double and triple integrals (Cartesian Coordinates only) – Changing of order of Integration. (Cartesian Coordinates only)

UNIT - V


TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

REFERENCES

T131 – C - PROGRAMMING

Lecture : 4 Periods/week  Internal Marks : 25  
Tutorial : 1 Period/Week   External Marks : 75  
Credits  : 4               External Examination : 3 Hrs

UNIT - I

Algorithm / pseudo code, flowchart, program development steps, structure of C program, A Simple C program, identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation.

Input-output statements, statements and blocks, if and switch statements, loops- while, do-while and for statements, break, continue, goto and labels, programming examples.

UNIT - II

Designing structured programs, Functions, basics, parameter passing, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, header files, C preprocessor, example c programs.

UNIT - III

Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two dimensional and multi-dimensional arrays, applications of arrays, pointers-concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory managements functions, command line arguments, c program examples.

UNIT - IV

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bitfields, C program examples.

UNIT - V

Input and output – concept of a file, text files and binary files, streams, standard I/o, Formatted I/o, file I/o operations, error handling, C program examples.

TEXT BOOKS

2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education

REFERENCES

3. C and Data Structures:A Snap Shot Oriented Treatise Using Live Engineering Examples by Prof. N.B.Venkateswarlu and, Prof.E.V.Prasad, S Chand & Co, New Delhi
4. C/C++ for Engineers and Scientists, Harry H.Cheng ,McGrawHill,
English Language continues to be regarded as an important tool for global communication and employability. Hence, it is imperative that students need to acquire communicative competence besides their core skills. The syllabus has been designed to develop linguistic and communicative competence of Engineering students with special emphasis on professional and functional aspects of English language i.e., on Listening, Speaking, Reading and Writing (LSRW Skills).

OBJECTIVES

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To develop the study skills and Communication skills of the students in both formal and informal situations.
- To enable the students to face the academic and professional challenges of the present day scenario.
- To help students acquire the ability to speak effectively in English in the real life situations.
- To inculcate reading as a habit and to develop reading skills among students.
- To train students to improve their active and passive vocabulary.
- To familiarize the students with different rhetorical functions of Technical English.
- To enable the students write letters and reports effectively in formal and professional situations.

UNIT - I

Chapter – 1: “Read & Proceed” from Step by Step (Pearson)
Extensive Reading - Masterminds– The Trailblazers – Jagadis Chandra Bose (Orient Longman)

UNIT - II

Chapter – 2: “Travel” from Step by Step (Pearson)
Extensive Reading - Masterminds– The World of Figures and Physics – Chandra Sekhara Venkata Raman (Orient Longman)

UNIT - III

Chapter – 3: “Gender” from Step by Step (Pearson)
Extensive Reading - Masterminds–The Institution Builders– Shanti Swarup Bhatnagar (Orient Longman)
UNIT - IV

Vocabulary – Synonyms, Antonyms, Words often Confused, Gerunds & Infinitives, Prefixes & Suffixes, Word plurals, Analogy
Grammar – Parts of Speech, Sentence Completion, Question Tags, Tense and Aspect

UNIT - V

Analytical Writing – Sentence Construction – Types of sentences, Exercises with scrambled words & Jumbled sentences, Paragraph writing, Dialogue writing (Formal & Informal), Letter Writing (Formal & Informal), Resume writing, Expansion (of a given topic), Abstract Writing (Summarizing / Synopsis), Decision-making, Drafting E-Mails & Memo writing, Essay writing.

TEXT BOOKS

• Step by Step (Pearson)
• Masterminds by EnakshiChatterjee (Orient Longman)

REFERENCES

T264 - NUMERICAL METHODS

Lecture : 4 Periods/week Internal Marks : 25
Tutorial : 1 Period/Week External Marks : 75
Credits : 4 External Examination : 3 Hrs

UNIT - I


UNIT - II


UNIT - III


UNIT - IV


UNIT - V


TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

REFERENCES

1. Introductory Methods of Numerical Analysis by S. S. Sastry – PHI
2. Numerical Methods for Engineers with programming and software application by Steven .C. Chopra and Ra. P. Canale – TMGH
INTRODUCTION TO ENGINEERING DRAWING:
Curves used in engineering practice:
   a) Conic Sections- Ellipse, Parabola, Hyperbola and rectangular hyperbola- General method and other methods.
   b) Cycloid, Epi-Cycloid and Hypo-Cycloid.
   c) Involutes.

ORTHOGRAPHIC PROJECTIONS:(First angle projection only)

PROJECTIONS OF PLANES
Planes parallel to one of the reference planes-Inclined to one reference plane and perpendicular to other-Oblique planes.

PROJECTIONS OF SOLIDS
Projection of solids in simple position - Axis inclined to one of the reference planes and parallel to the other-Axis inclined to both H.P and V.P.

SECTIONS OF SOLIDS:
Introduction-Sections of Prisms,Pyramids,Cylinders,Cones and Spheres

TEXT BOOK
Engineering Drawing, N.D. Bhat / Charitor publishers

REFERENCES
2. Engineering Drawing, R.K.Dhawan / S.Chand Company LTD.
1. Write a programme in ‘C’ language to cover the following problems.
   a) Roots of Quadratic Equation.
   b) Example program which shows the usage of various Operators available in C Language.
   c) Example program which shows the usage of various preliminary Data types available in C Language.
   d) Example programs to illustrate the order of evaluation.

II) WRITE EXAMPLE PROGRAMS

a) To check whether the given year is leap year (or) not
b) Converting given two digit number into words using switch statement
c) To illustrate the usage of ‘goto’ statement.
d) Finding smallest & biggest number from the given set of 4 numbers using ‘if’ statement.
e) Calculate the student grade in the examination – assume suitable constraints.
f) Prepare electricity bill for the consumed units – assume suitable constraints.

III) EXAMPLE PROGRAMS

a) To Display first N natural numbers
b) To find whether the given number is Armstrong (or) not
c) To find reverse of the given number and to check whether it is palindrome (or) not.
d) To find whether given number is strong number (or) not.
e) To check whether given number is Prime (or) not
f) To display prime numbers with in the given range (Nesting of Loops).
g) To display the following structure (Nesting of Loops)
i) 1
   1 2
   1 2 3
   1 2 3 4
   1 2 3 4 5
   1 2 3 4 5 1

IV) Write example programs in C Language:
a) To find factorial of a given number using functions.
b) Swap two numbers using functions.
c) To find GCD of two numbers using recursion
d) Write a recursive function to solve Towers of Honai problem.
e) Write an example program to illustrate use of external & static storage classes.
V) Write example programs in C Language to perform following operations:
   a) Finding the sum and average of given numbers using Arrays.
   b) To display elements of array in reverse order
   c) To search whether the given element is in the array (or) not using linear search &
      binary search.
   d) Write a C program to perform the following operations
      i) Addition, subtraction and multiplication of Matrices
      ii) Transpose of given matrix (The above operations are to be exercised using
         functions also by passing arguments)
   e) Write a C program to find whether the given string is palindrome (or) not.
   f) To accept line of text and find the number of characters, number of vowels and
      number of blank spaces in it.
   g) Write an example program to illustrate the use of any 5 string handling functions.

VI) a) Example program to bring clarity on pointer declaration & initialization and Pointer
    arithmetic.
    b) Write an example program to describe the usage of call by reference.
    c) Write a program to find sum of the elements of the array using functions.
    d) Write an example program to illustrate the usage of command line arguments.
    e) Program to illustrate the usage of dynamic memory management functions.

VII) a) Write an example program using structures to process the student record. Assume
    suitable fields for student structures (Different kinds of initialization of structure
    variables are to be exercised)
    b) Write a program to read records of 10 employees and find their average salary (exercise
    array of structures & Nested structures concepts through this program).
    c) Write a program to handle a structure variable using pointers and implement self referential
    structure(i.e. A structure variable having a pointer to itself)

VIII) Write an example program on file to perform following operations:
    a) Accessing content from files and writing content in to it. (Exercise different file
       operation modes)
    b) Copy the contents of one file into another (Exercise different file
       operation modes)
UNIT - I

COMPUTER AIDED DRAFTING

UNIT - II

ORTHOGRAPHIC PROJECTIONS:
Introduction to orthographic Projections

UNIT - III

ISOMETRIC DRAWING :

UNIT - IV

DEVELOPMENT OF SURFACES OF SOLIDS:

UNIT - V

INTERSECTION OF SURFACES:

TEXT BOOKS
3. Engineering Drawing, N.D. Bhat / Charitor
P831 - ENGINEERING WORKSHOP

Internal Marks : 25
Lab/Practicals : 3 Period/Week
Credits : 2
External Marks : 75
External Examination : 3 Hrs

TRADES FOR EXERCISES: (Common to EEE, ECE, CSE, EIE & IT)

At least three exercises from each trade:

1. Carpentry
2. Fitting
3. House – Wiring
4. Plumbing

TRADES FOR EXERCISES : (MECHANICAL ENGINEERING)

At least two exercises from each trade:

1. Carpentry
2. Fitting
3. Tin - Smithy
4. Black - Smithy
5. House - Wiring
6. Plumbing

TEXT BOOK

T119 - APPLIED MATHEMATICS – II

Lecture : 4 Periods/week  Internal Marks : 25
Tutorial : 1 Period/Week   External Marks : 75
Credits : 4               External Examination : 3 Hrs

UNIT – I

Laplace transforms of standard functions – Shifting Theorems, Transforms of derivatives and integrals – Unit step function – Dirac’s delta function. Inverse Laplace transforms – Convolution theorem - Applications of Laplace transforms to ordinary differential equations

UNIT – II


UNIT – III


UNIT – IV


UNIT – V

Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse z-transform -Convolution theorem – Solution of difference equation by z-transforms.

TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

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• To help students acquire the ability to speak effectively in English in the real life situations.
• To inculcate reading as a habit and to develop reading skills among students.
• To train students to improve their active and passive vocabulary.
• To familiarize the students with different rhetorical functions of Technical English.
• To enable the students write letters and reports effectively in formal and professional situations.

UNIT - I

Chapter 4: “Disaster Management” from Step by Step (Pearson)
Extensive reading – Masterminds - The institution builders - Meghanad Saha (Orient Longman)

UNIT - II

Chapter 5: “Health” from Step by Step (Pearson)
Extensive reading – Masterminds- The New Age – Homi Jehangir Bhabha (Orient Longman)

UNIT - III

Chapter 6: “Sports” from Step by Step (Pearson)
Extensive reading – Masterminds - The New Age – Vikram Sarabhai (Orient Longman)

UNIT - IV

Grammar – Articles, Prepositions, Voice, Speech, Concord, Correction of Sentences
Vocabulary – Phrasal verbs, Gerunds, Infinitives, One word Substitutes.
UNIT - V

Analytical writing – Comprehension, Technical dialogue writing,
Presentation skills - Note making, Information transfer / Data interpretation (Tables, Pie-
charts, Bar graphs, Tree diagrams, Pictograms, etc.), Report writing

TEXTBOOK

*Step by Step, Pearson Education, New Delhi 2010.*
*Master Minds*, (Orient Longman).

