AcAIV-63

# B.TECH. DEGREE COURSE

## SCHEME AND SYLLABI

(2002-03 ADMISSION ONWARDS)

M G UNIVERSITY
KOTTAYAM

MAHATMA GANDHI UNIVERSITY
KOTTAYAM
KERALA

# B.TECH. DEGREE COURSE

## SCHEME AND SYLLABI

## (2002-03 ADMISSION ONWARDS)

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**KOTTAYAM**
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# REGULATIONS

*(Effective from 2002-03 admission onwards)*

## 1. Conditions for admission

Candidates for admission to the B.Tech. Degree course shall be required to have passed the higher secondary/+2/XII Std. examination conducted by boards/departments recognized/accepted by the University, obtaining not less than 50% marks in Mathematics and not less than 50% marks in Mathematics, Physics and Chemistry put together or the diploma examination in Engineering, Kerala or any examination accepted by the Government of Kerala as equivalent there to with 50% marks in the final qualifying examination, subject to the usual concession allowed for backward and other communities as specified from time to time.

## 2. Duration of the course

a) The course for the B.Tech. Degree shall extend over a period of four academic years comprising of 8 semesters. The first and second semester combined and each semester from third semester onwards shall cover the groups of subjects as given in the scheme of studies and examinations.

b) Each semester shall normally comprise of 16 weeks.

c) The course calendar will be as follows.

| Semesters | Commencement | Closing | Examination |
|---|---|---|---|
| I & II Semesters | After the admissions are over. | 31st of March | 15th April |
| IV, VI and VIII Semesters | December 1st | 31st of March | 15th April |
| III, V and VII Semesters | First working day of June | 30th of September | 15th October |

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## 3. Eligibility for the Degree

Candidates for admission to the Degree of B.Tech. shall be required to have undergone the prescribed course of study in an institution maintained or affiliated to Mahatma Gandhi University for a period of not less than four academic years and to have passed all examinations specified in the scheme. The first academic year of study shall be from the date of commencement of admission till the closure of the academic year. The remaining 6 semester will have to be completed within 3 subsequent academic years.

## 4. Subjects of Study

The subjects of study shall be in accordance with the scheme and syllabi given in the Annexure.

## 5. Electives

All students shall choose electives in VII and VIII semesters, from a prescribed set of elective subjects offered by the institution, as indicated in the scheme. There should be at least 20% students of the class for an elective subject to be offered. New electives may be introduced according to the needs of emerging fields in technology. The name of the elective and its syllabus should be approved by the university before the course is offered.

## 6. Sessional work

Sessional marks for Theory, Drawing, Workshops, Laboratories and Practical will be awarded by the teaching faculty based on the day to day performance of the students. The allocation of sessional marks for the individual subjects shall be on the following basis.

| Theory Subjects | | Practical Subjects | |
|---|---|---|---|
| Attendance | 20% | Attendance | 20% |
| Assignments | 20% | Regular class work/Drawing/Workshop Record/Lab Record and Class Performance | 60% |
| Tests | 60% | Tests | 20% |

The sessional marks allotted for attendance shall be awarded in direct proportion to the percentage of attendance secured by the candidate in the subject. However full sessional marks for attendance shall be awarded to those who are securing 80% attendance and above.

## 7. Examination

There shall be University Examinations at the end of the first academic year and at the end of every semester from third semester onwards in subjects as prescribed in the scheme of examination.

## 8. Eligibility for appearing examination is subject to the following

a) The student should have successfully completed the course work for the year/semester.

b) The student should have not less than 75% attendance for the particular year in the case of I & II semesters combined or the particular semester in the case of higher semesters.

However, he is eligible for condonation of attendance (once in case of I & II semesters combined or twice in the case of higher semesters) subject to the conditions given below in the entire course.

i) His conduct must be satisfactory.
ii) The shortage shall not be more than 10% of actual working days.
iii) Condonation is given only on medical grounds.
iv) The condonation shall be granted subject to rules and procedures prescribed by the University from time to time.
v) It is open to the Vice Chancellor to grant condonation of shortage of attendance on the recommendation of Principal.

## 9. Repetition of the course work

a) A student who is not eligible for condonation of shortage of attendance shall repeat the course in full including the sessional work in the next immediate chance. The sessional marks earned during repetition of course alone will be counted in such case.

b) A student can repeat the course only once in each semester/year.

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c) A student can also repeat the course work for improving sessional marks subject to the following conditions.
   i) He shall repeat the course work in full (including sessionals) in a particular semester/year once and that too at the earliest available opportunity.
   ii) He shall not combine his course work with regular course work of any other semester.
   iii) A candidate who has satisfactorily completed the VIII semester course will not be allowed to repeat the course work in any semester.
   iv) He shall not be allowed to repeat the course work of any semester if he has already passed that semester examination in full.
   v) A candidate who has been registered for the higher semester examination will not be allowed to repeat the course work, in lower semester.
   vi) The sessional marks obtained during the repeated course only shall be considered for all purposes.

d) For repeating the course in any of the above cases the character and conduct of the student must be satisfactory as certified by the Head of the Institution.

**10. Conduct of Examination**

To conduct all the theory examinations, a Chief Superintendent and an Assistant Chief Superintendent should be appointed by the Principal. An external Chief Superintendent should also be appointed by the University as an Observer for conducting all theory examinations in Self-financing Engineering Colleges.

The examination in theory papers will be conducted in accordance with the following schedule as far as possible.

| | | Fore Noon | After Noon |
|---|---|---|---|
| Tues. | day 1 | 1 & 2, 6 | 4, 8 |
| Wed. | day 2 | 5 | 3, 7 |
| Thurs. | day 3 | 1 & 2, 6 | 4, 8 |
| Fri. | day 4 | 5 | 3, 7 |
| Mon. | day 5 | 1 & 2, 6 | 4, 8 |
| Tues. | day 6 | 5 | 3, 7 |
| Wed. | day 7 | 1 & 2, 6 | 4, 8 |
| Thurs. | day 8 | 5 | 3, 7 |
| Fri. | day 9 | 1 & 2, 6 | 4, 8 |
| Mon. | day 10 | 1 & 2, 6 | 4, 8 |
| Tues. | day 11 | 5 | 3, 7 |
| Wed. | day 12 | 1 & 2 | |
| Thurs. | day 13 | 5 | 3, 7 |
| Fri. | day 14 | 1 & 2 | |
| Mon. | day 15 | 1 & 2 | |

(Main and supplementary examinations will alternate)

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*Conduct of Practical Examinations*

The Principals of the concerned Engineering Colleges with the help of the Chairmen of all branches will conduct the practical examination for all semesters with the approval from the University and bonafide laboratory record, workshop record/project record, seminar report are mandatory for appearing practical/viva voce university examinations.

To conduct each practical examination, an External Examiner and an Internal Examiner should be appointed by the University. In Self-financing Engineering Colleges, no practical examination should be conducted without the presence of an External Examiner appointed by the University.

**11. Minimum for a pass**

A candidate shall be declared to have passed in any individual subject of a semester/year examination if he secures not less than 40% marks for the subject in University examination and not less than 50% of the total marks for the subject, i.e., University examination marks and sessional marks in that subject put together. A candidate who passes in all the subjects of a semester examination shall be declared to have passed the examination in full.

**12. Improvement of marks**

A candidate shall be allowed to re-appear for any theory examination in order to improve the marks already obtained subject to the following conditions.

a) The candidate shall be permitted to take the improvement examination only during the chance immediately after the first appearance.
b) The candidate shall not be allowed to appear for an improvement examination for the subject of the VIII semester.
c) The improved marks (better of the two) obtained by the candidate for each subject he has appeared for shall be counted for all purposes.
d) A candidate can apply for improvement in three subjects in combined SI&II provided he/she has passed all the theory subjects.
e) A candidate can apply improvement in two subjects in combined SI&II if he/she has only one supplementary theory examination.
f) A candidate can improve one subject in combined SI&II if he/she has only two supplementary theory examinations.
g) Those candidates who have to write supplementary examination in three or more theory papers in combined SI&II will not be eligible for improvement of any paper.
h) For higher semesters (SIII to SVII) (i) a candidate can apply for improvement in two subjects if he/she has passed all theory subjects (ii) a candidate can apply for improvement in one subjects if he/she has passed five theory subjects (iii) a candidate shall not be eligible for improvement of any paper if he/she has failed for two or more theory subjects.
i) No candidate shall be permitted to improve the marks for practical examination.
j) A candidate shall be allowed to withdraw from the whole examination of a semester in accordance with the rules for cancellation of examinations, of the University.

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## 13. Promotion to Higher semesters

A student is eligible to be promoted to the higher semesters subject to the following conditions.

i) He should have successfully completed the lower semester.
ii) He should have obtained 75% attendance in the lower semester or obtained condonation as per University rules.
iii) A student shall be permitted to register for any semester examination only if he had registered for the previous semester examination.
iv) A student can be permitted to register for the V semester University examination only if he has passed fully the combined I & II semester examination.
v) A student can be permitted to register for the VII semester examination only if he has passed fully the III and IV semester examination.

## 14. Completion of the course

The degree will be awarded to the candidate only if he successfully completes the course work and has passed all the examinations within a period of 8 years from the time of admission.

## 15. Classification of Successful candidates

a) A candidate who qualifies for the Degree passing all the semester examinations within five academic years (10 consecutive semesters) after commencement of his course of study and has secured not less than 75% of the aggregate of the total marks in all the 8 semesters shall be declared to have passes B.Tech. Examination in First Class with Distinction.
b) A candidate who qualifies for the Degree passing all the semester examinations within five academic years (10 consecutive semesters) after the commencement of the course of study and has secured not less than 60% of the aggregate of the total marks in all the 8 semesters shall be declared to have passes B.Tech. Examination in First Class.
c) All other successful candidates shall be declared to have passed B.Tech. Degree Examination in Second Class.
d) Successful candidates who complete the examination in four academic years (8 consecutive semesters and chances) after the commencement of the course of study shall be ranked branch-wise on the basis of the aggregate of the total marks for all the eight semesters.

## 16. Industrial visit

It is desirable to conduct Industry/Establishment/Site visits of one day duration as suggested by the department in 3rd to 8th semesters. Such visits should be limited to 15 numbers during the course and these days will be counted for attendance.

## 17. Co-curricular Activities and Extra Murals

*a) 'Students' Counselling*

Students counselling must be undertaken either during Saturdays or after regular working hours or on other holidays depending upon the convenience of students and faculty members. A team of 3 faculty members including group tutor of the class is expected to conduct regular counselling for duration

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of 5 hours/week in order to help the students in their curricular and personal problems.

b) *Industrial/Field Training & Literature Overview*

In order to promote Industry-Institute Interaction and to impart hands-on experience in the field work/literature overview, 3 hours/week must be set apart for each class in addition to regular working hours under the supervision of the faculty members.

c) *Seminar, Symposium, Group Discussions etc.*

Orientation lectures, Seminars etc. will be presented by the faculty and experts from Industries or other Educational institutions. Also there will be Seminars, Debates and Group Discussions presented by the students to develop their communication skill. 3 hours/week from 4 P.M. to 5 P.M. is to be apart for this, which is to be, supervised by the faculty members.

d) *Project work*

For the students in final semester, in addition to 4 hours allotted to regular project work, 5 hours/week must also be added on during Saturdays or other holidays in order to improve the quality of the projects undertaken. A candidate will not be permitted to appear for the project work/viva voce examinations unless, he/she submits the project report within the prescribed date (March 15th).

**18. Question Papers**

Question papers for Mathematics of all semesters and Engineering Graphics of I & II semesters combined shall contain two questions from each module of the relevant syllabus, one of which will have to be answered. All other theory papers will normally have the question papers in the following pattern.

Part A Short answer questions covering the whole syllabus with maximum 40% marks for this part. All questions are compulsory.

Part B Two questions from each module of the syllabus out of which one is to be answered. Maximum marks for this part is 60%.

**19. Revision of Regulations**

The University may from time to time revise, amend or change the Regulations, scheme of studies, and examination and syllabi. The changes, unless specified otherwise, will have effect from the beginning of the academic year/semester following the Notification from the UNIVERSITY.