REFERENCES

4. GRE and TOEFL, Kaplan and Baron's, Latest editions.
UNIT - I


UNIT - II

FUELS AND COMBUSTION: Definition and classification of Fuels- conventional fuels (solid, liquid, gaseous), Solid fuels- coal - analysis, Proximate and ultimate analyses of coal – significances, Liquid Fuels – primary- petroleum- refining of petroleum- cracking, knocking, synthetic petrol – Bergius and Fischer Tropesch’s process; Gaseous fuels- octane number – cetane number,– water gas, producer gas CNG, and biogas - gross and net calorific values – (definition only) – flue gas analysis – Orsat’s apparatus.

UNIT - III


UNIT - IV

UNIT - V


2. LUBRICANTS: Introduction to Lubricants, Principles and function of lubricants - Types of Lubrication and Mechanism - Thick Film or Hydrodynamic Lubrication, Thin Film or Boundary Lubrication, Extreme Pressure Lubrication. Classification and properties of lubricants-Viscosity, flash and fire point, cloud and pour point, aniline point, Neutralization Number and mechanical strength, Selection of lubricants.

TEXT BOOKS


REFERENCES

T193 – ENGINEERING MECHANICS – I

Lecture : 4 Periods/week          Internal Marks : 25
Tutorial : 1 Period/Week          External Marks : 75
Credits : 5                       External Examination : 3 Hrs

---------------------------------------------------------------------------------------------------------------

UNIT - I


**Resultant of Systems of Forces:** Resultant of Coplanar Concurrent Forces – Resultant of Coplanar Non-Concurrent Forces.

**Moments:** Introduction to Moment, Moment of Force and its Applications, Principle of moments – Couples and Resultant of Force Systems.

UNIT - II

**Equilibrium of Systems of Forces:** Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Lami’s Theorem, conditions of equilibrium.

UNIT - III

**Friction:** Introduction, Classification of friction, Laws of friction. Co-efficient of friction, Angle of friction, Angle of repose, Frictional forces on motion of bodies, Wedge friction.

UNIT - IV

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

**Centre of Gravity:** Centre of gravity of simple bodies (from basic principles), centre of gravity of composite Bodies.

UNIT - V

**Area Moment of Inertia**
Moment of Inertia of a plane figure with respect to an axis in its plane–Moment of inertia with respect to an axis perpendicular to the plane of the figure – Parallel axis theorem, Moment of Inertia of composite figures.

TEXT BOOKS


REFERENCES

2. Engineering Mechanics / AK Tayal. ,Umesh Publications
3. Vector Mechanics for Engineers Statics and Dynamics by Beer and Johnston, TATA Mc Graw Hill.
UNIT - I

INTERFERENCE: Superposition of waves-double slit interference- Young’s double slit experiment- Coherence – Interference from thin films- Newton’s rings.

DIFFRACTION:  Diffraction and wave theory of light (Fresnel and Fraunhofer diffractions) - single slit Diffraction, Intensity in single- slit diffraction, Calculating the intensity– Double slit interference and diffraction combined.

GRATINGS AND SPECTRA - Multiple slits-width of the maxima, Diffraction gratings, Grating spectrum – Dispersion and Resolving power.

POLARIZATION: Polarization by reflection Brewster’s law - Double refraction -Polarization by scattering - Retarders -Optical Activity.

UNIT - II

CRYSTAL STRUCTURES: Introduction –periodic arrays of atoms-Lattice translation vectors, Basis and crystal structure, Primitive cell, fundamental types of lattices-three dimension lattice types, Crystal systems- Structure and packing fractions of Simple cubic- Body centered cubic- Face centered cubic crystals.

X-RAY DIFFRACTION: Directions and planes in crystals – Miller indices – separation between successive ( h k l ) planes- Diffraction of X- rays by crystal planes – Braggs law- Laue method- powder method.

UNIT - III


UNIT - IV

SUPER CONDUCTIVITY : Phenomenon, Meissner effect, critical parameters, Type I, Type II Super conductors, BCS theory of super conductivity, Applications of Super conductors.

UNIT - V


TEXT BOOKS
2. Engineering Physics by V RAJENDRAN Tata McGrailll

REFERENCES
1. Introduction to solid state physics, C. Kittel, John wiley, 1999.
2. Engineering physics by H K MALIK AK SINGH TATA McGrailll
P832 - ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

Internal Marks            : 25
Lab/Practicals : 3 Period/Week
External Marks            : 75
Credits : 2
External Examination   : 3 Hrs

The English Language Communications Skills Lab focuses on practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts. It aims at improving the communicative competence of students and to enrich their power of expression, articulation and persuasiveness. The thrust is on developing competences, both linguistic as well as communicative, in order to improve employability potential.

OBJECTIVES

1. To expose the students to a variety of self-instructional, learner-friendly modes of English language learning and stimulate intellectual and attitudinal exercise.
2. To provide students with the required facility and practice to face computer-based competitive exams such GRE, TOEFL, IELTS etc.
3. To enable them to learn better pronunciation through emphasis on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To develop necessary attitudes and behaviors so as to improve their employability quotient.

SYLLABUS

The following course content is prescribed for the English Language Communication Skills Laboratory sessions:

1. Dimensions of Phonetics: Phonetic Transcription, Sounds, Stress, Intonation, Rhythm, Varieties of Spoken English: Indian, British and American
2. Oral Presentations -- Prepared and Extempore -- JAM
3. Role Play
4. Describing Objects / Situations / People
5. Information Transfer
6. Debates
7. Group Discussions

SUGGESTED SOFTWARE/BOOKS

* Digital Mentor, Globarena, Hyderabad, 2005
* Sky Pronunciation Suite: Young India Films, Chennai, 2009
* Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley, USA, 2001
* Dorling Kindersley Series of Grammar, Punctuation, Composition, Dorling Kindersley, USA, 2001
* Learning to Speak English - 4 CDs. The Learning Company, USA, 2002
* Krishna Mohan, Effective English Communication, Tata McGraw Hills, New Delhi, 2007
P830 - ENGINEERING PHYSICS AND CHEMISTRY LAB

Internal Marks : 25
Lab/Practicals : 3 Period/Week External Marks : 75
Credits : 2 External Examination : 3 Hrs

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ENGINEERING PHYSICS LABORATORY
(Any 5 experiments)

LIST OF EXPERIMENTS

1. LCR Resonance circuit
2. Newton’s Rings – Determination of Radius of curvature of plano convex lens
3. Verification of laws by using sonometer
4. Meldy’s experiment
5. Wedge shaped film
6. Volume Resonator
7. Refractive index of light
8. Diffraction Grating – Normal incidence method
9. Rigidity modulus of a given wire
10. Frequency of AC supply – Sonometer

ENGINEERING CHEMISTRY LABORATORY
(Any 5 experiments)

1. Estimation of total Hardness of water by EDTA method
2. Determination of Temporary and permanent hardness of water.
3. Iodometric Titration of K₂Cr₂O₇ v/s Na₂S₂O₃ to determine the percentage purity of K₂Cr₂O₇ sample.
4. Preparation of Stanard Potassium Dichromate and Estimation of Copper by Iodometry.
5. Determine the amount of Oxalic acid and Sulphuric acid in 1 liter solution by using given standard Sodium Hydroxide and Potassium Permanganate solution
7. Determination of Dissolved Oxygen (DO) content by Winkler’s method.
8. Preparation of Urea formaldehyde resin.
LAB - I

Exercise 1. Open and Run a VI
Objective: Open, run, and explore the components of a VI.
Open the Temperature System Demo VI from the tutorial_1 directory.

Exercise 2. Use of LabVIEW help utilities
Objective: Become familiar with the context help and the LabVIEW help
Open the Temperature System Demo VI from the tutorial_1 directory if it is not already open from Exercise 1.

Exercise 3. Create a VI
Objective: Build a simple VI that converts a Celsius temperature reading to Fahrenheit.

Exercise 4. Document a VI
Objective: Document a VI that you have created.

Exercise 5. Navigation and editing
Objective: To learn LabVIEW editing techniques.

Exercise 6. Debug a VI
Objective: To use the probe tool and the probe window and to examine data flow in the block diagram using execution highlighting.

LAB - II

Converting a VI into a sub VI (Exercise)
Use of sub-VI (demo)
Debug a VI (Demo)
Debug Main (Exercise)
Mechanical action of Boolean (Demo)
While Loop & Charts (exercise)
While Counter (Exercise)
Moving averages (Exercise)
Shift Register (Exercise)
Die Roller (Exercise)

LAB - III

Case structure (Demo)
Calculator
SEQUENCE STRUCTURE
Building arrays with loops (Demo)
Building arrays with loops (Exercise)
Build array function (demo)
Building Tables (demo)
Replace array elements
Sort array values
Temperature Analysis
LAB - IV

Case structure (Demo)
Calculator
SEQUENCE STRUCTURE
CLUSTER ERROR. FIND AND RECTIFY?
BUTTON SELECTION (Demo)
BUTTON SELECTION with Shift Register (Demo)
LOCALS FOR PARALLEL LOOP CONTROL
LOCAL FOR RESET
LOCALS FOR CONTROL
Global Variables (Demo)
Function Generator (demo)
Noisy Signal (Demo)
Noisy Signal Analyzer (Demo)
Noisy Signal Analyzer with Filter (Demo)

LAB - V

Modeling and simulation of Physical Systems
UNIT - I

MASS MOMENT OF INERTIA: Moment of inertia of a rigid body – Moment of inertia of lamina- slender bar, rectangular plate, Circular plate, circular ring, Moment of inertia of 3D bodies- cone, solid cylinder, solid sphere. Moment of Inertia of composite bodies.

UNIT - II

KINEMATICS: Introduction, displacement, velocity and acceleration. Motion with Uniform and Variable acceleration. Angular displacement, Angular velocity and Angular acceleration. Equations of Motion along a circular path.

UNIT - III

PROJECTILES: Introduction, Basic Definitions, Projectile equations, Horizontal projection, Inclined Projection, Projectile on Horizontal plane and Inclined plane.

UNIT - IV


UNIT - V


TEXT BOOK

Engineering Mechanics / Ferdinand . L. Singer / Harper – Collins

REFERENCES

4. Vector Mechanics for Engineers Static’s and Dynamics by Beer and Johnston, TATA Mc Graw Hill.
UNIT - I


UNIT - II


UNIT - III


UNIT - IV


Pure Substance: Introduction, Phases of Pure Substance, Phase Change Processes, Property Diagrams (T-v, P-v, P-T), P-v-T Surface, Property Tables.

UNIT - V


Refrigeration Cycles: Reveresd Carnot Cycle, Bell-Coleman Cycle, Simple Vapor Compression Cycle.

TEXT BOOK

REFERENCES

3. Engineering Thermodynamics – P.K.Nag, TMH
T319 – STRENGTH OF MATERIALS

UNIT - I

SIMPLE STRESSES AND STRAINS: Stresses and strain due to axial force. Hooke’s law, factor of safety, stepped bars – uniformly varying sections - stresses in composite bars due to axial force and temperature - strain energy due to axial force, stresses due to sudden loads and impact. Lateral strain: Poisson’s ratio - change in volume – shear stress - shear strain - relationship between elastic constants

UNIT - II

SHEAR FORCE AND BENDING MOMENT: Relationship between loading - shear force and bending moment - shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to concentrated loads and uniformly distributed loads only - maximum bending moment and point of contra flexure.

UNIT - III

STRESSES IN BEAMS: Theory of simple bending: assumptions - derivation of the equation M/I = E/R = f/y – section modulus - calculation of normal stresses due to flexure application.

TORSION: Theory of torsion and assumptions - derivation of the equation T/J = Cθ/L = q/r, polar modulus, power transmitted by a shaft, stresses in solid and hollow circular shafts

UNIT - IV

ANALYSIS OF STRESSES IN TWO DIMENSIONS: State of stress at a point, normal and tangential stresses on inclined planes - principal stresses and their planes - plane of maximum shear - Mohr’s circle of stresses.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beam cross sections like Rectangular, Circular, Triangular, I and T Sections.

UNIT - V


THIN, THICK AND SPHERICAL SHELLS: Hoop and longitudinal stress- thin and thick cylinders- spherical shells-changes in dimensions and volume.

TEXT BOOK

S.Ramamrutham, Strength of Materials, Dhanpat Rai & Sons

REFERENCES

4. R.Subramanian, Strength of Materials, Oxford University Press
UNIT - I


UNIT - II


UNIT - III

Steels: Classification of steels, structure and properties of plain carbon steels-low carbon steel, medium carbon steel and high carbon steel.

Cast Irons: Structure and properties of white cast iron, malleable cast iron, grey cast iron, spheroidal graphite cast iron.


UNIT - IV

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth. Comparison of properties of cold and hot worked parts.


UNIT - V

Ceramic Materials: Properties and applications of ceramic materials, glasses, cermets, and abrasive materials

Composite Materials: Classification of composites, various methods of component manufacture of fiber reinforced composites-hand layup process, filament winding process, SMC processes, continuous pultrusion processes, resin transfer moulding.

Introduction to metal ceramic mixtures, metal – matrix composites and C – C composites.

TEXT BOOK

Introduction to Physical Metallurgy / Sidney H. Avener-Tata McGraw-Hill

REFERENCES

UNIT - I

Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations

UNIT - II


UNIT - III


UNIT - IV

Diode and Transistors: P-n junction diode, symbol, V-I Characteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems). PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

UNIT - V

Electrical and Electronics Measuring Instruments.

Electrical Instruments: Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.


TEXT BOOK

Essentials of Electrical and Computer Engineering by David V. Kerns, Jr. J. David Irwin/Pearson.

REFERENCES

3. Electrical Technology by JB GUPTA
MACHINE DRAWING CONVENTIONS

Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

d) Title boxes, their size, location and details - common abbreviations & their liberal usage

e) Types of Drawings – working drawings for machine parts.

I. DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.

b) Keys, cottered joints and knuckle joint.

c) Rivetted joints for plates

d) Shaft coupling, spigot and socket pipe joint.

e) Journal, pivot and collar and foot step bearings.

II. ASSEMBLY DRAWINGS

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) Engine parts – stuffing boxes, cross heads, Eccentrics, Petrol Engine connecting rod, piston assembly.

b) Other machine parts - Screws jacks, Machine Vices Plummer block, Tailstock.

c) Valves: Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE : First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOK


REFERENCES

Any of the 10 Experiments are required to be conducted

**STRENGTH OF MATERIALS**

1. Compression test on helical spring.
2. Tension test on mild steel rod.
3. Double shear test on metals.
4. Torsion test on mild steel rod.
5. Impact test on metal specimen.
6. Hardness test on metals.
7. Deflection test on beams.

**METALLURGY LAB**

1. Preparation and study of the microstructure of pure metals like Iron, Cu and Al.
2. Preparation and study of the microstructure of low carbon steels, medium carbon steel and high carbon steels.
3. Study of the microstructures of gray cast iron, malleable cast iron and nodular cast iron.
4. Study of the microstructures of brass.
5. Study of the microstructures of heat treated steels.
6. Hardenability of steels by jominy end quench test.
7. Hardness of various treated and untreated steels.
8. Wear Test.
Any of the 10 Experiments are required to be conducted

**LIST OF EXPERIMENTS**

1. Brake Test on 3-Ph Squirrel Cage Induction Motor

2. Regulation of 3-Ph Alternator by Synchronous Impedance Method

3. O.C & S.C tests on 1-phase transformer

4. Separation of core losses of 1-phase transformer

5. Load Test on 1-phase Transformer

6. Mesh Analysis

7. Nodal Analysis

8. RL & RC Series circuits

9. Diode characteristics

10. Transistor characteristics

**ADDITIONAL EXPERIMENTS**

11. CE Amplifier

12. Half wave & Full wave rectifiers
IV-SEMESTER
T287 - PRODUCTION TECHNOLOGY

Lecture : 4 Periods/week  Internal Marks : 25
Tutorial : External Marks : 75
Credits : 4  External Examination : 3 Hrs

UNIT - I


Melting Practice- Furnaces: Cupola, Crucible and Induction furnace

UNIT - II


UNIT - III


UNIT - IV


UNIT - V

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion, Hydrostatic extrusion.

Sheet Metal Operations: Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming

TEXT BOOK

Manufacturing Engineering and Technology/Kalpakjain S/ Pearson Edu.

REFERENCES

1. Manufacturing Technology / P.N. Rao/TMH
2. Production Technology / R.K. Jain
4. Production Technology /Sarma P C /
5. Workshop Technology-B.S. Raghuvamsi-Vol.I /PHI
T234 - KINEMATICS OF MACHINES

Lecture : 4 Periods/week                Internal Marks : 25
Tutorial : 1 Period/Week              External Marks : 75
Credits : 4                           External Examination : 3 Hrs

UNIT - I

MECHANISMS: Elements – Classification –Types of kinematic pairs –Types of motions –
Degree of freedom-Gruebler’s criterion- Mechanism and machines – classification of
machines – kinematic chain – inversion of mechanism - inversions of quadric cycle chain –
single and double slider crank chains.

STRAIGHT LINE MOTION MECHANISMS: Exact and approximate copiers and generated
Mechanisms.

UNIT - II

VELOCITY AND ACCELERATION ANALYSIS: Absolute and relative motions-
Instantaneous centre - Kennedy’s theorem- determination of angular velocity of points and
links for simple mechanisms - Relative velocity method –Velocity Polygon-Acceleration
Polygon- Velocity and acceleration diagrams for simple mechanisms - Klein’s construction-
Coriolis acceleration.

STEERING MECHANISMS: Conditions for correct steering – Davis Steering gear-
Ackerman steering gear

UNIT - III

CAMS: Classification of cam and follower mechanism-Terminology - Types of follower
motion - Uniform velocity – Simple harmonic motion and uniform acceleration-Displacement
diagrams- Derivations of follower motion -Graphical layouts of cam profiles- Tangent cams.

UNIT - IV

GEARS: Terminology – law of gearing- Profile for gears- Involute gearing- Velocity of sliding
-interference and undercutting– Contact ratio-Basics of Helical, Bevel, Worm, Rack and
Pinion gears.

GEAR TRAINS: Speed ratio- Train value- Types of gear trains –Epicyclic gear trains –
Differential gear for an automobile.

UNIT - V

BELT AND ROPE DRIVES: Introduction - Selection of belt drive- Types of belt drives-
materials - Velocity ratio- slip -Creep - Tensions for flat belt drive-Angle of contact-
Centrifugal tension- Maximum tension – Ropes drives

TEXT BOOK


REFERENCES

2. Theory of Machines by Thomas Bevan/ CBS.
4. Theory of Machines - Sadhu Singh - Pearson Education.
UNIT - I

Introduction: General description of Fluid Mechanics, Classification of Fluids, Fluids and Continuum, Properties of Fluid – Pressure, Temperature, Density, Specific Weight, Specific Gravity, Viscosity, Compressibility, Surface Tension, Capillarity, Vapor Pressure, Cavitation.

Fluid Statics: Pressure Force on a Fluid Element, Hydrostatic Pressure Distributions, Hydrostatic forces on submerged plane and curved surfaces, Manometers, Buoyancy and Stability

UNIT - II

Analysis of Fluid Flow: Eulerian and Lagrangian approaches, Velocity Field, Flow Patterns- Pathline, Streamline, Streakline, Timeline, Stream Tube


UNIT - III


Flow in Noncircular Ducts: Hydraulic Diameter, Fully developed laminar flow between parallel plates, Fully developed laminar flow through a concentric annulus

UNIT - IV

Boundary Layer: Introduction, Boundary layer development, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness, Types of boundary layer, Momentum Integral Estimates- Karman Analysis of the Flat plate, Boundary layer Equations-2D Flow, Boundary layer growth on a flat plate-Blasius Solution, Boundary Layer with Pressure Gradient, Brief discussion on Lift and Drag

UNIT - V

Dimensional Analysis and Similarity: Introduction, Principle of Dimensional Homogeneity, Buckingham’s Pi Theorem, Dimensionless Groups, Similarity.

Introduction to Compressible Flow: Introduction, Perfect gas, Speed of sound, Mach Number, Specific heat ratio, Flow regimes based on Mach number, Compressibility-limiting condition for compressibility.

TEXT BOOK

Fluid Mechanics, White F.M. Tata McGraw-Hill
REFERENCES

2. Mechanics of Fluids, Shames, H.,
3. Introduction of Fluid Mechanics, Fox, R.W., and Mcdonald, A.J
T216 - IC ENGINES AND GAS TURBINES

UNIT - I


Engine Systems: Introduction, Layout of Fuel supply system for SI Engine-Simple Carburettor, Fuel supply system for CI Engine-Solid Injection-Individual pump type-Common rail type only, Cooling and Lubricating systems

UNIT - II

Air-Standard Cycles and Their Analysis: Introduction, Carnot, Otto, Diesel, Dual, Brayton cycles


Actual Cycles And Their Analysis: Introduction, comparison of air-standard and actual cycles, time loss factor, heat loss factor, exhaust blow down, loss due to rubbing friction, actual and fuel-air cycles of engines

UNIT - III

Combustion in SI Engines: Introduction, Homogeneous and Heterogeneous mixture, stages of combustion in SI engines, flame front propagation, factors influencing the flame speed, Abnormal combustion, phenomenon of knock in SI engines, effect of engine variables on knock, combustion chambers for SI engines- Fuel requirement and fuel rating.

Combustion in CI Engines: Introduction, stages of combustion in CI engines, factors affecting the delay period, phenomenon of knock in CI engines, comparison of knock in SI and CI engines, Combustion Chambers for CI engines, Fuel requirement and fuel rating.

UNIT - IV


UNIT - V


TEXT BOOK


REFERENCES

5. Engineering Fundamentals of the I.C.Engines- Pulkrabek PHI.
UNIT - I
**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over-exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems

- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

[11 Lectures]

UNIT – II

**Ecosystems:** Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem – Ecological succession. - Food chains, food webs and ecological pyramids.