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## Scheme – I & II Semesters Combined

Scheme – I & II (Common to all branches)

| Course Code | Course No. | Subject | Teaching Period | | | Duration of Uty. Exam (hrs) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect. | Tut. | Prac. | | Session al | The ory | Pract ical | Total |
| | CME LRPTA | | | | | | | | | |
| A | 101 | Engineering Mathematics I | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | 102 | Engineering Physics | 1 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | 103 | Engineering Chemistry | 1 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | 104 | Engineering Mechanics | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| E | 105 | Engineering Graphics | 1 | - | 3 | 3 | 50 | 100 | - | 150 |
| F | 106 | Basic Civil Engineering | 1 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | 107 | Basic Mechanical Engineering | 1 | 1 | - | 3 | 50 | 100 | - | 150 |
| H | 108 | Basic Electrical Engineering | 1 | 1 | - | 3 | 50 | 100 | - | 150 |
| I | 109 | Basic Electronics Engineering | 1 | 1 | - | 3 | 50 | 100 | - | 150 |
| J | 110 | Workshop | - | - | 6* | - | 50x3 | - | - | 150 |
| | | Total | 12 | 9 | 9 | - | 600 | 900 | - | 1500 |

*3 periods will be in Mechanical Engineering Workshop and 3 periods in Civil Engineering Workshop & Electrical Engineering Workshop alternately.

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# CIVIL ENGINEERING

## 3RD SEMESTER

| Course Code | Subject Code | Subject | Duration of Uty. Exam (hrs.) | No. of periods per week (hrs) | | | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lect. | Tut. | Prac. | Sessional | Theory | Practical | Total |
| A | CMELPA301 | Engineering Mathematics -II | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| B | C302 | Fluid Mechanics – I | 3 | 3 | 2 | - | 50 | 100 | - | 150 |
| C | C303 | Mechanics of Solids | 3 | 2 | 2 | - | 50 | 100 | - | 150 |
| D | C304 | Construction Engineering and Management | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| E | C305 | Surveying -I | 3 | 3 | 1 | | 50 | 100 | - | 150 |
| F | C306 | Civil Engineering Drawing - I | 3 | - | - | 3 | 50 | 100 | - | 150 |
| G | C307 | Material Testing Laboratory – I | 3 | - | - | 3 | 50 | - | 100 | 150 |
| H | C308 | Surveying practical – I | 3 | - | - | 3 | 50 | - | 100 | 150 |
| | | Total | 24 | 14 | 7 | 9 | 400 | 600 | 200 | 1200 |

## 4TH SEMESTER

| Course Code | Subject Code | Subject | Duration of Uty. Exam (hrs.) | No. of periods per week (hrs) | | | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lect. | Tut. | Prac. | Sessional | Theory | Practical | Total |
| A | CMELRPTA401 | Engineering Mathematics -III | 3 | 3 | 1 | - | 50 | 100 | | 150 |
| B | C402 | Fluid Mechanics – II | 3 | 2 | 2 | - | 50 | 100 | | 150 |
| C | C403 | Structural Analysis - I | 3 | 2 | 2 | - | 50 | 100 | | 150 |
| D | C404 | Engg. Economics and Construction Management | 3 | 2 | 2 | - | 50 | 100 | | 150 |
| E | C405 | Surveying – II | 3 | 3 | 2 | - | 50 | 100 | | 150 |
| F | C406 | Civil Engineering Drawing –II | 3 | - | - | 3 | 50 | 100 | | 150 |
| G | C407 | Hydraulics Laboratory | 3 | - | - | 3 | 50 | | 100 | 150 |
| H | C408 | Surveying Practical -II | 3 | - | - | 3 | 50 | | 100 | 150 |
| | | Total | 24 | 12 | 9 | 9 | 400 | 600 | 200 | 1200 |

## 5TH SEMESTER

| Course Code | Subject Code | Subject | Duration of Uty. Exam (hrs.) | No. of periods per week (hrs) | | | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lect. | Tut. | Prac. | Sessional | Theory | Practical | Total |
| A | CMELPA501 | Engineering Mathematics -IV | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| B | C502 | Design of concrete structures –I | 4 | 2 | 2 | - | 50 | 100 | - | 150 |
| C | C503 | Structural Analysis – II | 3 | 2 | 2 | - | 50 | 100 | - | 150 |
| D | C504 | Computer programming | 3 | 2 | 2 | - | 50 | 100 | - | 150 |
| E | C505 | Engineering Geology | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| F | C506 | Geo Technical Engineering – I | 3 | 3 | 1 | | 50 | 100 | - | 150 |
| G | C507 | Computing Techniques Lab | 3 | - | - | 3 | 50 | - | 100 | 150 |
| H | C508 | Geo Technical Engineering Lab | 3 | - | - | 3 | 50 | - | 100 | 150 |
| | | Total | 25 | 15 | 9 | 6 | 400 | 600 | 200 | 1200 |

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## 6TH SEMESTER

| Course Code | Subject Code | Subject | Duration of Uty. Exam (hrs.) | No. of periods per week (hrs) | | | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lect. | Tut. | Prac. | Sessional | Theory | Practical | Total |
| A | C601 | Structural Analysis – III | 3 | 2 | 2 | - | 50 | 100 | - | 150 |
| B | C602 | Design of Steel structures | 4 | 2 | 2 | - | 50 | 100 | - | 150 |
| C | C603 | Transportation Engineering -I | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| D | C604 | Water Resources Engineering - I | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| E | C605 | Geo Technical Engineering – II | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| F | C606 | Quantity surveying | 3 | 2 | 2 | | 50 | 100 | - | 150 |
| G | C607 | Material testing lab - II | 3 | - | - | 3 | 50 | - | 100 | 150 |
| H | C608 | Computer Aided Design -I | 3 | - | - | 3 | 50 | - | 100 | 150 |
| | | Total | 25 | 15 | 9 | 6 | 400 | 600 | 200 | 1200 |

## 7TH SEMESTER

| Course Code | Subject Code | Subject | Duration of Uty. Exam (hrs.) | No. of periods per week (hrs) | | | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lect. | Tut. | Prac./ Proj. | Sessional | Theory | Practical | Total |
| A | C701 | Design of Concrete Structures – II | 4 | 2 | 2 | | 50 | 100 | - | 150 |
| B | C702 | Water Resources Engineering - II | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| C | C703 | Transportation Engineering –II | 3 | 2 | 1 | - | 50 | 100 | - | 150 |
| D | C704 | Architecture and town planning | 3 | 2 | 1 | - | 50 | 100 | - | 150 |
| E | C705 | Environmental Engineering - I | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| F | C706 | Elective –I | 3 | 3 | 1 | | 50 | 100 | - | 150 |
| G | C707 | Transportation Engineering Lab. | 3 | - | - | 3 | 50 | - | 100 | 150 |
| H | C708 | Computer Aided Design -II | 3 | - | - | 3 | 50 | - | 100 | 150 |
| I | C709 | Project/Seminar | - | - | - | 2 | - | - | - | - |
| | | Total | 25 | 15 | 7 | 8 | 400 | 600 | 200 | 1200 |

At the beginning of the Seventh Seminar, students must submit a brief out line of the proposed project work. They must submit an interim report at the end of the semester. They will complete the project in the eight semest.

## 8TH SEMESTER

| Course Code | Subject Code | Subject | Duration of Uty. Exam (hrs.) | No. of periods per week (hrs) | | | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lect. | Tut. | Prac./ Proj. | Sessional | Theory | Practical | Total |
| A | C801 | Advanced structural design | 4 | 2 | 2 | - | 50 | 100 | - | 150 |
| B | C802 | Finite Element Analysis | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| C | C803 | Building Technology and Management | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| D | C804 | Environmental Engineering II | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| E | C805 | Elective –II | 3 | 3 | 1 | - | 50 | 100 | - | 150 |
| F | C806 | Elective –III | 3 | 2 | 1 | | 50 | 100 | - | 150 |
| G | C807 | Environmental Engineering Laboratory | 3 | - | - | 3 | 50 | - | 100 | 150 |
| H | C808 | Project / Seminar | - | - | - | 4 | 100 | - | | 100 |
| I | C809 | Viva - Voce | | | | | | | 50 | 50 |
| | | Total | 25 | 16 | 7 | 7 | 450 | 600 | 150 | 1200 |

Sessional marks for seminar will be out of 25. Sessionl marks for project will be out of 75, in which 35 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation board consisting of a minimum of 3 faculty members including the guide. Sessional marks for laborataries will be based on classwork assessed by faculty. In each semester, for laborataries 60% of sessional marks is for class performance, lab record and viva, 20% for attendance and 20% for test paper.

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## MECHANICAL ENGINEEING

### 3RD SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Duration of Uty. Exam. (Hrs.) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect. | Tut. | Prac. | | Sessional | Theory | Practical | Total |
| A | CMEL PA 301 | Engineering Mathematics - II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | M 302 | Machine Drawing - I | - | - | 4 | 3 | 50 | 100 | - | 150 |
| C | M 303 | Fluid Mechanics | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| D | M 304 | Metallurgy & Material Science | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | M 305 | Thermodynamics | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| F | M 306 | Strength of Materials and Structural Engg. | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | M 307 | Fluid Mechanics Laboratory | - | - | 3 | 3 | 50 | - | 100 | 150 |
| H | M 308 | Strength of Materials Laboratory | - | - | 3 | 3 | 50 | - | 100 | 150 |
| | | Total | 13 | 7 | 10 | - | 400 | 600 | 200 | 1200 |

### 4TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Duration of Uty. Exam. (Hrs.) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect. | Tut. | Prac. | | Sessional | Theory | Practical | Total |
| A | CMEL RPTA 401 | Engineering Mathematics - III | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | M 402 | Theory of Machines-1 | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | M 403 | Hydraulic Machines | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| D | M 404 | Machine Tools | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | M 405 | Electrical Technology | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | M 406 | Machine Drawing - II | - | - | 4 | 4 | 50 | 100 | - | 150 |
| G | M 407 | Hydraulic Machines Laboratory | - | - | 4 | 3 | 50 | - | 100 | 150 |
| H | M 408 | Electrical and Electronics Laboratory | - | - | 4 | 3 | 50 | - | 100 | 150 |
| | | Total | 12 | 6 | 12 | - | 400 | 600 | 200 | 1200 |

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## 5TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Duration of Uty. Exam. (Hrs.) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect. | Tut. | Prac. | | Sessional | Theory | Practical | Total |
| A | CMEL PA 501 | Engineering Mathematics - IV | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | M 502 | Manufacturing Processes | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | M 503 | Computer Programming | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| D | M 504 | Theory of Machines II | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| E | M 505 | Mechatronics and Control systems | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| F | M 506 | Thermal Engineering - I | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| G | M 507 | Computer Laboratory | - | - | 3 | 3 | 50 | - | 100 | 150 |
| H | M 508 | Machine Tool Laboratory | - | - | 3 | 3 | 50 | - | 100 | 150 |
| | | Total | 14 | 10 | 6 | - | 400 | 600 | 200 | 1200 |

## 6TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Duration of Uty. Exam. (Hrs.) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect. | Tut. | Prac. | | Sessional | Theory | Practical | Tota |
| A | M 601 | Mechanics of Materials | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| B | M 602 | Metrology and Instrumentation | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | M 603 | Thermal Engineering - II | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| D | M 604 | Heat and Mass Transfer | 2 | 2 | - | 3 | 50 | 100 | - | 150 |
| E | M 605 | Principles of Management and Engineering Economics | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | M 606 | Computer Aided Design and Manufacturing | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | M 607 | Heat Engines Laboratory | - | - | 3 | 3 | 50 | - | 100 | 150 |
| H | M 608 | Advanced Machine Tool Laboratory | - | - | 3 | 3 | 50 | - | 100 | 150 |
| | | Total | 15 | 9 | 6 | - | 400 | 600 | 200 | 120 |

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## 7TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Duration of Uty. Exam. (Hrs.) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect. | Tut. | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | M 701 | Gas Dynamics and Jet Propulsion | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | M 702 | Industrial Engineering | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | M 703 | Refrigeration and Air Conditioning | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | M 704 | Dynamics of Machinery | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | M 705 | Machine Design and Drawing - I | 2 | - | 2 | 3 | 50 | 100 | - | 150 |
| F | M 706 | Elective - I | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | M 707 | Mechanical Engineering Laboratory | - | - | 4 | 3 | 50 | - | 100 | 150 |
| H | M 708 | Heat Transfer Laboratory | - | - | 4 | 3 | 50 | - | 100 | 150 |
| I | M 709 | Project and Seminar | - | - | 2 | - | - | - | - | - |
| | | Total | 13 | 5 | 12 | - | 400 | 600 | 200 | 1200 |

At the beginning of the seventh semester, students must submit a brief out line of the proposed project work. They must submit an interim report at the end of the semester. They will complete the project in the eighth semester.