**Biodiversity and its conservation:** Introduction - Definition: genetic, species And ecosystem diversity. - Bio-geographical classification of India - Value of Biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. - India as a mega diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

[11 Lectures]

UNIT – III

**Environmental Pollution:** Definition, Types, Cause, effects and control measures of:

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

**Solid waste Management:** Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

[11 Lectures]
UNIT – IV


UNIT – V


TEXT BOOKS

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE

Textbook of Environmental Sciences and Technology by M. Anji Reddy
BS Publication.
UNIT - I

Probability: Sample space and events – Probability – The axioms of probability – Some Elementary theorems - Conditional probability – Baye’s theorem.

UNIT - II


UNIT - III

Population and samples. Sampling distribution of mean (with known and unknown variance), proportion, variances. - Sampling distribution of sums and differences. Point and interval estimators for mean, variance and proportions.

UNIT - IV

Statistical Hypothesis – Errors of Type I and Type II errors and calculation. One tail and two-tailed tests. Testing of hypothesis concerning means, proportions and their differences using Z-test. 
Tests of hypothesis using Student’s t-test, F-test and $\chi^2$ test. Applications of decision making using the above tests.

UNIT - V

Simple Correlation and Regression.
Queuing Theory: Pure Birth and Death Process M/M/1 Model and Simple Problems related to the evaluation of waiting time, length of the queue etc.

TEXT BOOK

Probability and Statistics for Engineers, Miller ,John E. Freund, PHI

REFERENCES

1. Probability and Statistics, Gupta & Kapoor
2. Probability, Statistics and Queuing theory applications for Comp. Sciences, 2/e, Trivedy, John Wiley
P879 - THERMAL ENGINEERING LAB

Internal Marks : 25
Lab/Practicals : 3 Period/Week
Credits : 2

External Marks : 75
External Examination : 3 Hrs

Any of the 10 Experiments are required to be conducted

1. I.C. Engines Valve & Port Timing Diagrams

2. Performance Test on Variable Compression Ratio single cylinder 4-Stroke petrol Engine By using Eddy Current Dynamometer

3. Performance Test on single cylinder 4-Stroke Diesel Engine by using Mechanical Dynamometer

4. Performance test on twin cylinder 4-stroke diesel engine.

5. Performance Test on single cylinder 2-Stroke Petrol Engine.

6. Evaluation of Engine friction power by conducting Morse test on Multi cylinder 4-Stroke Petrol Engine.

7. Evaluation of Engine friction by conducting Retardation test on 4-stroke Diesel Engine.


11. Performance Test on Reciprocating Air – Compressor.

12. Performance Test on Vapour Compression Refrigeration Unit.

13. Performance Test on Air Conditioning Unit.


15. Viscosity of lubricants by using Redwood/ Say bolt viscometer Apparatus

16. Flash and Fire Point of fuels by using pesky Martin Apparatus

17. Carbon Residue test

P866 - PRODUCTION TECHNOLOGY LAB

Internal Marks : 25
Lab/Practicals : 3 Period/Week
External Marks : 75
Credits : 2
External Examination : 3 Hrs

Any of the 10 Experiments are required to be conducted

I. METAL CASTING LAB

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II WELDING LAB

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise

III MECHANICAL PRESS WORKING

3. Bending and other operations

IV PROCESSING OF PLASTICS

1. Injection Moulding
T328 - THERMAL ENGINEERING

UNIT - I


Combustion: Fuels and combustion, concepts of heat of reaction, Adiabatic flame temperature, Stoichiometry

UNIT - II


Draught System: Functions, Types, Natural Draft-Height of chimney for given draught and discharge, Condition for maximum discharge, Efficiency of chimney, Artificial draught-induced and forced.

UNIT - III

Steam Nozzles: Introduction, Types of nozzle, Flow through nozzles- thermodynamic analysis– assumptions -velocity of nozzle at exit condition for maximum discharge, critical pressure ratio, Ideal and actual expansion in nozzle, velocity coefficient, Supersaturated flow, degree of super saturation and degree of supercooling -Wilson line

UNIT - IV


Steam Condensers: Introduction, Types, Working principle, vacuum efficiency and condenser efficiency

UNIT - V

Compressors– Introduction, Classification

Reciprocating: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and Effect of clearance volume, Free Air Delivery, Multistatge Compression-Condition for Minimum work

Rotary: Roots Blower, Vane sealed compressor, principle of working – efficiency considerations

Centrifugal: Principle of operation –Energy transfer-velocity diagram

Axial: Principle of operation – velocity triangles and energy transfer per stage, degree of reaction,
TEXT BOOK

Thermodynamics and Heat Engines, VOL-II, R. Yadav, Central Book Depot

REFERENCES

1. Applied Thermodynamics, T.D Eastop and A. McConkey, Pearson Education
3. Thermal Engineering, Mahesh Rathore, TMH
4. Basic Engineering Thermodynamics, Roy Choudhury
5. Power Plant Engineering, P.K Nag, TMH
T239 - MACHINE DESIGN – I

Lecture : 4 Periods/week  
Tutorial : 1 Period/Week 
Credits : 4

Internal Marks : 25  
External Marks : 75  
External Examination : 3 Hrs

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Machine Design Data Books are Permitted

UNIT - I

INTRODUCTION: Basic procedure of machine design– Basic requirements of machine design – Design of machine elements – Design Analysis-Design synthesis – Introduction to Indian standards-Selection of Preferred sizes

DESIGN FOR STATIC STRENGTH: Modes of failure-Factor of safety-Stress-strain relationship-Shear stress and shear strain-Stresses due to bending moment-Stresses due to torsional moment-Eccentric axial moment-Theories of elastic failure-Maximum principal stress theory-Maximum shear stress theory-Distortion energy theory

UNIT - II

DESIGN FOR FATIGUE STRENGTH: Stress concentration – Stress concentration factors-Reduction of stress concentration-Fluctuating stresses-Fatigue failure-Endurance limit-S-N curve-Notch sensitivity-Endurance limit-Approximate estimation-Reversed stresses-Design for finite and infinite life problems-Soderberg and Goodman lines-Gerber equation- Impact stresses

UNIT - III

THREADED JOINTS: Threaded joints-Terminology of screw threads-Materials and manufacture-Bolted joint-Simple analysis-Eccentrically loaded bolted joints in shear-Eccentric load perpendicular to axis of bolt-Bolts of uniform strength

WELDED JOINTS: Butt joints-Fillet joints-Strength of butt joints-Strength of parallel fillet welds-Strength of transverse fillet welds-Maximum shear stress in parallel fillet and transverse fillet welds-Axially loaded unsymmetrical welded joints-Welded joint subjected to bending moment

UNIT - IV

POWER SCREWS: Forms of thread-Multiple threaded screws-Terminology-Torque requirement for lifting and lowering loads-Self locking screw-Efficiency of square threaded screw-Efficiency of self locking screw- design of screw and nut-Design of screw jack.

KEYS, COTTER AND KNUCKLE JOINTS: Types of keys- Design of square and flat keys-Cotter joints-Socket and Spigot cotter joint-Knuckle joint-Failures

UNIT - V

SHAFTS: Transmission shafts-Shaft design on strength basis-Shaft design on torsional rigidity basis-ASME code for shaft design-Design of hollow shaft on strength and torsional rigidity basis

SHAFT COUPLINGS: Requirements – Rigid couplings-Muff coupling-Clamp coupling-Flange coupling-Bushed pin flexible coupling
TEXT BOOK

Mechanical Engineering Design/Shigley. J.E/ Mc Graw-Hill

REFERENCES

6. Data Books : (i) P.S.G. College of Technology (ii) Mahadevan
T170 - DYNAMICS OF MACHINES

Lecture : 4 Periods/week  Internal Marks : 25
Tutorial : 1 Period/Week  External Marks : 75
Credits : 4  External Examination : 3 Hrs

UNIT - I

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

UNIT - II

BRAKES AND DYNAMOMETERS : Simple block brakes- internal expanding brake- band brake of vehicle- Dynamometers – Absorption and transmission types-General description and methods of operations.
PRECESSION : Gyroscopes- effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships- Static and dynamic force analysis of planar mechanisms.

UNIT - III

TURNING MOMENT DIAGRAM AND FLY WHEELS: Turning moment – Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Fly wheels and their design.

UNIT - IV

VIBRATIONS: Types of vibrations-Basic features of vibrating systems-Degrees of freedom-Free longitudinal vibrations-Equilibrium method-Energy method- Rayleigh’s method.

UNIT - V

BALANCING : Balancing of rotating masses -Single and multiple – single and different planes-Balancing of reciprocating masses - Primary, Secondary and higher balancing of reciprocating masses -Analytical and graphical methods - Unbalanced forces and couples - locomotive balancing – Hammer blow-Swaying couple - variation of tractive efforts.

TEXT BOOK

Theory of Machines / S.S Ratan/ Mc. Graw Hill

REFERENCES

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Theory of Machines / Shigley / MGH
3. Theory of Machines / Thomas Bevan / CBS Publishers
UNIT - I


UNIT - II


**Performance of Turbines**: Performance Under Unit Head-Unit Quantities- Performance Under Specific conditions – Specific Speed - Performance Characteristic Curves – Cavitation – Selection of Turbines.

UNIT - III

**Reciprocating Pumps**: Introduction-Main components and working of a Reciprocating pump-Types -Work done by Reciprocating pump-Single Acting & Double Acting Pump-Coefficient of Discharge – Slip-Percentage Slip And Negative Slip- Indicator diagram – Effect of Acceleration Of Piston On Velocity &Pressure in suction and delivery pipes – Air vessels – Rate of flow into and from air vessels

UNIT - IV

**Centrifugal Pumps**: Types Component parts and Working – Work done by the Impeller-Manometric head –Losses and Efficiencies – Effect of Vane Angle on Manometric Efficiency – Effect of Finite number of vanes of the Impeller on Head and Efficiency – Minimum Starting Speed – Loss of Head due to reduced or increased flow – Diameters of impeller and pipes-Specific Speed – Multistage Pumps – Pumps in parallel — NPSH – Cavitation

UNIT - V


**TEXT BOOK**


**REFERENCES**

1. Elements of Hydraulic Machines and Fluidics / Jagdish Lal
2. Hydraulic Turbines / Nechleba M
T242 - MACHINE TOOLS

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UNIT - I

Elementary Treatment of Metal Cutting Theory: Elements of cutting process – Methods of Metal Cutting – Classification of Cutting Tools - Geometry of Single Point Cutting Tool. Chip formation, mechanism and types of chips- chip breakers. Merchant’s Force diagram, measurement of cutting forces, work done in cutting. Metal cutting theories. Machining parameters-Tool Life, Tool Failure-Cutting Tool Materials, Cutting Fluids

UNIT - II

Turret and Capstan Lathes: Collet chucks – Other work holders – Tool holding devices – Box and tool layout.

UNIT - III

Shaping, Slotting and Planing Machines: Principles of working – Principal parts – Specification classification, operations performed, machining time calculations.

UNIT - IV

Milling Machines: Principles of working – Specifications – Classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – Machining operations-Types -Geometry of milling cutters –Milling cutters – Methods of indexing – Accessories to milling machines.
Different types of abrasives – bonds specification of grinding wheel and selection of grinding wheel

UNIT - V

Lapping, Honing and Broaching Machines: Comparison to grinding – lapping and honing.
Constructional features of speed and feed units, machining time calculations

TEXT BOOK
Production Technology by R.K. Jain and S.C. Gupta.

REFERENCES
3. Manufacturing Science by Gosh and Malik
4. Manufacturing Engineering & Technology by Kalpakjain S /Pearson Education
UNIT - I

Management Science: Basic concepts of Management, Contribution of Taylor and Fayol to Scientific Management, Motivation and Control, Maslow’s hierarch of needs, Leadership styles, Managerial Grid.

UNIT - II


UNIT - III

Plant Location: Importance and factors affecting plant location, Single and Multi facility plant location problems.

Plant Layout: Need, Importance, Objectives and Principles of good plant layout, Types of layout and applications.

Material Handling: Objectives, functions, principles of material handling, Types of material handling equipment and selection.

UNIT - IV

Materials Management: Objectives, Inventory control - Purpose, types, functions, basic EOQ, safety stock inventory control systems, selective control of inventory ABC and VED analysis, Inventory control system-periodic review system, Store Management and stores record, purchase management.

UNIT - V

Inspection and Quality Control: Types of Inspections, Statistical Quality Control techniques, acceptance sampling plan, Introduction to Total Quality Management, Quality Circles, ISO 9000 series procedures.

TEXT BOOK


REFERENCES

P834 - FLUID MECHANICS AND HYDRAULIC MACHINES LAB

Internal Marks : 25
Lab/Practicals : 3 Period/Week
External Marks : 75
Credits : 2
External Examination : 3 Hrs

Any of the 10 Experiments are required to be conducted

1. Verification of Bernollious Theorem
2. Calibration of Venturimeter
4. Determination of friction factor for a given pipe line
5. Determination of loss of head due to sudden contraction in a pipeline
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Kaplan Turbine.
10. Performance Test on Multi Stage Centrifugal Pump.
11. Performance Test on Reciprocating Pump.
12. Turbine flow meter.
13. Calibration of low speed wind tunnel.
15. Potential Flow Study Using Hele-Shaw Apparatus
16. Flow Visualization study using Water Flow Channel
Any of the 10 Experiments are required to be conducted

**MACHINE TOOLS LAB**

1. Introduction of general purpose machines - Lathe, Drilling machine, Milling machine, Shaper, Planing machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on lathe machine.
4. Drilling and Tapping
5. Shaping and Planing
6. Slotting
7. Milling
8. Grinding of Tool angles.

**MODELING LAB**

2. Part Modeling:(Two examples)
   Generation of various 3D models through protrusion, revolve, shell, sweep etc. Creation of various features
3. Assembly modeling of machine parts.(Two examples)
   Ex: knuckle joint, universal joint, IC engine piston and rod end assembly etc
4. Wireframe modeling(One example)
5. Surface modeling(One example)

**PACKAGES**

ProE/CATIA/UniGraphics.

**REFERENCES**

Lab Manuals
VI-SEMESTER
UNIT - I


One- Dimensional Steady State Conduction: Heat flow through plane wall and cylinder with constant thermal conductivity- Electrical analogy-Thermal resistance-Overall heat transfer coefficient-Heat flow through Composite Wall and Cylinder - Critical radius of insulation for Cylinder.

UNIT - II

One Dimensional Steady State Conduction: Heat flow through plane wall and cylinder with Variable Thermal conductivity - Uniform internal heat generation in Slabs-Extended Surfaces- Analysis of Long Fin and Short fin with insulated tip - Fin efficiency and Effectiveness.

One Dimensional Transient Heat Conduction: Systems with negligible internal resistance-Lumped Heat analysis--Significance of Biot and Fourier Numbers-Plane wall with finite surface and internal resistance using Heisler Chart.

UNIT - III

Convective Heat Transfer: Introduction-Types of Convection- Convective heat transfer coefficient- Dimensional analysis -Buckingham Pi Theorem applied to Forced convection -- Significance of Non Dimensional numbers-The boundary layer concept-The velocity and Thermal boundary layers.


Natural Convection: Development of Hydrodynamic and thermal boundary layer along a Vertical plate- Empirical correlations for Vertical plate, Vertical Cylinder, Horizontal Plate and Horizontal Cylinder.

UNIT - IV


UNIT - V


NOTE: Heat and Mass Transfer Data Book by C.P. Kothandaraman and Subramanian-New Age Publications is to be allowed in Examination.

TEXT BOOK


REFERENCES

2. Heat Transfer – C. J. Cengel - TMH
3. Heat transfer - J.P.Holman, McGrawHill
T240 - MACHINE DESIGN –II

Lecture : 4 Periods/week
Tutorial : 1 Period/Week
Credits : 4

Internal Marks : 25
External Marks : 75
External Examination : 3 Hrs

Machine Design Data Books are Permitted

UNIT - I


ROLLING CONTACT BEARINGS: Ball and roller bearings – Static loading of ball and roller bearings – Dynamic capacity - Bearing life.

UNIT - II

ENGINE PARTS:
PISTON: Forces acting on piston – Construction -Design and proportions of piston- Cylinder- Cylinder liners.
CONNECTING ROD: Thrust in connecting rod – Rankine's formula-Johnson’s formula- Stress due to whipping action on connecting rod ends
CRANK SHAFT: Strength and proportions of center crank shaft – Crank pins

UNIT - III


UNIT - IV


UNIT - V


TEXT BOOK

Shigley J.E / Mechanical Engineering Design / McGraw-Hill

REFERENCES

4. Data Books : (i) P.S.G. College of Technology (ii) Mahadevan
UNIT - I

Introduction – Need for unconventional machining methods - Classification of unconventional machining processes – considerations in process selection.

UNIT - II

Mechanical Processes
Basic principle, equipment, process variable and applications of ultrasonic machining, abrasive jet machining and water jet machining.

UNIT - III

Electrochemical Processes
Process, principles, equipment and material removal rate in electrochemical machining, electrochemical grinding, electrochemical deburring and electrochemical honing. Chemical machining - principle - maskants - etchants - advantages and applications.

UNIT - IV

Electrical Discharge Machining

UNIT - V

Electron Beam, Laser Beam and Plasma Arc Machining
Principle, process, equipment and applications of electron beam machining, laser beam machining, plasma arc machining and hot machining.

TEXT BOOK

Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.

REFERENCES

1. Unconventional manufacturing processes/ M.K.Singh/ New age international
UNIT - I
ENGINEERING ETHICS
Senses of 'Engineering Ethics' variety of moral issues types of inquiry moral dilemmas
moral autonomy Kohlberg's theory Gilligan's theory consensus and controversy – Models
of Professional Roles theories about right action Selfinterest customs and religion uses of
ethical theories.

UNIT - II
HUMAN VALUES
Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue
– Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage –
Valuing Time – Cooperation – Commitment – Empathy – SelfConfidence – Character –
Spirituality

UNIT - III
ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation engineers as responsible experimenters codes of ethics a
balanced outlook on law the challenger case study

UNIT - IV
SAFETY, RESPONSIBILITIES AND RIGHTS
Safety and risk assessment of safety and risk risk benefit analysis and reducing risk the
three mile island and chernobyl case studies. Collegiality and loyalty respect for authority
collective bargaining confidentiality conflicts of interest occupational crime professional
rights employee rights Intellectual Property Rights (IPR) discrimination.

UNIT - V
GLOBAL ISSUES
Multinational corporations Environmental ethics computer ethics weapons development
engineers as managers consulting engineers engineers as expert witnesses and advisors
moral leadership sample code of Ethics ( Specific to a particular Engineering Discipline ).

TEXT BOOKS
   York 1996.
   Hall of India, New Delhi, 2004.

REFERENCES
1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall,
   New Jersey,2004 ( Indian Reprint now available )
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “ Engineering Ethics –
   Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 ( Indian
   Reprint now available )
   Delhi, 2003.
**T268 - OPERATIONS RESEARCH**

<table>
<thead>
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<tr>
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**UNIT - I**

Introduction to Operations Research, operations research models, applications.  

**UNIT - II**


**UNIT - III**

**Theory Of Games**: Minimax (maximin) Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, 2 X 2 games – dominance principle – m X 2 & 2 X n games, and graphical method.

**UNIT - IV**

**Waiting Lines**: Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.  
**Inventory**: Single item Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

**UNIT - V**

**Project Management**: Network Modeling, Probabilistic model, various types of activity times estimation, programme evaluation review technique (PERT), critical path method (CPM).  
**Dynamic Programming**: Bellman’s Principle of optimality, Applications of dynamic programming, capital budgeting problem, shortest path problem, linear programming problem.

**TEXT BOOK**

Operations Research / Paneer Selvam.

**REFERENCES**

1. Introduction to O.R/Hiller & Libermann (TMH).
5. Introduction to O.R /Taha/PHI.
T276 - POWER PLANT ENGINEERING

<table>
<thead>
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<td>Credits</td>
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UNIT - I

**Introduction:** Various Energy sources-Types of power plants-Resources and Development of Power in India.

**Steam Power Plant:** Plant Layout-Working of Different circuits-Types of Coal-Coal handling systems--Coal storage- Overfeed and Underfeed fuel beds-Pulverized Fuel burning system - Ash handling systems-Dust collection and its disposal-Mechanical type - Electrostatic Precipitator-Cooling Towers and heat rejection.

UNIT - II

**Diesel Power Plant:** Plant layout with auxiliaries-Fuel storage and Fuel supply system-Air supply system-Exhaust system-Water cooling system-Lubrication system-Starting system-Supercharging-Advantages and Disadvantages of Diesel plants over Thermal plants.

**Gas Turbine Plant:** Introduction-Classification-Layout with auxiliaries-Principles of working of Closed and Open cycle gas turbines-Combined cycle power plants and comparison.

UNIT - III

**Hydro Electric Power Plant:** Hydrology-Hydrological cycle- Rainfall- Run off Hydrograph-Flow duration curve- Mass curve--Site selection of hydro plant-Typical layout-Different types of hydro plants.

**Nuclear Power Plants:** Nuclear Fission and Fusion - Nuclear Fuels- Breeding-Components of Reactor-Types of Nuclear Reactors-Pressurized water reactor(PWR)-Boiling water reactor(BWR)-CANDU reactor-Gas cooled reactor-Liquid metal cooled reactor-Fast Breeder Reactor-Nuclear waste and its Disposal.

UNIT - IV

**Power From Non-Conventional Sources:** Solar power plants-Utilization of Solar collectors-Principle of working of Wind energy-Types- Tidal Energy.

**Direct Energy Conversion System:** Solar cell- Fuel cell-Thermo Electric and Thermo ionic conversion system-MHD generation.

UNIT - V

**Power Plant Economics:** Fixed cost-Operating cost.-Fluctuating loads-General arrangement of Power Distribution-Load curves-Load duration curve- Connected load-Maximum demand-Demand factor-Average load-Load factor-Diversity factor- Plant capacity factor.

**Pollution and Control:** Introduction- Particulate and gaseous pollutants-Air and Water pollution by Thermal plants and its control—Acid rains -Methods to control pollution.