## 8TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Duration of Uty. Exam. (Hrs.) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect. | Tut. | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | M 801 | Production Engineering | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | M 802 | Automobile Engineering | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | M 803 | Production Planning and Control | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | M 804 | Machine Design and Drawing - II | 2 | - | 2 | 3 | 50 | 100 | - | 150 |
| E | M 805 | Elective - II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | M 806 | Elective - III | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | M 807 | Mechanical Measurements Laboratory | - | - | 4 | 3 | 50 | - | 100 | 150 |
| H | M 808 | Project and Seminar | - | - | 4 | - | 100 | - | - | 100 |
| I | M 809 | Viva Voce | - | - | - | - | - | - | 50 | 50 |
| | | Total | 15 | 5 | 10 | - | 450 | 600 | 150 | 1200 |

Sessional marks for seminar will be out of 25. Sessional marks for project will be out of 75, in which 35 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation board consisting of a minimum of 3 faculty members including the guide. Sessional marks for workshops and laboratories will be based on day to day performance assessed by faculty members. In each semester for workshops and laboratories, 60% of the sessional marks will consists of class performance, lab record and viva conducted by faculty members day to day. Out of the remaining 40%, 20% will be for attendance and 20% for final examiniation.

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## ELECTRICAL AND ELECTRONICS ENGINEERING

### 3RD SEMESTER

| Course Code | Course No. | Subject | Teaching Hours | | | | Duration of Univ. Exam(Hrs.) | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | | Sessional | University | Total |
| A | CMEL PA 301 | Engineering Mathematics -II | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| B | E 302 | Mechanical Technology | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| C | E 303 | Electric Circuit Theory | 2 | 2 | | 4 | 3 | 50 | 100 | 150 |
| D | E 304 | Electromagnetic Theory | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| E | E 305 | Electical and Electonic Measurements | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| F | E 306 | Power Generation & Distribution | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| G | E 307 | Basic Electrical Lab | | | 4 | 4 | 3 | 50 | 100 | 150 |
| H | E 308 | Mechanical Lab* | | | 4 | 4 | 3 | 50 | 100 | 150 |
| | | Total | 15 | 7 | 8 | 30 | 24 | 400 | 800 | 1200 |

*Mechanical Lab consists of: 1) Hydraulic Machines Lab & 2) Heat Engines Lab.
University Exam will be either in Hydraulic Machines Lab or Heat Engines Lab.

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KOTTAYAM

### 4TH SEMESTER

| Course Code | Course No. | Subject | Teaching Hours | | | | Duration of Univ. Exam(Hrs.) | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | | Sessional | University | Total |
| A | CMELR PTA 401 | Engineering Mathematics -III | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| B | E 402 | Network Analysis & Synthesis | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| C | E 403 | Electronic Circuits | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| D | E 404 | Electrical Machines - I | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| E | E 405 | Computer Programming | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| F | E 406 | Electrical and Electronic Instruments | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| G | E 407 | Electrical Measurements Lab | | | 4 | 4 | 3 | 50 | 100 | 150 |
| H | E 408 | Computer Programming Lab | | | 4 | 4 | 3 | 50 | 100 | 150 |
| | | Total | 16 | 6 | 8 | 30 | 24 | 400 | 800 | 1200 |

## 5TH SEMESTER

| Course Code | Course No. | Subject | Teaching Hours | | | | Duration of Univ. Exam(Hrs.) | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | | Sessional | University | Total |
| A | CMEL PA 501 | Engineering Mathematics -IV | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| B | E 502 | Digital Circuits | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| C | E 503 | Communication Engineering | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| D | E 504 | Industrial management and Economics | 3 | 2 | | 5 | 3 | 50 | 100 | 150 |
| E | E 505 | Linear Integrated Circuits | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| F | E 506 | Power Electronics | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| G | E 507 | Electrical Machines Lab - I | | | 4 | 4 | 3 | 50 | 100 | 150 |
| H | E 508 | Electronic Circuits Lab | | | 4 | 4 | 3 | 50 | 100 | 150 |
| | | Total | 15 | 7 | 8 | 30 | 24 | 400 | 800 | 1200 |

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## 6TH SEMESTER

| Course Code | Course No. | Subject | Teaching Hours | | | | Duration of Univ. Exam(Hrs.) | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | | Sessional | University | Total |
| A | E 601 | Control Systems - I | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| B | E 602 | Electrical Machines - II | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| C | E 603 | Electrical Power Transmission | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| D | E 604 | Digital Signal Processing | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| E | E 605 | Microprocessors and Applications | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| F | E 606 | Computer Organisation | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| G | E 607 | Digital Lab | | | 4 | 4 | 3 | 50 | 100 | 150 |
| H | E 608 | Systems Lab | | | 4 | 4 | 3 | 50 | 100 | 150 |
| | | Total | 16 | 6 | 8 | 30 | 24 | 400 | 800 | 1200 |

## 7TH SEMESTER

| Course Code | Course No. | Subject | Teaching Hours | | | | Duration of Univ. Exam(Hrs.) | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj. | Total | | Sessional | University | Total |
| A | E 701 | Electrical Machines -III | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| B | E 702 | Electrical Drives and Control | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| C | E 703 | Utilisation of Electrical Power | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| D | E 704 | Control Systems - II | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| E | E 705 | System Design with Microcontrollers | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| F | E 706 | Elective - I | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| G | E 707 | Electrical Drawing | | | 3 | 3 | 3 | 50 | 100 | 150 |
| H | E 708 | Control and Power Electronics Lab | | | 4 | 4 | 3 | 50 | 100 | 150 |
| I | E 709 | Project & Seminar* | | | 2 | 2 | | | | |
| | | Total | 15 | 6 | 9 | 30 | 24 | 400 | 800 | 1200 |

*The Project Work will be started in the Seventh Semester. Sessional Marks for Seminar will be out of 25 and that for Project will be out of 75.

## 8TH SEMESTER

| Course Code | Course No. | Subject | Teaching Hours | | | | Duration of Univ. Exam(Hrs.) | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj. | Total | | Sessional | University | Total |
| A | E 801 | Power System Analysis | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| B | E 802 | Switch Gear and Protection | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| C | E 803 | Instrumentation | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| D | E 804 | Electrical System Design | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| E | E 805 | Elective - II | 3 | 1 | | 4 | 3 | 50 | 100 | 150 |
| F | E 806 | Elective - III | 2 | 1 | | 3 | 3 | 50 | 100 | 150 |
| G | E 807 | Electrical Machines Lab -II | | | 4 | 4 | 3 | 50 | 100 | 150 |
| H | E 808 | Project and Seminar** | | | 4 | 4 | | 100 | | 100 |
| I | E 809 | Viva Voce | | | | | | | 50 | 50 |
| | | Total | 16 | 6 | 8 | 30 | 21 | 450 | 750 | 1200 |

**Sessional Marks for Seminar will be out of 25 and that for Project will be out of 75 in which 40 marks will be based on day to day performance assessed by the Guide. The remaining 35 marks are to be awarded based on the presentation of the project by the student in the presence of 2 staff members one of which shall be the Guide.

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## ELECTRONICS & COMMUNICATION ENGINEERING

### 3RD SEMESTER

| Course Code | Course No. | Subject | Teaching periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | CMEL PA 301 | Engineering Mathematics II | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | LA302 | Network Theory | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | LA303 | Electrical Technology | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | LA304 | Solid state devices | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | LA305 | Electronic circuits –I | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | LA306 | Computer programming | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | LA307 | Electrical lab | 0 | 0 | 4 | 3 | 50 | | 100 | 150 |
| H | L308 | Basic Electronics Lab | 0 | 0 | 4 | 3 | 50 | | 100 | 150 |
| | | Total | 16 | 6 | 8 | | 400 | 600 | 200 | 1200 |

### 4TH SEMESTER

| Course Code | Course No. | Subject | Teaching periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | CMELR TPA 401 | Engineering Mathematics III | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | LA402 | Digital Electronics and Logic Design | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | LA403 | Communication Engineering | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | LA404 | Electronic circuits –II | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | LTA405 | Signals and systems | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | LA406 | Reliability & Humanities | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | LA407 | Electronic circuits Lab | 0 | 0 | 4 | 3 | 50 | | 100 | 150 |
| H | LA408 | Computer programming Lab | 0 | 0 | 4 | 3 | 50 | | 100 | 150 |
| | | Total | 16 | 6 | 8 | | 400 | 600 | 200 | 1200 |

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## 5TH SEMESTER

| Course Code | Course No: | Subject | Teaching periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | T |
| A | CMEL PA 501 | Engineering Mathematics IV | 3 | 1 | 0 | 3 | 50 | 100 | - | 1 |
| B | LA502 | Power Electronics | 2 | 1 | 0 | 3 | 50 | 100 | - | 1 |
| C | L503 | Applied Electromagnetic Theory | 3 | 1 | 0 | 3 | 50 | 100 | - | 1 |
| D | LA504 | Computer organization and Architecture | 2 | 1 | 0 | 3 | 50 | 100 | - | 1 |
| E | LA505 | Linear integrated circuits | 3 | 1 | 0 | 3 | 50 | 100 | - | 1 |
| F | L506 | Microprocessors and Microcontrollers | 3 | 1 | 0 | 3 | 50 | 100 | - | 1 |
| G | LA507 | Digital IC lab | 0 | 0 | 4 | 3 | 50 | | 100 | 1 |
| H | L508 | Communication–I lab | 0 | 0 | 4 | 3 | 50 | | 100 | 1 |
| | | Total | 16 | 6 | 8 | | 400 | 600 | 200 | 1 |

M G UNIVERSITY KOTTAYAM

## 6TH SEMESTER

| Course Code | Course No: | Subject | Teaching periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | LA 601 | Industrial Management and Economics | 3 | 2 | 0 | 3 | 50 | 100 | - | 150 |
| B | L602 | Digital communication Techniques | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | LTA 603 | Digital signal processing | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | L604 | Radiation and Propagation | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | L605 | Electronic Instrumentation | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | L606 | Control Systems | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | L607 | Linear IC Lab | 0 | 0 | 3 | 3 | 50 | | 100 | 150 |
| H | L608 | Mini Project | 0 | 0 | 3 | 3 | 50 | | 100 | 150 |
| | | Total | 17 | 7 | 6 | | 400 | 600 | 200 | 1200 |

## 7TH SEMESTER

| Course Code | Course No: | Subject | Teaching periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Pra./ Proj. | | Sessional | Theory | Practical | Total |
| A | LA701 | Microcontroller based system design | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | LA702 | VLSI technology | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | L703 | Microwave and Radar Engineering | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | L704 | Optical fiber communication systems | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | L705 | Information Theory and coding | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | L706 | Elective – I | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | LA707 | Microprocessor and Microcontroller Lab | 0 | 0 | 3 | 3 | 50 | | 100 | 150 |
| H | L708 | Communication-II lab | 0 | 0 | 3 | 3 | 50 | | 100 | 150 |
| I | L709 | Project design and seminar | 0 | 0 | 2 | | | | | |
| | | Total | 16 | 6 | 8 | | 400 | 600 | 200 | 1200 |

## 8TH SEMESTER

| Course Code | Course No: | Subject | Teaching periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | LA801 | Computer Networks | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | L802 | Advanced communication systems | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | LA803 | Advanced microprocessors | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | L804 | Television Engineering | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | L805 | Elective –II | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | L806 | Elective – III | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | L807 | Systems Lab | 0 | 0 | 3 | 3 | 50 | | 100 | 150 |
| H | L808 | Project design and seminar | 0 | 0 | 3 | - | 100 | | | 100 |
| I | L809 | Viva -voce | 0 | 0 | 0 | - | - | - | 50 | 50 |
| | | Total | 18 | 6 | 6 | | 450 | 600 | 150 | 1200 |