TEXT BOOK

A course in Power plant engineering- Arora & Domkundwar—Dhanpat Rai & Co

REFERENCES

3. Power plant technology, M.M. El Wakil, TMH.
T248 - MECHANICAL VIBRATIONS

Lecture : 4 Periods/week       Internal Marks : 25
Tutorial :                    External Marks : 75
Credits : 3                   External Examination : 3 Hrs

---------------------------------------------------------------------------------------------------------------

UNIT - I

Undamped free vibrations of single degree of freedom systems: Introduction- Differential
equation – Solution of differential equation - Torsional vibrations – Equivalent stiffness of
spring combinations -Springs in series – Springs in parallel – Natural frequency of a vibration
system by energy method.

UNIT - II

Damped free vibrations of single degree of freedom systems: Introduction – Different types
of dampings – Free vibrations with viscous damping – Over damped, critically damped and
under damped systems -Logarithmic decrement – Viscous dampers

UNIT - III

Forced vibrations of single degree of freedom systems: Introduction – Forced vibrations with
constant harmonic excitation – Steady state vibrations – Forced vibration with rotating and
reciprocating unbalance -Forced vibrations due to excitation of the support –Vibration
isolation and transmissibility - Typical isolators and mount types – vibration measuring
instruments

UNIT - IV

Two degrees of freedom systems: Introduction – Principal modes of vibrations – Other cases
of simple two degrees of freedom systems – Two masses fixed on a tightly stretched string -
Double pendulum – Torsional system – Undamped forced vibrations with harmonic
excitation -Undamped dynamic vibration absorber

UNIT - V

Multi degree of freedom systems - Exact analysis- Undamped free vibrations of a multi
degree of freedom system – Influence coefficients – Flexibility coefficients and Maxwell
reciprocal theorem – Torsional vibrations of multi rotor systems – Vibrations of geared
systems - Numerical method – Determination of natural frequency of vibration by Rayleigh’s
method.

TEXT BOOK

Mechanical vibrations/ G.K.Grover/ Nem chand & Bros.

REFERENCES

2. Mechanical vibrations/William W.Seti/ Schaum outline series
4. Mechanical Vibrations/S.S.Rao/Pearson Education
UNIT - I


UNIT - II


UNIT - III

Aircraft Performance: Introduction: The Drag Polar, Equations of Motion, Thrust Required for Level, Unaccelerated Flight, Thrust Available and Maximum Velocity, Power Required for Level, Power Available and Maximum Velocity, Altitude Effects on Power Required and Available, Rate of Climb, Gliding Flight, Absolute and Service Ceilings, Time to Climb, Range and Endurance

UNIT - IV


UNIT - V


TEXT BOOK

Introduction to Flight, John D. Anderson, Jr., McGrawHill

REFERENCES

1. Aerodynamics for Engineering Students, Houghton and Carpenter
2. Mechanics of Flight, A.C. Kermode,
# T332 - TRIBOLOGY

<table>
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## UNIT - I

**Friction and Wear:** Types of friction, Theories of friction, Study of current concepts of boundary friction and dry friction, friction reducing measures. Causes of wear, Types of wear, Mechanism of various types of wear, laws of wear, effects of wear

## UNIT - II

**Viscosity and Lubricants:** Viscosity, flow of fluids, viscosity and its variation - absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used, Viscosity standards, Lubricants and their physical properties, Various theories of lubrication

## UNIT - III

**Theory of hydrodynamic lubrication:** petroffs equation, Reynold’s equation in two dimensions, bearing modulus, Sommerfield number, Effects of side leakage, pressure, flow, load capacity and friction calculations, heat balance, minimum oil film thickness, oil whip and whirl.

## UNIT - IV

**Theory of hydrostatic lubrication:** Hydrostatic step bearing, pivoted pad thrust bearing, hydrostatic lifts, hydrostatic squeeze films, pressure, flow, load capacity and friction calculations, oil rings, pressure feed bearing, partial bearings, externally pressurized bearings, Air lubricated bearing, Advantages and disadvantages

## UNIT - V

**Anti-friction bearings and Bearing materials:** Anti-friction bearings, types, Advantages and disadvantages, General requirements of bearing materials, types of bearing materials, General bearing design considerations.

## TEXT BOOK

Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI.

## REFERENCES

1. Tribology in Industry: Sushil Kumar Srivatsava, S. Chand &Co.
2. Tribology – B.C. Majumdar.
T331 - TOTAL QUALITY MANAGEMENT

<table>
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<td>External Examination</td>
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UNIT - I

Introduction: Evolution of total quality management, Definition of Quality, Quality costs, Quality Council, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT - II


UNIT - III

Statistical process control: The seven tools of quality, Statistical Fundamentals, Population and Sample, Normal curve, Control charts for variables and attributes, Process capability, Concepts of six sigma, New seven Management tools.

UNIT - IV

TQM Tools: Benchmarking, Benchmarking Process, Quality Function Deployment (QFD), House of Quality, QFD Process, Taguchi Quality Loss Function, Total Productive Maintenance-Concept, improvement needs, FMEA- Stages of FMEA.

UNIT - V


TEXT BOOK


REFERENCES

T270 - OPTIMIZATION TECHNIQUES

<table>
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OBJECTIVE

This course is a basic mathematical tool in solution of number of system operational methods and design of components and systems. The course also contains non-traditional optimization techniques like Genetic Algorithms and Particle Swarm methods. The contents of this course are also widely used in operations research in systems planning and management.

UNIT - I

Linear Programming (LP)
Introduction through engineering applications, standard form of LP problem (LPP), Geometrical interpretation, simplex method and algorithm, two phases of simplex method, Numerical problems, Revised simples method, Duality in LP, Dual simplex method, sensitivity analysis.

UNIT - II

Applications and extensions of LP
Transportation problem, Assignment problem, Karmarkar’s method, Quadratic programming and Engineering Applications.

UNIT - III

Non-linear Programming – Unconstrained minimization

UNIT - IV

Non-linear Programming – Constrained Minimization

UNIT - V

Dynamic Programming & Non-traditional Optimization
Principle of optimality, computational procedure, applications from engineering. Evolutionary Programming Techniques – Genetic Algorithm (GA), the three parameters of GA, computational procedure for both binary and analogue coded inputs. Introduction to Particle swarm Optimization. Numerical examples.
TEXT BOOKS


REFERENCES

5. “Swarm Intelligence”, Kennedy, J. and Eberhart, R.C., 2001, Morgan Kaufm
### P836 - HEAT TRANSFER LAB

<table>
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Any of the 10 Experiments are required to be conducted

1. Composite Slab Apparatus – Overall heat transfer coefficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzmann Apparatus.
15. Study of Two – Phase flow.
P844 - MECHANICS OF MACHINES LAB

Internal Marks : 25
Lab/Practicals : 3 Period/Week
Credits : 2

External Marks : 75
External Examination : 3 Hrs

------------------------------------------------------------------------------------------------------------------

Any of the 10 Experiments are required to be conducted

LIST OF EXPERIMENTS

1. To determine gyroscopic couple on Motorized Gyroscope
2. To find the coefficient of friction between belt and pulley
3. To determine the endurance strength of specimen using rotating beam machine
4. Determination of transmission efficiency of gear reducers
5. To find the stability and sensitivity of Watt governor
6. To find the stability and sensitivity of Porter governor
7. To find the transverse vibrations of free-free beam
8. Balancing of rotating masses
9. Balancing of reciprocating masses
10. Determination of damping coefficient of single degree of freedom system using spring mass system
11. Determination of critical speed of shaft with concentration loads
12. Determine the moment of inertia of connecting rod by compound pendulum method
13. Determine the moment of inertia of flywheel by oscillation
14. To study various types of cam and follower mechanisms
15. To study inversions of four bar mechanisms, single and double slider crank mechanisms
16. To study various types of gear trains- simple, compound, reverted, epicyclic and differential.
17. To study the working of screw jack and determine its efficiency
VII-SEMESTER
T203 - FINITE ELEMENT METHOD

<table>
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UNIT - I


UNIT - II

Analysis of Beams: Element stiffness matrix for two nodes, two degrees of freedom per node beam element Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions.

UNIT - III

Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements. Two dimensional four noded isoparametric elements and numerical integration-Gauss quadrature

UNIT - IV

One dimensional steady state heat transfer analysis of a fin-Element conductivity matrix-Convection matrix-Heat rate vector. Two dimensional analysis of thin plate with triangular elements-Element conductivity matrix-Convection matrix-Heat rate vector

UNIT - V

Dynamic Analysis: Formulation of finite element model-element matrices-evaluation of eigen values and eigen vectors for a stepped bar and a beam.

TEXT BOOK

Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu / Prentice – Hall

REFERENCES

2. The Finite Element Methods in Engineering / SS Rao / Pergamon
4. Finite Element Analysis/ C.S.Krishna Murthy
T132 - CAD/CAM

Lecture : 4 Periods/week                      Internal Marks : 25
Tutorial :                                    External Marks : 75
Credits :                                     External Examination : 3 Hrs

UNIT - I

Fundamentals of CAD: Introduction – The design process – The application of computers for design- Creating the manufacturing data base – Benefits of CAD.

UNIT - II

Geometric Modeling: Representation of curves: Introduction, wireframe models, wireframe entities, curve representation, parametric representation of analytical curves, parametric representation of Bezier and B-Spline curves
Representation of surfaces: Introduction, surface models surface entities, parametric representation of analytical surfaces- parametric representation of Bezier and B-Spline surfaces
Representation of solids: Introduction, solid models, solid entities, Solid representation, Fundamentals of solid modeling, Boundary representation, CSG representation.

UNIT - III


UNIT - IV


UNIT - V

Computer Aided Quality Control: Introduction – the computers in Q C – Contact Inspection methods – Non contact inspection methods: optical, non optical –Computer Aided Testing-Integration of CAQC with CAD/CAM.
TEXT BOOK


REFERENCES

1. Mikell P. Groover and Emory W. Zimmers, CAD/CAM- prentice Hall of India private LTD. New Delhi
3. P. Radhakrishnan, S. Subramanyan & V. Raju, CAD/CAM/CIM, New Age International Publishers
T251 - METROLOGY

Lecture : 4 Periods/week  Internal Marks : 25
Tutorial : External Marks : 75
Credits : 4  External Examination : 3 Hrs

UNIT - I

Linear Measurement: Standards of measurements- line and end standard. Basic principle and applications of slip gauges, dial indicator and micrometers.
Angular Measurement: Bevel protractor – angle slip gauges – spirit levels – sine bar, rollers and spheres used to determine the tapers
Flat Surface Measurement: Basic principle of straight edges and surface plates.

UNIT - II

Optical Measuring Instruments: Tool maker’s microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer.
Comparators: Basic principle and applications of – mechanical, electrical, electronic and pneumatic comparators.

UNIT - III

Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system
Limit Gauges: Taylor’s principle – Design of go and No go gauges, plug, ring, snap, profile and position gauges

UNIT - IV

Screw Thread Measurement: Screw thread terminology, errors in screw threads – measurement of various elements of screw threads-Major diameter, minor diameter, effective diameter, pitch, flank angle and thread form.

UNIT - V

Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools..
Coordinate Measuring Machines: Basic principle, types and applications of CMM.