M G UNIVERSITY KOTTAYAM

## COMPUTER SCIENCE & ENGINEERING

### 3RD SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | RT301 | Engineering Mathematics II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | R 302 | Micro Processor Systems | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | RT 303 | Solid State Electronics | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | RT 304 | Problem Solving and Computer Programming | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | RT 305 | Humanities | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | R306 | Logic System Design | 3 | 1 | - | | 50 | 100 | - | 150 |
| G | R 307 | Solid State Electronics Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| H | R 308 | Programming Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| | | Total | 16 | 6 | 8 | - | 400 | 600 | 200 | 1200 |

### 4TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | CMEL RPTA 401 | Engineering Mathematics III | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | R 402 | Computer Organization | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | R 403 | Object Oriented Programming | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | R 404 | Integrated Circuits | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | R 405 | Data Structures and Programming Methodologies | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | R406 | Advanced Microprocessors and Peripherals | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | R 407 | Integrated Circuits Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| H | R 408 | Data Structures Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| | | Total | 16 | 6 | 8 | - | 400 | 600 | 200 | 1200 |

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## 5TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | RT501 | Engineering Mathematics IV | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | R 502 | Operating Systems | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | RT503 | Database Management Systems | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | R 504 | File Structures and Algorithms | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | RT505 | Language Processors | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | RT506 | Data Communication | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | R 507 | Microprocessor Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| H | R 508 | Database Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| | | Total | 16 | 6 | 8 | - | 400 | 600 | 200 | 1200 |

## 6TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours ) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac/ Proj. | | Sessional | Theory | Practical | Total |
| A | R 601 | PC & PC based Systems | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | RT602 | Software Engineering | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | R 603 | Project Management and Quality Assurance | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | RT604 | Computer Networks | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | RT605 | Network Computing | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | R 606 | Algorithm Analysis and Design | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | R 607 | System Software Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| H | R 608 | Mini Project | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| | | Total | 16 | 6 | 8 | - | 400 | 600 | 200 | 1200 |

M G UNIVERSITY KOTTAYAM

## 7TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | RT701 | Object Oriented Modeling and Design | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | RT702 | Computer Graphics | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | R 703 | Theory of Computation | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | R 704 | Advanced Software Environments | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | RT705 | Web Technologies | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | R 706 | Elective I | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | R 707 | Computer Hardware and Networking Lab | 0 | 0 | 3 | 3 | 50 | - | 100 | 150 |
| H | R 708 | Network Programming Lab | 0 | 0 | 3 | 3 | 50 | - | 100 | 150 |
| I | R709 | Project & Seminar | 0 | 0 | 3 | - | - | - | - | - |
| | | Total | 15 | 6 | 9 | - | 400 | 600 | 200 | 1200 |

## 8TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours ) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | RT801 | Security in Computing | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | R 802 | High Performance Computing | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | R 803 | Principles of Programming Languages | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | RT804 | Artificial Intelligence | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | R 805 | Elective II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | R 806 | Elective III | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | R 807 | Graphics and Multimedia Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| H | R 808 | Project & Seminar | 0 | 0 | 4 | - | 100 | - | - | 100 |
| I | R809 | Viva-Voce | - | - | - | - | - | - | 50 | 50 |
| | | Total | 16 | 6 | 8 | | 450 | 600 | 150 | 1200 |

M G UNIVERSITY KOTTAYAM

## POLYMER ENGINEERING

### 3RD SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours ) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | CMEL 301 | Engineering Mathematics- II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | P 302 | Humanities | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | P 303 | Computer Programming | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | P 304 | Polymer Science- I | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | P 305 . | Organic Chemistry | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | MP 306 | Strength of Materials & Structural Engineering | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | P 307 | Chemistry lab | - | | 3 | 3 | 50 | - | 100 | 150 |
| H | P 308 | Computer Lab | - | | 3 | 3 | 50 | - | 100 | 150 |
| | | Total | 18 | 6 | 6 | - | 400 | 600 | 200 | 1200 |

### 4th Semester

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours ) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | CMEP 401 | Engineering Mathematics- III | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | P 402 | Object Oriented Programming | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | LP 403 | Electrical Technology | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | P 404 | Chemical Engg. - I | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | P 405 | Polymer Physics | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | P 406 | Polymer Science- II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | P 407 | Polymer Preparation & Characterisation Lab | - | | 3 | 3 | 50 | - | 100 | 150 |
| H | P 408 | Electrical Machines Lab | - | | 3 | 3 | 50 | - | 100 | 150 |
| | | Total | 18 | 6 | 6 | - | 400 | 600 | 200 | 1200 |

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## 5TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours ) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | CMEP 501 | Engineering Mathematics- IV | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | P 502 | Chemical Engg. - II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | P 503 | Plastics - Science & Technology | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | P 504 | Rubber - Science & Technology | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | P 505 | Latex Technology | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | P 506 | Polymer Processing-I | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | P 507 | Specification Tests Lab | - | | 3 | 3 | 50 | - | 100 | 150 |
| H | P 508 | Polymer Analysis Lab | - | | 3 | 3 | 50 | - | 100 | 150 |
| | | Total | 18 | 6 | 6 | - | 400 | 600 | 200 | 1200 |

## 6TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours ) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Sessional | Theory | Practical | Total |
| A | P 601 | Principles of Management | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | P 602 | Engg. Statistics & Quality Control | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | P 603 | Chemical Engg. - III | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | P 604 | Biomedical & Biopolymers | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | P 605 | Polymer Blends & Composites | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | P 606 | Polymer Processing-II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | P 607 | Latex Products Lab | - | | 3 | 3 | 50 | - | 100 | 150 |
| H | P 608 | Polymer Products Lab | - | | 3 | 3 | 50 | - | 100 | 150 |
| | | Total | 18 | 6 | 6 | - | 400 | 600 | 200 | 1200 |

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## 7TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours ) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | P 701 | Elective- I | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | P 702 | Industrial Engineering | 2 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | P 703 | Production Engineering | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | P 704 | Chemical Engg. - IV | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | P 705 | Tyre Technology | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | P 706 | Polymer Testing | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | P 707 | Polymer Testing Lab | - | - | 3 | 3 | 50 | - | 100 | 150 |
| H | P 708 | Chemical Engineering Lab | - | - | 3 | 3 | 50 | - | 100 | 150 |
| I | P709 | Project/Seminar | - | - | 2 | - | - | - | - | - |
| | | Total | 16 | 6 | 8 | - | 400 | 600 | 200 | 1200 |

At the beginning of the seventh semester, students must submit an abstract of their undergraduate project. They must submit a preliminary report at the end of the semester. They will complete the project in the eighth semester.

## 8TH SEMESTER

| Course Code | Course No. | Subject | Teaching Periods | | | Uty. Exam duration (hours ) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | P 801 | Elective- II | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| B | P 802 | Computer Aided design & Manufacturing | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| C | P 803 | Fibre Technology | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| D | P 804 | Polymers & Environment | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| E | P 805 | Polymer Product Design | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| F | P 806 | Speciality Polymers | 3 | 1 | - | 3 | 50 | 100 | - | 150 |
| G | P 807 | Chemical Technology Lab | - | - | 3 | 3 | 50 | - | 100 | 150 |
| H | P 808 | Project Work & Seminar | - | - | 3 | - | 100 | - | - | 100 |
| I | P 809 | Viva- voce | - | - | - | - | - | - | 50 | 50 |
| | | Total | 18 | 6 | 6 | - | 450 | 600 | 150 | 1200 |

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## INFORMATION TECHNOLOGY

### 3RD SEMESTER

| Course Code | Course No. | SUBJECT | Teaching Periods | | | Duration Uty Exams (Hrs) | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P/D | | Sessional | Univ. Exam | Total |
| A | RT 301 | Engg. Mathematics II | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| B | T302 | Electrical Circuits and Systems | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| C | RT303 | Solid State Electronics | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| D | RT304 | Problem Solving & Computer Programming | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| E | RT305 | Humanities | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| F | T306 | Digital Electronics | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| G | T307 | C Programming Lab | 0 | 0 | 4 | 3 | 50 | 100 | 150 |
| H | T308 | Electronic Circuits Lab | 0 | 0 | 4 | 3 | 50 | 100 | 150 |
| | | TOTAL | 16 | 6 | 8 | | 400 | 800 | 1200 |

### 4TH SEMESTER

| Course Code | Course No. | SUBJECT | Teaching Periods | | | Duration Uty Exams (Hrs) | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P/D | | Sessional | Univ. Exam | Total |
| A | CMELR PTA401 | Engg. Mathematics III | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| B | T402 | Data Structures & Algorithms | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| C | T403 | Linear Integrated Circuits & Applications | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| D | T404 | Computer System Architecture | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| E | LTA405 | Signals & Systems | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| F | T406 | Object Oriented Programming in C++ | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| G | T407 | C++ & DS Lab | 0 | 0 | 4 | 3 | 50 | 100 | 150 |
| H | T408 | Integrated Circuits Lab | 0 | 0 | 4 | 3 | 50 | 100 | 150 |
| | | TOTAL | 16 | 6 | 8 | | 400 | 800 | 1200 |

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of inertia of thin circular and rectangular plates – mass moment of inertia of solid rectangular prisms, cylinders and cones.

Friction-angle of friction and coefficient of friction – laws of dry friction-ladder friction – wedge friction.

**Module 3**

Simple trusses – analysis of trusses by methods of joints and sections – graphical-method. Simple stress and strain – bars of uniform cross section – shear stress – modulus of rigidity – bulk modulus – Poisson's ratio – Relation between different modulii.

**Module 4**

**Dynamics:** Kinematics (Velocity – acceleration) rectilinear motion of a particle under variable acceleration

Relative velocity – simple cases only. Circular motion with uniform acceleration – relation between angular and rectilinear motion – normal and tangential acceleration – motion of rotation and translation – instantaneous centre of zero velocity (elementary treatment only)

**Module 5**

**Kinetics of particles** – Newton's Laws of motion of translation – work, energy and power – principles of momentum and impulse. Motion of rotation – couple – torque – Newtons laws of motion of rotation – differential equations of rotation – angular impulse and torque – conservation of angular momentum – work-done and power by torque and couple.

**References**


1. Shames I.H., Engineering Mechanics, Prentice hall of India
2. S.Timoshinko, Engineering Mechanics, McGraw Hill
3. Ramachandra, Engineering Mechanics, Standard Publishers and Distributors
4. S. Rajasekaram & G.Sankarasubramanian, Engineering Mechanics, Vikas Publishing Co.
5. Beer F.P. & Johnston E.R., Mechanics for Engineers – Statics and Dynamics, McGrwa Hill
6. Meriam J.L. & Kraige L.G., Engineering Mechanics, John Wiley


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## ENGINEERING GRAPHICS

**CMELRPTA 105** **1+0+3**

**Module 1**

**Introduction of Engineering Graphics**: drawing instruments and their uses – familiarization with current, Indian standard code of practice for general engineering drawing.

Scales – plain scale – vernier scal – diagonal scale.

Conic sections – construction of ellipse, parabola, hyoperbola and rectangular hyperbola. Construction of cycloids, involute, archimedian spiral and logarithmic spiral – drawing tangents and normals to these curves.

## 7TH SEMESTER

| Course Code | Course No. | SUBJECT | Teaching Periods | | | Duration Uty Exams (Hrs) | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj | | Sessional | Univ. Exam | Total |
| A | RT 701 | Object Oriented Modelling and Design | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| B | RT 702 | Computer Graphics | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| C | T 703 | Modern Communication Systems | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| D | T 704 | Mutimedia Techniques | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| E | RT 705 | Web Technologies | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| F | T706 | Elective I | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| G | T 707 | Multimedia Lab | 0 | 0 | 3 | 3 | 50 | 100 | 150 |
| H | T708 | Communication Systems Lab | 0 | 0 | 3 | 3 | 50 | 100 | 150 |
| I | T 709 | Project & Seminar | 0 | 0 | 3 | – | – | – | – |
| | | TOTAL | 15 | 6 | 9 | | 400 | 800 | 1200 |

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## 8TH SEMESTER

| Course Code | Course No. | SUBJECT | Teaching Periods | | | Duration Uty Exams (Hrs) | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | Prac./ Proj | | Sessional | Univ. Exam | Total |
| A | RT 801 | Security in Computing | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| B | T 802 | Information Systems and Management | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| C | T 803 | E-Commerce | 2 | 1 | 0 | 3 | 50 | 100 | 150 |
| D | RT 804 | Artificial Intelligence | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| E | T 805 | Elective II | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| F | T 806 | Elective III | 3 | 1 | 0 | 3 | 50 | 100 | 150 |
| G | T 807 | Internet Lab | 0 | 0 | 4 | 3 | 50 | 100 | 150 |
| H | T 808 | Project & Seminar | 0 | 0 | 4 | – | 100 | – | 100 |
| I | T 809 | Viva Voce | 0 | 0 | 0 | – | 0 | 50 | 50 |
| | | TOTAL | 16 | 6 | 8 | | 450 | 750 | 1200 |

## APPLIED ELECTRONICS AND INSTRUMENTATION

### 3RD SEMESTER

| Course Code | Course No | Subject | Teaching Periods | | | Uty Exam Duration (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | Sessional | Theory | Practical | Total |
| A | CMEL PA 301 | Engineering Mathematics-II | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | LA302 | Network Theory | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | LA303 | Electrical Technology | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | LA304 | Solid State Devices | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | LA305 | Electronic Circuits-I | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | LA306 | Computer Programming | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | LA307 | Electrical Lab | 0 | 0 | 4 | 3 | 50 | | 100 | 150 |
| H | A308 | Basic Electronics Lab | 0 | 0 | 4 | 3 | 50 | | 100 | 150 |
| | | Total Teaching Hours | 16 | 6 | 8 | | 400 | 600 | 200 | 1200 |

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### 4TH SEMESTER

| Course Code | Course No | Subject | Teaching Periods | | | Uty Exam Duration (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | Sessional | Theory | Practical | Total |
| A | CMELR PTA 401 | Engineering Mathematics-III | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | LA402 | Digital Electronics and Logic Design | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | LA403 | Communication Engineering | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | LA404 | Electronic Circuits-II | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | LTA405 | Signals and Systems | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | LA406 | Reliability and Humanities | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | LA407 | Electronics Circuits Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| H | LA408 | Computer Prog Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| | | Total Teaching Hours | 16 | 6 | 8 | | 400 | 600 | 200 | 1200 |

## 5TH SEMESTER

| Course Code | Course No | Subject | Teaching Periods | | | Uty Exam Duration (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | Sessional | Theory | Practical | Total |
| A | CMEL / PA 501 | Engineering Mathematics IV | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | LA502 | Power Electronics | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | A503 | Basic Instrumentation | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | LA504 | Computer Organisation And Archetecture | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | LA505 | Linear Integrated Circuits | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | A506 | Transducers And Recording Systems | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | LA507 | Digital I.C. Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| H | A508 | Measurement Lab | 0 | 0 | 4 | 3 | 50 | - | 100 | 150 |
| | | Total Teaching Hours | 16 | 6 | 8 | - | 400 | 600 | 200 | 1200 |

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## 6TH SEMESTER

| Course Code | Course No | Subject | Teaching Periods | | | Uty Exam Duration (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | Sessional | Theory | Practical | Total |
| A | LA601 | Industrial Management And Ecnomics | 3 | 2 | 0 | 3 | 50 | 100 | - | 150 |
| B | A602 | Micro Processors And Micro Controllers | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | LTA603 | Digital Signal Processing | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | A604 | Industrial Instrumentation I | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | A605 | Data Communication | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | A606 | Control Sysrem Theory | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | A607 | Instrumentation Lab | 0 | 0 | 3 | 3 | 50 | - | 100 | 150 |
| H | A608 | Mini Project | 0 | 0 | 3 | 3 | 50 | - | 100 | 150 |
| | | Total Teaching Hours | 17 | 7 | 6 | - | 400 | 600 | 200 | 1200 |

## 7TH SEMESTER

| Course Code | Course No | Subject | Teaching Periods | | | Uty Exam Duration (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | LA 701 | Micro Controller based System Design | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | LA 702 | VLSI Technology | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | A 703 | Industrial Instrumentation II | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | A 704 | Process Dynamics & Control | 2 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | A 705 | Bio medical Instrumentation | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | A 706 | Elective I | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | LA 707 | Microprocessor and Microcontroller Lab | 0 | 0 | 3 | 3 | 50 | - | 100 | 150 |
| H | A 708 | Industrial Electronics Lab | - | - | 3 | - | 50 | - | 100 | 150 |
| I | A 709 | Project Design And Seminar | 0 | 0 | 2 | - | - | - | - | - |
| | | Total | 16 | 6 | 8 | | 400 | 600 | 200 | 1200 |

## 8TH SEMESTER

| Course Code | Course No | Subject | Teaching Periods | | | Uty Exam Duration (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac./ Proj. | | Sessional | Theory | Practical | Total |
| A | LA801 | Computer Networks | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| B | A802 | Modern Control Theory | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| C | LA803 | Advanced Microprocessors | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| D | A804 | Computerised Process Control | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| E | A805 | Elective - II | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| F | A806 | Elective - III | 3 | 1 | 0 | 3 | 50 | 100 | - | 150 |
| G | A807 | Process Control Lab | 0 | 0 | 3 | 3 | 50 | - | 100 | 150 |
| H | A808 | Project and Seminar | 0 | 0 | 3 | - | 100 | - | | 100 |
| I | A809 | Viva - Voice | 0 | 0 | 0 | - | - | - | 50 | 50 |
| | | Total | 18 | 6 | 6 | | 450 | 600 | 150 | 1200 |

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# COURSE CALENDAR FOR ODD SEMESTER / EVEN SEMESTER

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **JUNE** | Centralised Valuation | | | | | | | | | | Regular Class Starts | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| **DECEMBER** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ( Publication of S8 Result by 15th July every year | | | | | | | | | | | | | | | | | | | | | | | | | | | Publication of results | | | |
| **JULY** | ELECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **JANUARY** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **AUGUST** | 1st Series Test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **FEBRUARY** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Last date of receipt of application forms for Uty. Exams. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **SEPTEMBER** | | | | | | | | | | | | | | | | | | | | | | | | | 2nd Series Test | | | | | | |
| **MARCH** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **OCTOBER** | | | | | | | | Study Leave | | | | | | | | | | | | | | Theory Exam. Starts | | | | | | | | |
| **APRIL** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **NOVEMBER** | | | | | Theory Exams | | | | | | | | | | | | | | | | | Practical Exams | | | | | | | | |
| **MAY** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |

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# B.TECH. DEGREE COURSE

## SYLLABUS

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## S 1 & 2 SEMESTER

## (COMMON TO ALL BRANCHES)

[Civil (C), Mechanical (M), Electrical & Electronics (E), Electronics & Communication (L), Computer Science & Engineering (R), Polymer Engineerir (P), Information Technology (T), Applied Electronics & Instrumentation (A)and Instrumentation & Control (N)]

## ENGINEERING MATHEMATICS – I

**CMELRPTA 101** **3+1+0**

**Module 1 Matrix**

Elementary transformation – finding inverse and rank using elementary transformation – solution of linear equations using elementary transformations – eigenvalues and eigenvectors – application of Cayley Hamiltion theorem – Diagonalization – Reduction of quadratic form into sum of squares using orthogonal transformation – nature of quadratic form.

**Module 2 Partial Differentiation**

Partial differentiation – chair rules – Eulers theorem for homogeneous functions – Taylors series for function of two variables – maxima and minima of function of two variables (proof of results not expected.)

**Modules 3 Multiple Integrals**

Double integrals in cartesian and polar co-ordinates – application in finding area and volume using double integrals – change of variables using Jacobian – triple integrals in cartesian, cylindrical and spherical co-ordinates – volume using triple integrals – simple problems.

**Module 4 Laplace Transforms**

Laplace transforms – Laplace transform of derivatives and integrals – shifting theorem – differentiation and integration of transforms – inverse transforms – application of convolution property – solution of linear differential equations with constant coefficients using Laplace transform – Laplace transform of unit step function, impulse function and periodic function

**Module 5 Fourier Series**

Dirichelt conditions – Fourier series with period 2* and 21 – Half range sine and cosine series – simple problems – rms value.

**References**


1. Advanced Engg. Mathematics — Erwin Kreyszig
2. Higher Engg. Mathematics — Grawal B.S.
3. Engg. Mathematics — N.P.Bali
4. Laplace and Fourier Transforms — Goyal and Gupta
5. Advanced Mathematics for Engineers — E.S.Sokolinokoff
6. Methods of Applied Mathematics — F.B.Hilderbrand


## ENGINEERING PHYSICS

**CMELRPTA 102** **1+1+0**

**Module 1 Optical Instruments and Applications**

Electron microscope – characteristics of laser – spontaneous emission – stimulated emission – population inversion-pumping pumping mechanisms – typical laser systems like Ruby lase – He-Ne laser – semi conductor laser – Applications of laser.

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**Module 2 Super Conductivity**

Transition temperature – Meissner effect – Isotope effect – Type I and II super conductors – BCS theory (qualitative study) – High temperature super conductivity (general idea) – Joseph son effect – SQUIDS – Applications of Super conductors.

**Module 3 Crystallography and Lattice Planes**

Crystallography – space lattice – unitcell – crystal systems – Co-ordination number packing factor – lattice planes and Miller Indices – spacing between lattice planes – Bragg's law and crystal structure analysis – Bragg's Xray spectrometer.

**Module 4 Magnetic Materials**

Dia, Para, Ferro, Antiferro and Ferri magnetic materials – soft and hard magnetic materials – properties – applications – magnetic permeability – susceptibility – relation between them – Hysteresis.

Dielectrics: Properties – Dielectric constant – Dielectric strength – Dielectric loss – Polar and non polar molecule – Dielectric polarization – dielectric susceptibility – types – applications.

Ultra sonics – Production – piczoelectric and magnetostriction method – properties – applications.

**Module 5 Fibre Optics and its Application**

General ides of optical fibre – NA of fibre – step index and graded index fibre – multi mode and single mode fibre – applications of optical fibre – fibre optic communication system (block diagram) – Optical fibre sensors.

**References**


| | | |
|---|---|---|
| 1. | Engg. Physics | R.K.Gaur and S.L.Gupta |
| 2. | Engg. Physics | Dr. M.Arumugam |
| 3. | Solid State Physics | C.Kittel |
| 4. | Engg. Materials | Decker |
| 5. | Physics for Engineers | B.Premlet |


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## ENGINEERING CHEMISTRY

**CMELRPTA 103** **1+1+0**

**Module 1 Electro Chemistry**

Conductance – Experimental Determination – Galvenic cells – reversible and irreversible cells – EMF and its measurement – Single electrode potential – types of electrodes – Hydrogen electrode – Calomel electrode – Electrochemical series – Nernst equation – concentration cells – polarization and over voltage – decomposition potential – Secondary cells – Lead-Acid accumulator – Fuel cells.

**Module 2 Plastics and Elastomers**

High Polymers – types of polymerization – addition, condensation and co-polymerism - thermo plastics and thermo setting plastics – preparation and properties of PVC, PVA, Poly propelene, Poly vinylidene chloride, Teflon,

Terylene, Acrylics, Nylon, Bakelite – Moulding techniques – Lamination – glass reinforced plastics – Natural Rubber properties – Valcunisation of rubber – synthetic rubber – industrial uses buna rubbers, butyl rubber, silicon rubber and Thiokol.

**Module 3 Corrosion and protective coatings**

Chemical and electro chemical corrosion – Factors affecting corrosion – corrosion control – cathodic protection – inorganic coating – metallic coating – hot dipping – electroplating – metal spraying – cladding – vacuum metalistion – anodisation – vitreous coating.

**Module 4 Domestic water supply**

Requirements and methods of processing – Industrial water supply: Hard and soft waters – defects of using water containing dissolved minerals for industrial purposes – Boiler Troubles – methods of treatment.

**Module 5**

Fuels: Classification – calorific value and its determination – solid, liquid and gaseous fuels – petrol knock – octane number – cetane number – synthetic gasoline – natural gas – pollution – causes of pollution – air pollution due to automobiles – control of air pollution Lubrication and Lubricants: Mechanism of lubrication – different types of lubricants – manufacture and properties of lubricating oil – manufacture, properties and uses of semi-solid lubricants – properties and uses of solid lubricants – synthetic lubricants.