TEXT BOOK


REFERENCES

1. Engineering Metrology / I C Gupta./ Danpath Rai
T297 - REFRIGERATION AND AIR CONDITIONING

Lecture : 4 Periods/week  Internal Marks : 25
Tutorial : 1 Periods/week  External Marks : 75
Credits : 4  External Examination : 3 Hrs

UNIT - I
Refrigerants: Classification of refrigerants- Desirable properties-Nomenclature-Commonly used refrigerants- Alternate refrigerants.
Air Refrigeration System: Introduction-Air refrigeration system working on Reversed Carnot cycle – Air refrigeration system working on Bell Coleman cycle- COP- Open and Dense air systems.

UNIT - II
Vapour Compression Refrigeration System: Working principle-Simple vapour compression refrigeration cycle – COP- Representation of cycle on T-s and P-h charts- Effect of Sub cooling and Superheating --Actual Vapor compression cycle

UNIT - III
Vapour Absorption Refrigeration System: Description and working of Aqua-Ammonia system- Calculation of maximum COP- Lithium Bromide- Water system-Principle of operation of Three fluid absorption system.

UNIT - IV
Psychrometry: Introduction - Psychrometric properties and relations- Psychrometric chart Psychrometric processes-Sensible, Latent and Total heat–Sensible Heat Factor and Bypass Factor.
Human Comfort: Thermodynamics of Human body-Effective temperature – Comfort chart.

UNIT - V
Air Conditioning Systems: Introduction-Components of Air conditioning system- Classification of Air conditioning systems-Central and Unitary systems- Summer, Winter and Year round systems- Cooling load estimation.
Design of Air Condition Systems: Summer air conditioning –ADP-System with Ventilated and re-circulated air with and without bypass factor- RSHF, GSHF and ESHF.


TEXT BOOK
Refrigeration and air conditioning - C. P. Arora. - TMH

REFERENCES
1. A course in refrigeration and air conditioning - S. C. Arora, Domkundwar.- Dhanapat Rai
2. Refrigeration and Air conditioning - Manohar Prasad - TMH
UNIT - I

**Basic Concepts**: Introduction, Fundamental Methods of Measurement, Basic Elements of Measurement system, Performance Terms, Basic Concepts in Dynamic Measurements  

**Analysis of Experimental Data**: Causes and Types of Experimental Errors, Uncertainty Analysis, Method of Least Squares, Graphical Analysis and Curve Fitting

UNIT - II


**Measurement of Displacement**: Introduction, Classification, Dimensional Measurement, Gage Blocks, Optical Methods, Pneumatic Gage,  

**Measurement of Force and Torque**: Introduction, Elastic Transducer, Strain Gage Load Cells, Dynamometers- Mechanical, Hydraulic, Electrical

UNIT - III

**Measurement of Pressure**: Introduction, Barometers, Manometers, Dial type pressure gauge, Pressure Transducers, Pitot, Static, and Pitot-Static Tube and its characteristics, Low Pressure Measurement Gauges  

**Measurement of Fluid Flow**: Introduction, Rotameter, Turbine flow meter, Laser Doppler Anemometer, Hot-wire Anemometer, Flow Visualization Methods

UNIT - IV

**Measurement of Temperature**: Introduction, Types of thermometers, Thermocouples, RTD, Thermisters, Pyrometers  

**Measurement of Humidity**: Introduction, Sling psychrometer, Absorption psychrometer, Dew point meter.

UNIT - V

**Measurement of Speed**: Mechanical Tachometers – Electrical tachometers – Stroboscope, Noncontact type of tachometer  

**Measurement of Motion and Vibration**: Introduction, Elementary Vibrometers, Elementary Accelerometer, Principles of Seismic instruments, Sound Measurement

TEXT BOOK

Mechanical Measurements, BeckWith, Marangoni, Linehard, Person Education Asia

REFERENCES

1. Experimental Methods for Engineers, J.P. Holman, McGraw Hill  
# T324 - THEORY OF ELASTICITY

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Internal Marks</th>
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<td>Credits</td>
<td>External Examination</td>
<td>3 Hrs</td>
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</table>

## UNIT - I

**Elasticity:** Two dimensional stress analysis - Plane stress - Plane strain - Equations of compatibility - Stress function - Boundary conditions.

**Problem in rectangular coordinates:** Solution by polynomials - Saint Venent's principles - Determination of displacement - Simple beam problems.

## UNIT - II

**Problems in polar coordinates:** General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

## UNIT - III

**Analysis of stress and strain in three dimensions:** Principle stresses – Homogeneous deformations - Strain spherical and deviatoric stress - Hydrostatic strain.

## UNIT - IV

**General theorems:** Differential equations of equilibrium and compatibility - Displacement - Uniqueness of solution - Reciprocal theorem.

## UNIT - V

**Bending of prismatic bars:** Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.

### TEXT BOOK

Timeshenko & Goodier, Theory of Elasticity - McGraw Hill

### REFERENCES

1. Applied stress analysis by Dr. Sadhu Singh, Khanna Publishers
2. Theory of Elasticity by A.I.Lurie, Springer
3. Experimental stress analysis by Dally and Riley, Mc Graw-Hill
5. Theory of Elasticity by A.Meceri, Springer
UNIT - I

Introduction: Components of Four Wheeler Automobile-The Basic Structure-Power Unit-
Power Transmission - Rear Wheel Drive- Front Wheel Drive- Four Wheel Drive-Types of
Automobiles.

Engine: Basic Terminology- Types- firing order- Engine Construction Details-Engine
Service- Reboring.

UNIT - II

and Electrical pumps –Fuel Filters- Functions of Carburettor-Simple Carburettor-Defects in
Simple Carburttor-Types of Modern Carburettors- Zenith Type-S.U.Type-Petrol Injection-
Multi Point Fuel Injection System.

Fuel Supply Systems in Diesel Engines: Requirements of Diesel Injection System-Types
of Injection Systems-Fuel Feed Pump-Fuel Injection Pump-Fuel Injector-Types of Nozzles-
Air Cleaners.

UNIT - III

Engine Cooling Systems: Need- Air cooling - water cooling-Thermo-syphon - forced
circulation- Radiator- Thermostat- Pressure Sealed Cooling- Antifreeze solutions.

Engines Lubricating Systems: Necessity –Types- Petroil- Splash – Pressure lubrication
systems- Oil Pumps- Crankcase ventilation.

Ignition System: Functions-Battery Ignition system-Magneto coil Ignition System- Electronic
Ignition.

UNIT - IV

Electrical System: Starting System-Bendix Drive Mechanism-Soleniod Switch- lighting
System-Horn-Wiper.

Transmission: Clutches-Priniciple-Types-Cone Type- Single-plate and Multi-plate clutches-
Centrifugal clutches-Gear Boxes-Types-Sliding Mesh-Constant Mesh- synchronemesh type
automatic transmission-overdrive- propeller shaft- Hotch Kiss Drive-Differential

UNIT - V

Steering System: Steering Geometry-Camber-Castor-King Pin Rake- Combined Angle-
Toe-In- Center Point Steering-Steering Gears-Types-Power Steering, Wheel Alignment

Suspension Systems: Need for Suspension systems- Torsion bar-shock absorbers-Air
Suspension.


TEXT BOOKS


REFERENCES

T249 - MECHATRONICS

Lecture : 4 Periods/week Internal Marks : 25
Tutorial : External Marks : 75
Credits : 3 External Examination : 3 Hrs

UNIT - I

Introduction : Definition – Trends - Control Methods: Standalone , PC Based ( Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

UNIT - II


UNIT - III

Electronic Interface Subsystems : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC’s - Protection schemes – circuit breakers, over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets
Electromechanical Drives : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM’s - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

UNIT - IV


UNIT - V

TEXT BOOKS

2. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

REFERENCES

UNIT - I

Introduction: Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies

Manufacturing Operations: Manufacturing Operations, Product/Production Relationship, Production concepts and Mathematical Models & Costs of Manufacturing Operations

UNIT - II

Automated Flow Lines: Methods of work part transport transfer, Mechanical buffer storage, control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines

UNIT - III

Automated Manufacturing Systems: Components of a Manufacturing systems, Classification of Manufacturing Systems, overview of Classification Scheme, Single Station Manned Workstations and Single Station Automated Cells.

UNIT - IV

Automated Material Handling: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems, Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT - V

Adaptive Control Systems: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations. Use of various parameters such as cutting force, Temperatures, vibration and acoustic emission.

TEXT BOOK

Automation, Production systems and computer Integrated Manufacturing : M.P. Groover/PE/ PHI

REFERENCES

2. CAD/ CAM / CIM by Radhakrishnan.
3. Automation by W.Buekinsham.
OBJECTIVE

In this course it is aimed to introduce to the students the principles and applications of control systems in everyday life. The basic concepts of the block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

UNIT - I

Control system modeling

UNIT - II

Time domain analysis

UNIT - III

Frequency domain analysis

UNIT - IV

Compensators
Realization of basic compensators – cascade compensation in time domain and frequency domain and feedback compensation – design of lag, lead, lag-lead compensator using Bode plot and Root locus. Introduction to P, PI and PID controllers.

UNIT - V

State variable analysis
State variable methods - introduction to the state variable concept - state space models - physical variable - phase variable and diagonal forms from time domain - diagonalisation - solution of state equations - homogenous and non homogenous cases- properties of state transition matrix - relation between transfer function and state space models , Controllability and Observability.
TEXT BOOKS


REFERENCES

Any of the 10 Experiments are required to be conducted

1. Assemble Modeling (At least three examples))
2. Determination of deflection and stresses in 2D and 3D trusses and beams.
3. Determination of deflection and stresses in plane stress, plane strain and Axisymmetric components.
4. Determination of stresses in 3D structures.
5. Determination of stresses in shell structures
8. Steady state heat transfer Analysis of plane and Axisymmetric components,
9. Study of various post processors used in NC Machines.

PACKAGES

ANSYS/NASTRAN/CATIA/ProE etc.

REFERENCES

Lab Manuals
Any of the 10 Experiments are required to be conducted

**METROLOGY**

1. Measurement of lengths, heights, diameters by vernier calipers and micrometers.
3. Taper measurement by using balls and rollers.
4. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
5. Machine tool alignment of test on the lathe.
7. Tool makers microscope and its application
8. Angle and taper measurements by Bevel protractor, Sine bars, etc.
9. Use of spirit level in finding the flatness of surface plate.
10. Thread measurement by Three wire method or Tool makers microscope.
11. Surface roughness measurement by Taly Surf.

**INSTRUMENTATION**

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotometer for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of McLeod gauge for low pressure.
VIII-SEMESTER
UNIT - I

Introduction: Basic concepts – Robot anatomy –Components of robots- Robot motions –
Number of D.O.F – Work volume – Robot drive systems – Classification of robots by control
method – Specifications of robots.
End Effectors: Introduction – Types of end effectors – Mechanical grippers – Vacuum cups,
magnetic grippers, adhesive grippers and others – Robot / End effectors interface –
Considerations in gripper selection and design

UNIT - II

Manipulator Kinematics: Introduction – The direct kinematics problem: Rotation matrices,
composite rotation matrix about on arbitrary axis , rotation matrix with euler angle
representation – Geometric interpretation of rotation matrices, homogeneous coordinates
and transformation matrix, geometric interpretation of homogeneous transformation
matrices, composite H.T matrix ,Problems- D-H representation – problems on forward
kinematics problems on forward kinematics.