**References**


1. Engg. Chemistry — Jain and Jain
2. Engg. Chemistry — O.P.aggarwal
3. Chemistry in Engg. And Tech. (Vol. I & II) — J.C.Kuriakose and J.Rajam
4. Environmental Chemistry — A.K.De


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## ENGINEERING MECHANICS

**CMELRPTA 104** **2+2+0**

**Module 1**

**Forces in Plane** – Vector addition of concurrent forces in plane – problems involving the equilibrium of particles – free body diagrams.

Definition of rigid body – moment of a force about an axis – varignon's theorem of moment – couple – properties of force couples – resolution of a given force in to force acting at a given point and a couple – reduction of a system of coplanar forces acting on a rigid body into a single force and a single couple – equilibrium of a rigid body under coplanar forces – types of supports – reaction at supports of beams and frames – graphical method.

**Module 2**

**Centre of gravity**, centroid of wires, areas, volumes – moment of inertia of lamina and radius of gyration – parallel axis theorem and its applications – mass moment

of inertia of thin circular and rectangular plates – mass moment of inertia of solid rectangular prisms, cylinders and cones.

Friction-angle of friction and coefficient of friction – laws of dry friction-ladder friction – wedge friction.

**Module 3**

Simple trusses – analysis of trusses by methods of joints and sections – graphical-method. Simple stress and strain – bars of uniform cross section – shear stress – modulus of rigidity – bulk modulus – Poisson's ratio – Relation between different modulii.

**Module 4**

**Dynamics:** Kinematics (Velocity – acceleration) rectilinear motion of a particle under variable acceleration

Relative velocity – simple cases only. Circular motion with uniform acceleration – relation between angular and rectilinear motion – normal and tangential acceleration – motion of rotation and translation – instantaneous centre of zero velocity (elementary treatment only)

**Module 5**

**Kinetics of particles** – Newton's Laws of motion of translation – work, energy and power – principles of momentum and impulse. Motion of rotation – couple – torque – Newtons laws of motion of rotation – differential equations of rotation – angular impulse and torque – conservation of angular momentum – work-done and power by torque and couple.

**References**


1. Shames I.H., Engineering Mechanics, Prentice hall of India
2. S.Timoshinko, Engineering Mechanics, McGraw Hill
3. Ramachandra, Engineering Mechanics, Standard Publishers and Distributors
4. S. Rajasekararn & G.Sankarasubramanian, Engineering Mechanics, Vikas Publishing Co.
5. Beer F.P. & Johnston E.R., Mechanics for Engineers – Statics and Dynamics, McGrwa Hill
6. Meriam J.L. & Kraige L.G., Engineering Mechanics, John Wiley


## ENGINEERING GRAPHICS

**CMELRPTA 105** **1+0+3**

**Module 1**

**Introduction of Engineering Graphics**: drawing instruments and their uses – familiarization with current, Indian standard code of practice for general engineering drawing.

Scales – plain scale – vernier scal – diagonal scale.

Conic sections – construction of ellipse, parabola, hyoperbola and rectangular hyperbola. Construction of cycloids, involute, archimedian spiral and logarithmic spiral – drawing tangents and normals to these curves.



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**Module 2**

**Introduction to orthographic projections**: planes of projection – projection of points in different quadrants. Orthographic projection of straight lines parallel to one plane and inclined to the other plane – straight lines inclined to both the planes – true length and inclination of lines with reference planes – traces of lines – projection of planes.

**Module 3**

Projection of polyhedra and solids of revolution – cubes, prisms, cones, cylinders, pyramids, tetrahedron, octahedron and sphere – frustums.

Projection of solids with axis parallel to one plane and parallel, perpendicular of inclined to the other plane - projection of solids on auxiliary planes.

Sections of solids by planes inclined to horizontal or vertical planes.

**Module 4**

Development of surfaces of cubes, prisms, cylinders, pyramids and cones – development of funnels and pipe elbows.

Introduction to isometric projection – isometric scale – isometric views – isometric projections of prism, pyramids, cylinders, cones and spheres.

**Module 5**

**Introduction to prespective projections**: prespective views of prisms.

Intersection of surfaces – methods of determining lines of intersection – intersection of prism, cylinder in cylinder.

**References**


1. Elementary Engineering Drawing – N.D.Bhatt.
2. Geometrical Drawing – P.S.Gill.
3. Geometrical Drawing – V.Lakshmi Narayanan & M.C.Marhur
4. Engineering Graphics – P.I.Varghese & K.C.John


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## BASIC CIVIL ENGINEERING

**CMELRPTA 106** **1+1+0**

**Module 1**

**Materials: Cement** – Types of Portland cement – grades of cement and its uses – Steel – types of steel for reinforcement bars – steel structural sections. Aggregates: sources, types & sizes – requirements of good aggregates. Mortar preparation – Concrete – grades of concrete as per IS Code – water cement ratio, workability, batching, mixing, compaction and curing.

**Module 2**

**Timber** – Varieties found in Kerala – effects, seasoning, decay preservation – specification for use in construction.

**Bricks:** varieties and strength – tests on bricks.

**Roofing:** Steel truss. A. C. and GI sheets roofing for industrial buildings – sketches only – reinforced concrete roofs. (Design details not required)

**Module 3**

**Building Components**: Foundation: Bearing capacity and settlement - definitions - Isolated footing - combined footing - rafts, piles and well foundation - machine foundation - special situations where those foundations are suitable. (Brief description only).

Superstructure: Walls - brick masonry - English bond - Flemish bond - Stone masonry-Random Rubble masonry.

**Module 4**

**Surveying:** Classifications - based on object of survey - based on instruments used. Chain Surveying: Instruments - field work - field book - procedure and booking. Compass Surveying: Prismatic compass – Basic principles - Bearing of survey lines & local attraction.

Leveling: field work - reduction of levels - Height of instrument method.

**Module 5**

**Site plan** preparation for buildings (Sketch only) – Kerala Municipal Building Rules – 1999-general provisions regarding site and building requirements – Exterior and interior open air spaces – coverage and floor area ratio – provisions of the size, height and ventilation of rooms (residential buildings) disposal of domestic waste water through septic tank and soak pit. Classification of roads and components of roads – basics of traffic engineering – Road marking – Traffic Islands, signaling – (brief description only)

**References**


1. Jha and Sinha, Construction and foundation Engineering, Khanna Publishers
2. Punmia B. C., Surveying Vol –I, Laxmi Publications
3. Rangwala, Building Materials, Charotar Book stall
4. K. Khanna & C. E. G. Justo, Highway Engineering, Khanna Publishers
5. Nevile, Properties of Concrete, Mc Graw Hill
6. Kerala Municipal Rules – 1999


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## BASIC MECHANICAL ENGINEERING

**CMELRPTA 107** **1-1-0**

**Module 1**

**Thermodynamics:** Basic concepts and definitions, Gas laws, specificheat – Universal gas constant – Isothermal, adiabatic and polytropic processes, work done and heat transferred: Carnot, Otto & Diesel Cycles – air standard efficientcy.

**Module 2**

**I.C. Engines:** Working of two stroke and four stroke engines – petrol and diesel engines – fuel systems, injector and carburetor – ignition system – lubrication and cooling systems.

Refrigeration and air-conditioning: methods of refrigeration – vapour compression and vapour absorption systems – block diagrams and general descriptions – winter and summer air conditioning systems – general description.

**Module 3**

**Power transmission:** Methods of transmission – belt, rope, chain and gear drives. Fields of application, calculation of length of belt – expression for ratio of belt tension. Velocity ratio and slip – simple problems – velocity ratio and choice of gear wheels – simple problems.

**Module 4**

**Power plants:** General layout of hydraulic, diesel, thermal and nuclear power plants, nonconventional energy sources, general description only.

Types of hydraulic turbines – selection of turbines depending upon head, discharge and specific speed – steam turbines – reaction and impulse turbines – compounding methods.

**Module 5**

Simple description of general purpose machines like lathe, shaping machines, drilling machine, milling machine and grinding machine.

Manufacturing process: moulding and casting, forging, rolling, welding – arc welding – gas welding (simple descriptions only)

**References**


1. Elements of Hear Engines — R.C.Patel
2. Thermal Engineering — P.L.Bellany
3. Elements of Mechanical Engineering — S.Domkundwar
4. Power Plant Engineering — Nagpal


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## BASIC ELECTRICAL ENGINEERING

**CMELRPTA 108** **1+1**

**Module 1**

S I unit of Current, Voltage, Power and Energy, Ohm's Law – Temperature Coefficient of Resistance – Kirchhoff's Laws – Solution of Series-Parallel D.C. circuits – star Delta Transformation – Magnetic Circuits – Flux-Flux density – m m f – Magnetising Force – Reluctance –Permeability –Comparison of Electric and Magnetic Circuits-Force experienced by a current carrying conductor in Magnetic Field – Electromagnetic Induction – Farady's Laws – Lenz's Law – Statically Induced e m f – dynamically induced e.m.f. – Self and mutual Induction – Coefficient of coupling.

**Module 2**

Alternating Quantity – Generation of Sinusoidal Voltage – Frequency – R.M.S. and Average Value – Form Factor – Peak Factor – Phasor Representation – Phase and Phase Difference – Solution of Series R L C circuits – Power and p.f. – Operator 'j' – Admittance – solution of series and parallel R L C circuits.

**Module 3**

Resonance – Series and Parallel – Q factor – Selectivity and Bandwidth – Three phase system – Representation – Star and Delta Systems – Phase sequence – Balanced Delta connected System – Balanced Star Connected system – Phasor representations – Simple Problems.

**Module 4**

D.C. Machine – Principle of Operations of a D.C. generator – Constructional Details – e.m.f. equation – Types of Generators.

D.C. Motor – Principle of Operations – Back e.m.f. and its Significance – Necessity of Starters – Types of motors and Applications.

Transformer – Principle of Operations – e.m.f. equation – Ideal Transformer – Constructional Details – Losses and Efficiency – Use of Power, Distribution and Instrument Transformers.

Induction Motor – Principle of Operation of 3 phase Induction Motor – Cage and Slip ring – Slip – Applications – types of Single Phase Induction Motors – Applications.

Alternator – Principle of Operations – Types

**Module 5**

Requirements of Good Lighting System – Working Principle of Incandescent – Fluorescent and Mercury Vapour Lamps – Estimate the quantity of Materials required and Draw the wiring layout of (a) Residential Building with One or Two rooms. (b) Workshop with one Induction Motor.

Generation – Types of Generation – Hydroelectric, Thermal, Nuclear and Non Conventional – Transmission – Need for high Voltage Transmission – Transmission Voltages in Kerala – Distribution – Underground Versus Overhead – Feeder – Distributor – Service Mains – Conductor materials – One line Diagram of a typical Power System.

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**References**


1. Electrical Technology — H.Cotton
2. Electrical Technology — Hughese
3. Electrical Circuits — Edminister J.A.
4. Electrical Design, Estimating & Costing — S.K.Bhattacharya, K.B.Raina
5. A Course in Electrical Power — M.L.Soni & P.V.Gupta


## BASIC ELECTRONICS ENGINEERING

**CMELRPTA109** **1+1+0**

**Module 1**

**Basic circuit components**

**Passive components:** Resistors - Types of resistors - Fixed Resistors - Variable resistors, resistor tolerance, colour coding, power rating of resistors.

Capacitors: Types of capacitors: Fixed capacitors, Mica, Paper, Ceramic and Electrolytic capacitors, Variable capacitors, voltage rating of capacitors.

Inductors: Fixed and Variable inductors.

**Semiconductor Components**: Definition of insulators, semiconductors and conductors types: Intrinsic and extrinsic, p and n type materials, pn junction, Classifications: Germanium, Silicon, Zener, LEDs (working principle only).
**Transistors**: npn, pnp, working principle.
**Integrated circuits**: Advantages, classification, Linear and Digital ICs.

**Module 2**

**Basic electronic circuits**
**Diode circuits:** Forward and reverse characteristics, Rectifiers: Half wave, full wave, Bridge circuits, DC Power supply: Capacitor filter, Zener regulator, eliminator circuit.
**Transistor circuits:** CB, CE, CC characteristics, concept of $\alpha$ and $\beta$, Amplifiers, common emitter RC coupled amplifier, Frequency response, Bandwidth.