UNIT - III

Manipulator jacobian – problems – Dynamics: Introduction , Lagrange Euler formulation ,
Problems

UNIT - IV

Trajectory Planning: Introduction – considerations on trajectory planning – joint
Interpolated trajectory – Cartesian path trajectory – problems
Robot Programming :- Methods of robot programming – Lead through method.-Textual
robot languages – Generations of programming languages – Robot language structure –
Motion commands – End effector and sensor commands – VAL II programming language.

UNIT - V

Sensors: Position sensors: Potentiometers, resolvers, encoders – velocity sensors
Robot Application in Manufacturing: Material transfer and machine loading/ unloading
applications – Processing operations – Assembly and inspection – Future applications.

TEXT BOOK

Mikell P.Groover, MITCHELL WEISS, ROGER N. Nagel& NICHOLAS G. Odrey; Industrial

REFERENCES

1. R.K.Mittal and IJ Nagrath, robotics and control ,Tata Mc Graw – Hill publishing
   company Limited, New Delhi.
2. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning private
   limited, New Delhi
3. Saeed B.Niku, Introduction to robotics analysis systems Application, PHI learning
   private limited, New Delhi
4. K.S.Fu, R.C Gonzalez and C.S.G.Lee, Robotics control, Sensing, vision, and
   intelligence; Mc Graw HILL International Editions
UNIT - I

Shear center and Unsymmetrical bending: Bending axis and shear center – shear center for axi-symmetric and unsymmetrical sections – Bending stresses in beams subjected to nonsymmetrical bending – Deflection of straight beams due to nonsymmetrical bending.

UNIT - II

Continuous beams: Clapeyron’s theorem of three moments – Beams with constant and varying moment of inertia.

UNIT - III

Torsion: St.Venant’s approach - Prandtl approach – Membrane analogy – Torsion of thin walled open and closed sections.

UNIT - IV

Columns: Buckling and stability – Columns with pinned ends – Columns with other support conditions -Limitations of Euler’s formula – Rankine’s formula – Columns with eccentric axial loads – Secant formula.

UNIT - V

Thin walled pressure vessels: Circumferential and longitudinal stresses – Riveted cylindrical boilers –Wire bound thin pipes – Cylinder with hemispherical ends.
Contact stresses: Methods of computing stress – Deflection of bodies in point and line contact applications.

TEXT BOOK


REFERENCES

1. Strength of Materials/ Dr. Sadhu Singh / Khanna Publishers
UNIT - I

Introduction: Energy sources and availability, new energy techniques, Renewable energy sources


UNIT - II

Solar Energy Collecting Devices:
Solar energy collectors, Concentrated and flat plate, Energy balance and collector efficiency, Solar energy storage, Application to space heating, distillation, Solar heating- air heating system- solar water heating system- forced and natural circulation systems- solar pond – solar stills- solar dryers- commercial and solar heating/cooling systems-solar refrigeration system- cooking and green house effect.

UNIT - III


UNIT - IV

Energy from ocean: Ocean thermal electric conversion, energy from tides, small scale hydroelectric development- Ocean Energy-principles utilization – OTEC – thermodynamic cycles (Open & Closed Cycle OTEC) - tidal and wave energy

Geothermal Energy: Sources, hydrothermal sources, hot dry rock resources, geothermal fossil system, prime movers for geothermal energy- Geothermal Energy – resources – types of wells – methods of harnessing the energy – potential in India

UNIT - V

Direct Energy Conversion Systems:
TEXT BOOK

G.D. Rai, Non Conventional energy Sources, Khanna Publishers

REFERENCES

1. Power plant Engineering by P.K. Nag
2. Renewable energy sources Tiwari and Ghosal/Narosa
5. Renewab energy source and emerging technologies, kothari, PHI
T139 - COGNITIVE ENGINEERING

<table>
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<td>Credits</td>
<td>External Examination</td>
<td>3</td>
<td>3 Hrs</td>
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UNIT - I


UNIT - II

Three Stage memory model, Sensory memory: the sperling experiment, short-term memory: Jacob’s experiment, Chucks, Long term memory; Ebbing Hans Forgetting Curve; Tulvings long term memory model, memory retrieval.

UNIT - III

The seven stages of action, Gulf of Execution and Gulf of Evaluation, Basic design principles, Visibility, A good conceptual model, good mapping, feed back.

UNIT - IV

Physical constraints, semantic constraints, cultural constraints, logical constraints affordances, Natural Mapping, The problem with switches, grouping problem, mapping problem, Visibility and feedback, the structure of tasks, simplifying the structure of tasks.

UNIT - V

User- Centred design: Use of both knowledge in the world and the head; simplifying the structure of tasks, make things visible, bridge the gulf of execution and the gulf of evaluation, get the mapping right, exploit the power of constraints, Design for errors, Case studies of Cognitive Engineering.

TEXT BOOKS

T208 - GAS DYNAMICS

Lecture : 4 Periods/week  Internal Marks : 25
Tutorial :                  External Marks : 75
Credits :  3             External Examination : 3 Hrs

UNIT - I


UNIT - II

Steady One-dimensional Flow: Introduction, Fundamental Equations, Discharge from a reservoir, Critical values, Streamtube area-velocity relation, Types of nozzles, Applications of nozzles, Area Mach number relation, Isentropic flow through nozzles, Diffusers

UNIT - III


UNIT - IV

Prandtle Mayer Flow: Introduction, Thermodynamics considerations, Prandtle Mayer Expansion Fan, Reflections (3)
Flow with Friction and Heat Transfer: Introduction, Flow in constant Area Duct with friction, Adiabatic Constant area flow of a perfect gas, Fanno line Flow, Flow with heating and cooling in ducts, Rayleigh line relation

UNIT - V

Measurements in Compressible Flow: Pressure measurements, Static pressure and Dynamics head measurement in compressible flow, Compressibility correction to dynamics pressure, Pressure coefficient, Temperature measurements, Supersonic flow visualization techniques.

TEXT BOOK


REFERENCES

UNIT - I

Overview of MEMS
MEMS and Microsystems definitions and examples, Difference between Microsystems and Microelectronics, Benefits of miniaturization, Applications: Industrial/automotives sensors, Medical systems, aircraft sensors, Structural health monitoring, Telecommunication etc, Materials for MEMS.

UNIT - II

SCALING LAWS IN MINIATURIZATION
Introduction to Scaling, Scaling in Geometry, Scaling in Electrostatic forces. MEMS Design Considerations.

UNIT - III

MICRO FABRICATION - I
Introduction, Photolithography, Photoresists and Application, Light Sources, Photoresist Removal, Ion Implantation, Diffusion, Oxidation, Chemical Vapor Deposition (CVD), Sputtering, Deposition by Epitaxy, Etching.

UNIT - IV

MICRO FABRICATION - II
Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison.
Surface Micromachining: Process, associated Mechanical problems (Adhesion, Interfacial stresses, Stiction), LIGA process, MEMS Packaging.

UNIT - V

MEMS DEVICES AND STRUCTURES
Microsensors: Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors.
Microactuation: Actuation using thermal forces, Piezoelectric crystals, Electrostatic forces, MEMS with microactuators: Microgrippers, Micromotors, Microgears, Micropumps.

TEXT BOOK
Tai-Ran Hsu, MEMS & Microsystems Design and Manufacture, Tata McGraw Hill.

REFERENCES
1. Fundamentals of Micro Fabrication, Marc Madou, CRC Press
2. The MEMS Handbook, Mohamed Gad-el-Hak, CRC Press
3. Micro and Smart Systems, G.K.Anantha Suresh, Wiley India
T230 - INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

Lecture : 4 Periods/week                     Internal Marks : 25
Tutorial :                                  External Marks : 75
Credits : 3                                  External Examination : 3 Hrs

UNIT - I

**Introduction**: Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics

**Governing Equations of Fluid Dynamics**: Introduction, Control Volume, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation

UNIT - II


UNIT - III

**Basics Aspects of Discretization**: Introduction, Introduction of Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation

UNIT - IV

**Incompressible Fluid Flow**: Introduction, Implicit Crank-Nicholson Technique, Pressure Correction Method, Computation of Boundary Layer Flow

UNIT - V


TEXT BOOK


REFERENCES

UNIT - I

**Stress:** Stress at a point - Stress equations of Equilibrium - Laws of stress transformation - Principal stresses – Maximum Shear stress - Dimensional state of stress.

UNIT - II

**Strain Measurement:** Strain - its relation to experimental determination - properties of strain Gauge systems - Electrical resistance strain gauges - strain gauge circuits - recording instruments - analysis of strain gauge data.

UNIT - III

**Moire Methods:** Mechanism of formation of Moire fringe - geometrical approach to Moire fringe analysis - displacement field approach to Moire fringe analysis - out of plane measurements experimental procedure.

UNIT - IV

**Photo Elasticity Methods:** Temporary double refraction - stress optic law - effects of stressed model in a plane polariscope fringe multiplication - isochromatic fringe patterns - isoclinic fringe pattern compensation techniques – calibration methods - separation methods - scaling model to phototype stresses - materials.

UNIT - V

**Birefringent Coatings:** Coating stresses and strains - sensitivity - materials and applications - effect of thickness - stress separation.

**TEXT BOOK**

Experimental Stress Analysis, James Dalley, W.F.Riley, McGraw Hill

**REFERENCES**

1. Experimental Stress Analysis, Dove Adams, McGraw Hill
2. Strain Gauge Primer, Perry and Lissiener, McGraw Hill
3. Photomechanics, Durelli, Prentice Hall
UNIT - I

Introduction: Definition – Objectives of Production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

UNIT - II

Forecasting – Objectives and Importance of forecasting – Types of forecasting, forecasting techniques—simple moving average method, weighted moving average method, exponential smoothing method, linear regression and Delphi method. Errors in forecasting—MAD, MSE, MAPE, MFE.

UNIT - III

Inventory management – purpose of inventories – relevant inventory costs, EOQ model and assumptions in EOQ. ABC analysis – VED analysis. Inventory control systems – P–Systems and Q-Systems. Introduction to MRP, inputs to MRP, Bill of material, JIT inventory-Kanban system.

UNIT - IV


UNIT - V


TEXT BOOK

Operations Management / Joseph Monks.

REFERENCES

1. Elements of Production Planning and Control / Samuel Eilon.
3. Modern Production/ operation managements / Baffa & Rakesh Sarin
UNIT I


UNIT II


UNIT III


UNIT IV

Two Dimensional Viewing: The viewing Pipeline-Viewing Coordinate Reference Frame- Window-to-Viewport Coordinate Transformation-Two Dimensional Viewing Functions- Clipping Operations-Point Clipping-Line Clipping-Polygon Clipping.

UNIT V


TEXT BOOK


REFERENCES

1. David F. Rogers; “Procedural Elements for Computer Graphics”; TMH
UNIT - I


UNIT - II


UNIT - III


UNIT - IV

Synthesis of Nano Materials Top Down (Nanolithography CVD)- Bottom Up (Sol-get Processing, Chemical Synthesis) – Wet Deposition Techniques- Molecular design and modeling

UNIT - V


TEXT BOOKS

2. Nano Structured Materials and Nano Technology-Hari Singh Nalwa

REFERENCES

Nano Essentials – T.Pradeep /TMH