**Module 3**

**Basic communication engineering**
**Communication:** Frequency bands: RF, VHF, UHF. Modulation – need for modulation, basic principles of amplitude, frequency, phase and pulse modulation.
**Radio engineering:** block schematic of AM radio receiver and transmitter - function of each block.
**Television Engineering**: Basic principles of TV – CRT - scanning - simplified block schematic of a monochrome TV receiver.
**Wireless communication:** mobile, microwave and satellite (basic principles and block schematic only).

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**Module 4**

**Basic instrumentation and Digital electronics**
**Electronic instrumentation:** Transducers: Basic principles of Strain guage, LVDT, Thermistor, Photodiode, microphones, Loud speaker.
Measurements: Multimeter and X-Y recorder.
**Digital electronics:** number systems - binary, octal and hexadecimal - conversion - representation of negative numbers using 1's compliment and 2's compliment method. Logic gates – truth table.

**Module 5**

**Basic Computer engineering**
**Digital computer:** Block schematic, function of each block: CPU, Memory, I/O devices.
Memory: RAM, ROM, Magnetic Tape, Floppy Discs, Hard Discs and CD.
**Programming**: Machine language, Assembly language, High level language, System Software, Operating systems, Compilers and Assemblers.

**References**


1. Basic Electronics: Bernad Grob, Mc Graw Hill Publication
2. Electronic Devices: Floyd, Pearson Education
3. Electronic Devices & Circuits Theory: Boyelstad & Naschelsky, Prentice Hall.
4. Electronic Principles: Malvino, Mc Graw Hill Publication
5. Digital Principles: Malvino & Leach, Mc Graw Hill Publication
6. Integrated Electronics: Millman & Halkias, Mc Graw Hill Publication
7. Electronic Instrumentation: H.S Kalsi, Mc Graw Hill Publication
8. Systems Programming: J.J. Donavan, Mc Graw Hill Publication


## WORKSHOP

### A-MECHANICAL ENGINEERING WORKSHOP

**CMELRPTA 110** **0+0+6**

Carpentry — Planing – cutting – chiseling, marking – sawing – cross and tee joints – dovetail joints – Engineering Application, Seasoning, Preservation – Plywood and plyboards.

Fitting — Practice in chipping – filing – cutting – male and female joints

Smithy — Forging of square and hexagonal prisms, hexagonal bolt – Forging Principles, materials and different operations.

Foundry — Preparation of Simple sand moulds – moulding sand characteristics, materials, gate, runner, riser, core, chaplets and casting defects. Demonstration & study of machine tool - lathe, drilling, boring, soltting shaping and milling machines, grinding, CNC and machining centers.

### B-CIVIL ENGINEERING WORKSHOP

**CMELRPTA 110**

**Masonry** English bond – flemish bond –wall –junction – one brick – one and a half brick - two brick two and a half brick—Arch setting.

**Plumbing** Study of water supply and sanitary fittings—water supply pipe fitting –tap connection – sanitary fittings - urinal, wash basin—closet (European and Indian), manholes.

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**Surveying** Study of surveying instruments – chain – compass – plane table – leveling – theodolite—minor instruments.

## C – ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP CMELRPTA 110

1. Wiring of one lamp and one plug, control of two lamps in series and in parallel.
2. Stair case Wiring.
3. Godown Wiring.
4. Hospital Wiring.
5. Wiring of fluorescent, C F L and mercury vapour lamp.
6. Wiring of Distribution Board including Power Plug using Isolator, M C B and E L C B.
7. Insulation megger – earth megger, measurement of Insulation resistance and earth resistance.
8. Identification of electronic components and soldering practice.
9. Soldering and testing of a H W and FW rectifier with capacitor filter in a P C B.
10. Soldering of typical I C circuit.

3 periods will be in Mechanical Engineering Workshop and 3 periods in Civil Engineering Workshop & Electrical Engineering Workshop alternately.

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# B.TECH. DEGREE COURSE

## SYLLABUS

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# CIVIL ENGINEERING BRANCH

# THIRD SEMESTER

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## ENGINEERING MATHEMATICS - II

**CMELPA 301** **3+1**

**Module 1 Vector Differential Calculus**

Differentiation of vector functions - scalar and vector fields – gradient, divergence and curl of a vector function – their physical meaning – directional derivative – scalar potential, conservative fields – identities – simple problems.

**Module 2 Vector Integral Calculus**

Line, surface and volume Integrals – work done by a force along a path – Application of Green's theorem, Stokes theorem and Gauss divergence theorem.

**Module 3 Function of Complex Variable**

Definition of analytic functions and singular points – derivation of C.R. equations in Cartesian co-ordinates – harmonic and orthogonal properties – construction of analytic function given real or imaginary parts – complex potential – conformal transformation of function like $z^n$, $e^z$, $1/z$, $\sin z$, $z+k^2/z$ – bilinear transformation – cross ratio – invariant property – simple problems.

**Module 4 Finite Differences**

Meaning of $\Delta$, $\nabla$, E, $\mu$, $\delta$ - interpolation using Newton's forward and backward formula – central differences – problems using Stirling's formula, Lagrange's formula and Newton's divided difference formula for unequal intervals.

**Module 5 Difference Calculus**

Numerical differentiation using forward and backward differences – Numerical integration – Newton – Cote's formula – trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – simple problems. Difference equations – Solution of difference equations.

**References**


1. Erwin Kreyszig, Advanced Engg. Mathematics, Wiley Eastern Ltd.
2. Grawal B.S., Higher Engg. Mathematics, Khanna Publishers.
3. M.K.Venkataraman, Numerical Methods in science & Engg., National Publishing Co.
4. S.Balachandra Rao and G.K.Shantha, Numerical Methods, University press.
5. Michael D.Greenberg, Advanced Engg. Mathematics, Prentice-Hall.
6. M. R. Spiegel, Theory and Problems of Vector analysis, McGraw – Hill.


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## FLUID MECHANICS - I

**C302** **3+2**

**Module 1**

**Properties of fluids:** Definition and Units, Mass density, specific weight, surface tension, capillarity, Viscosity – Classification of fluids – Ideal and real fluids, Newtonian and non – Newtonian fluids.

**Fluid pressure** – Atmospheric, Absolute, gauge and Vaccum Pressure, Measurement of Pressure – Piezometer, manometer, Bourden Gauge.

Total pressure and centre of pressure on a submerged lamina. Pressure on a submerged curved surface – pressure on lock gates, Pressure on gravity dams.

**Module 2**

**Buoyancy** – Centre of buoyancy – Metacentre – Stability of floating bodies – Determination of metacentric height – Analytical & experimental methods.

**Types of flow** – Streamline, Path line and Streak line, Velocity Potential, Stream Function, Circulation and Vorticity, Laplace's Differential equation in rectangular co-ordinates for two dimensional irrotational flow.

**Flow Net** – Orthogonality of stream lines and equipotential lines.

Stream tube – continuity equation for one dimensional flow.

**Module 3**

**Forces influencing motion** – Energy of fluids, Euler's equation, statement and derivation of Bernoulli's equation and assumptions made.

**Applications of Bernoulli's equation** – Venturi meter, Orifice meter, Pitot tube

**Orifices and Mouth Pieces** – Coefficients of Contraction, Velocity and Discharge, External and internal mouthpiece.

**Notches and weirs** – Rectangular, triangular, trapezoidal notches, Cippoletti weir, submerged weir, broad crested weir.

**Module 4**

**Flow through pipes:** Laminar and Turbulent flow – Reynold's experiment, loss of head due to friction, Darcy – Weishbach Equation, Other energy losses in pipes.

**Hydraulic Gradient and Total Energy Lines:** Flow through long pipes – Pipes in series and parallel, Siphon, Transmission of power through pipes –nozzle diameter for maximum power transmission.

**Laminar Flow in circular pipes:** Hagen poiseuille Equation, Laminar flow through porous media, Stoke's law.

**Turbulent flow through pipes:** Hydro-dynamically smooth and rough boundary, Velocity distribution for turbulent flow.

Drag and lift for immersed bodies.

**Module 5**

**Dimensional Analysis and Model studies:** Units and dimensions of physical quantities, Dimensional Homogeneity of formulae and it's application to common fluid flow problems, Dimensional Analysis-Rayleigh's method, Buckingham's method. Derivations of dimensionless parameters, Froude's, Reynold's, Webber, Mach numbers.

**Hydraulic Models:** Need, Hydraulic Similitude, geometric, Kinematic, Dynamic Similarity, Scale ratios of various physical quantities for Froude's and Reynold's model laws – problems, Selection of scale of models – Distorted models, Moving Bed models, Scale effects in models, Spillway models and Ship models.

**References**

1. Streeter V. L., Fluid Mechanics, Mc Graw Hill, International Students Edition.

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2. Dr. P. N. Modi & Dr. S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House Delhi.
3. Jagdishlal, Fluid Mechanics & Hydraulics, Metropolitan Book Co., Delhi.
4. R. J. Garde and A. G. Mirajoaker, Engineering Fluid Mechanics, Nem Chand & Bross., RoorKee.

## MECHANICS OF SOLIDS

**C303** **2+2**

**Module 1**

Stress-strain: Bars of varying cross section-Composite section-temperature stresses.

Strain energy: Gradually applied and suddenly applied load.

Compound stresses: Two dimensional problems-principal stresses and principal planes-maximum shear stress-planes of maximum shear- Graphical method.

**Module 2**

Bending moment and shear force: Shear force and Bending moment diagrams for various types of statically determinate beams with various loading combinations-relation between load, shear force and bending moment.

**Module 3**

Stresses in beams: Theory of simple bending- stresses in symmetrical sections-bending stress distribution- modulus of section- shear stress distribution in beams-stress in various sections- built up sections – composite sections- beams of uniform strength.

**Module 4**

Stresses due to torsion: Torsion of solid and hollow circular shafts- power transmitted-stresses due to axial thrust-bending and torsion.

Springs: Close coiled and open coiled- carriage springs.

Pressure vessels: Thin and thick cylinders-Lame's equation-stresses in thick cylinders due to internal and external pressures.

**Module 5**

Columns and struts: Short and long columns-elastic instability-Euler's formula for long columns with different end conditions- slenderness ratio- Rankine's formula-Empirical formula-Buit up members-columns subjected to eccentric loading and initial curvature.

Combined bending and direct stresses: Core of different sections- wind pressure on structures.

Unsymmetrical bending: Product of inertia-principal axes-stresses due to unsymmetrical bending.

Shear centre: Shear centre of sections having two axes of symmetry.

**References**

1. Timoshenko.S.P. Strength of Materials, Part-1, D.Van Nostrand company, Inc.Newyork.

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2. Popov E.P., Engineering Mechanics of solids, Prentice Hall of India, New Deihi.
3. Punmia B.C, Strength of Materials and Mechanics of structures, Vol.1, Lakshmi Publications, New Delhi.
4. Vazirani V.N., Ratwani N. M., Analysis of Structures, Vol.1, Khanna Publishers, New Delhi.
5. Kazimi S.M.A., Solid Mechanics, Tata Mc Graw Hill.
6. William A Nash, Strength of Materials, Mc Graw Hill.
7. Ryder G.H., Strength of Materials, ELBS.
8. Arthur Morley, Strength of Materials, ELBS, Longman's Green& Company.

## CONSTRUCTION ENGINEERING AND MANAGEMENT

**C 304** **3+1**

**Module 1**

**Admixtures in Concrete** – light weight concrete – heavy weight concrete – mass concrete – ready mix concrete – polymer concrete – vacuum concrete – shortcrete – pre-packed concrete – pumped concrete.

**Joints** – Construction joints – expansion joints – contraction joints – sliding joints – joints in water retaining structures etc.

Scaffolding and Formwork (elementary concepts only).

**Module 2**

**Flooring** – different types – Mosaic – marble – granite – roofing – pitched and flat roofs – domes and folded plate roofs – doors, windows and ventilators – types – construction details of paneled&glazed– I. S. specifications.

**Damp prevention** – Causes – Material used – Damp proofing of floors – walls – roofs.

Finished works – plastering, painting – white washing – distempering – application of Snowcem – Concrete repairs-construction and constructed facilities.

**Module 3**

**Functional planning of buildings** – general principles of site plan – principles of functional planning – orientation of buildings – shading principles.

**Modern construction materials – Intelligent buildings – building automation.**

**Module 4**

**Construction management** – Mechanisation in construction – earth moving, handling, pneumatic and hoisting equipment – pile driving equipment – Earth work computation – mass diagram – soil compaction & stabilization – owning and operating works of construction equipment.

**Module 5**

**Departmental organizational structure** – staff pattern – powers and functions of officers in planning, organising, directing and controlling construction –PWD code.

PWD system of account – classification of transactions –heads of accounts – cash – precautions in keeping accounts – construction accounts.

Stores – Safe custody of stores – classification – works – administrative sanction, technical sanction – categories of works.

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**References**


1. M. S. Shetty, Concrete technology, S.Chand & Co.
2. S. P.Arora, Building construction, Dhanpat Rai & Sons, New Delhi.
3. Dr.Mahesh Varma, Construction Equipment and its Planning and Application, Metropolitan Book Company.
4. R.L.Peurifoy, W.B.Ledbetter, Construction Planning, Equipment, and methods, Tata Mc Graw Hill.
5. B.L.Gupta, Amit Gupta, Construction Management and Accounts, Standard publishers and Distributors.


## SURVEYING - I

**C305** **3+1**

**Module 1**

**Introduction** – Principles – classifications – Chain surveying: Ranging and chaining. Reciprocal ranging – over-coming obstacles –setting perpendicular and gradients – traversing – plotting – errors in chaining and their corrections.

Compass surveying – Prismatic compass – surveyor's compass – bearings – systems and conversions – local attraction – Magnetic declination – dip – traversing – plotting – adjustment of error by graphical and analytical method (Bowditch's). Plane table surveying – Different methods – Traversing.

**Module 2**

**Levelling:** levels and staves – spirit level – sensitiveness – bench marks – temporary and permanent adjustments –booking - methods of reduction of levels – arithmetic checks-differential, fly, check and profile levelling cross sectioning – curvature and refraction – reciprocal levelling – errors in levelling – contouring – characteristics and uses of contours – Locating contours- plotting.

**Module 3**

**Theodolite traversing:** Transit theodolite – vernier, micrometer and micro-optic theodolites – description and uses – fundamental lines of a transit theodolite – temporary and permanenet adjustments – horizontal angle – reiteration and repetition methods– booking. Vertical angle measurements. Methods of traversing – conditions of closure – closing error and distribution – Gales traverse table – plotting by co-ordinates – omitted measurements.

**Tacheometric surveying**: - general principles Stadia method – distance and elevation formulae for staff held vertical – Instruments constants – analytic lens – tangential method – use of subtense bar – electromagnetic distance measurement – principles

**Module 4**

**Areas and volumes** Areas – by latitude and departure - meridian distance method – double meridian distance method – co-ordinate method – trapezoidal and

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Simpson's method – area by planimeter. Volume – trapezoidal and prismoidal rule. Volume from contours. - Capacity of reservoirs – Mass haul curve.

**Module 5**

**Curves:** Elements of a simple curve – setting out simple curve by chain and tape methods – Rankine's method – two theodolite method – compound and reverse curve (parallel tangents only) – transition curves – different kinds – functions and requirements – setting out the combined curve by theodolite – elements of vertical curve.

**References**


1. Dr. B. C. Punmia, Surveying Vol. I & II, Laxmi Publications (P) LTD, New Delhi.
2. T.P. Kanetkar & Kulkarni, Surveying and leveling Vol. I&II A.V.G.Publications, Pune.
3. Dr. K. R. Arora, Surveying Vol. I, Standard Book House New Delhi.
4. C. Venkatramaiah, Text Book of Surveying, Universities Press (India) LTD. Hyderabad.
5. S.K.Roy, Fundamental of Surveying, Prentice Hall of India, New Delhi.
6. S.K. Hussain & M.S. Nagaraj, Surveying, S.Chand & Company Limited.
7. B.N.Basak – Surveying.
8. Alak De, Plane Surveying, S.Chand &Co.


## CIVIL ENGINEERING DRAWING - I

**C306** **0+3**

### PART A

Detailed drawings of paneled doors, glazed doors, glazed windows and ventilators with wooden frames. (2 sheets).
Reinforced concrete staircase (1 sheet).
Roof truss in standard steel sections (1 sheet).
Roof lines (1 sheet).
Roof detailing for M. P. tiles (1 Sheet).

### PART B

Working drawings – plan, section and elevation of single storied buildings with RC and tiled roofs (only residential buildings) (8 sheets).
**(Preparation of plan from line sketches only)**

**Marks distribution**

| | |
|---|---|
| Part A | 40 marks |
| Part B | 60 marks |

**References**


1. Balagopal & T. S. Prabhu, Building drawing & detailing, Spades Publishers and distributors, Calicut.
2. Shah & Kale, Building Drawing, Tata Mc Graw Hill, New Delhi.
3. B.P.Varma, Civil Engineering drawing and House Planning, Khanna Publishers, Delhi.
4. Gurucharan Singh, Subhash Chander Sharma, Civil Engineering drawing, Standard Publishers distributors, Delhi.


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## MATERIAL TESTING LABORATORY - I

**C 307** **0+3**

1. Tests on springs (open and close coiled)
2. Bending Test on Wooden Beams using U. T. M.
3. Verification of Clerk. Maxwell's Law of reciprocal deflection and determination of E for steel.
4. Torsion Pendulum (M.S. wires. Aluminum wires and brass wires)
5. Torsion test using U. T. M. on M. S. Rod, torsteel and High Tensile steel.
6. Torsion Test on M. S, Road
7. Shear Test on M.S. Rod.
8. Fatigue Test
9. Impact Test (Izod and Charpy)
10. Hardness Test (Brinell. Vicker's and Rebound)
11. Strut Test.

**Note**

All tests should be done as per relevant BIS.

## SURVEY PRACTICAL - I

**C308** **0+3**

1. Running a closed compass traverse – plotting and adjustments.
2. Plane table surveying.
   i. Traversing.
   ii. Three point problem
   iii. Two point problem.
3. Levelling.
   i. Study of leveling instruments
   ii. Reduction of levels by H I method
   iii. Reduction of levels by rise and fall method
   iv. Longitudinal sectioning and cross sectioning.
   v. Contouring.
4. Theodolite Surveying
   i. Study of transit theodolite.
   ii. Measurements of horizontal angles by the method of repetition.
   iii. Measurement of horizontal angles by the method of reiteration.
5. Study of minor instruments.

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# FOURTH SEMESTER

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## ENGINEERING MATHEMATICS - III

**CMELRPTA401** **3+1+0**

**Module 1**

**Ordinary Differential Equations:** Linear Differential equations with constant coefficents - Finding P.I. by the method of variation of parameters – Cauchys equations - Linear Simultaneous eqns- simple applications in engineering problems.

**Module 2**

**Partial Differential Equations:** Formation by eliminating arbitrary constants and arbitrary Functions - solution of Lagrange Linear Equations – Charpits Method – solution of Homogeneous linear partial differential equation with constant coefficients – solution of one dimensional wave equation and heat equation using method of separation of variables – Fourier solution of one dimensional wave equation.

**Module 3**

**Fourier Transforms:** Statement of Fourier Integral Theorems – Fourier Transforms – Fourier Sine & Cosine transforms - inverse transforms - transforms of derivatives – Convolution Theorem (no proof) – Parsevals Identity - simple problems.

**Module 4**

**Probability and statistics:** Binomial law of probability - The binomial distribution, its mean and variance - Poisson distribution as a limiting case of binomial distribution - its mean and variance - fitting of binomial & Poisson distributions - normal distribution - properties of normal curve - standard normal curve - simple problems in binomial, Poisson and normal distributions.

**Module 5**

**Population & Samples:** Sampling distribution of mean ($\sigma$ known) –Sampling distribution of variance, F and Chi square test – Level of significance - Type 1 and Type 2 errors – Test of hypothesis – Test of significance for large samples – Test of significance for single proportion, difference of proportions, single mean and difference of mean (proof of theorems not expected).

**References**


1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. M.K. Venkataraman, Engineering Mathematics Vol. II -3rd year Part A & B, National Publishing Company.
3. Ian N.Sneddon, Elements of Partial Differential Equations,Mc Graw Hill International Edn.
4. Richard A Johnson. Miller and Fread's Probability and statistics for engineers, Pearson Education Asia / PHI.
5. Bali and Iyengar, A text book of Engineering Mathematics (Volume II), Laxmi Publications Ltd.
6. Erwin Kreyszig, Advanced Engg. Mathematics, Wiley Eastern Ltd.
7. Hogg and Tanis, Probability and statistical inferences, Pearson Education Asia.


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## FLUID MECHANICS - II

**C402** **2+2**

**Module 1**

**Flow in open Channel** – Uniform and non uniform flow, equations for uniform flow – Chezy's and Manning's formula, Most economical cross sections – Velocity distribution in open channels, Conveyance of a canal section, Normal depth, computation of uniform flow, Energy in open channel flow, specific energy, specific force diagrams, critical velocity, critical states of flow, Froude number, measurement of discharge in channels.

**Module 2**

**Gradually varied flow** – Dynamic Equation for gradually varied flow, Different forms of the dynamic equation, Characteristics of surface profiles in prismatic channels, backwater computation by direct step method.

**Module 3**

**Rapidly varied flow**, hydraulic jump – initial and sequent depths, non-dimensional equation, Practical application of hydraulic jump, Types of jump in horizontal floor, Basic characteristics of the jump, Energy loss, efficiency, height of jump, jump as energy dissipater, stilling basins, Location of hydraulic jump.

**Module 4**

**Hydraulic Machines** – Impact of jet, Force of jet on stationary and moving plates – turbines – Classification, velocity triangle for Pelton, Francis, Kaplan turbines, Specific speed, selection of turbines, draft tube – types, Penstock, surge tank – types, tail race.

**Module 5**

**Centrifugal Pumps** – Types, Velocity triangle for pumps, Head of pump, Losses and efficiency, Minimum starting speed, Specific speed, Multistage pump, Pumps in parallel. Positive displacement pumps – working principle, types of reciprocating pumps, work done, effect of acceleration and frictional resistance, slip and coefficient of discharge. Indicator diagram, separation in suction and delivery pipes. Air vessel – rate of flow into and from air vessel.

**References**


1. Ven Te Chow, Open Channel Hydraulics, Mc Graw Hill Ltd.
2. K. Subrahmanya, Flow in open channel vol.1, Tata McGraw Hill, New Delhi
3. Dr. P. N. Modi & Dr. S. M. Seth, Hydraulics & Fluid Mechanics, Standard Book House, Delhi.
4. Jagadheesh Lal, Hydraulic Machines, Metropolitian Book Co., New Delhi.


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## STRUCTURAL ANALYSIS - I

**C403** **2+2**

**Module 1**

**Deflection of determinate beams:** Differential equation of the elastic curve-slope and deflection of beams by method of successive integration-Macaulay's method- moment area method-conjugate beam method-deflection due to shear.

**Module 2**

**Energy Theorems**: Strain energy due to axial load-bending-shear and torsion-principle of super position-principle of virtual work-Castigliano's first theorem-Betti's theorem-Maxwell's law of reciprocal deflection-unit load method and strain energy method for determination of deflection of statically determinate beams-pin jointed frames-effect of temperature-lack of fit.

**Module 3**

**Moving loads and influence lines:** effect of moving loads-influence lines for reaction, shear force and bending moment for determinate beams-load position-absolute maximum bending moment.

**Module 4**

**Arches:** Theoretical arch-Eddy's theorem-analysis of three hinged arches – moving loads on arches-settlement and temperature effect.

**Module 5**

**Cables and suspension bridges**: General cable theorem-analysis of cables under concentrated and uniformly distributed loads-shape and stresses due to self weight-anchor cables-temperature effect-suspension bridges with three hinged and two hinged stiffening girders-influence lines for bending moment and shear force-temperature stresses in stiffening girder.

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**References**


1. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co.1996.
2. Smith J.C. Structural Analysis, Macmillian Pub.Co.1985.
3. Rajesekharan &Sankarasubramanian,G., Computational Structural Mechanics, Prentice Hall of India, 2001.
4. Wang C.K.& Solomon C.G., Introductory Structural Analysis, McGraw Hill.1968.
5. Sadhu Sindh, Strength of Materials, Khanna Publishers, 1988.
6. Seeli F.B.& Smith J.P., Advanced Mechanics of Materials, John Wiley &Sons, 1993.
7. Norris & Wilbur, Elementary Structural Analysis, McGraw Hill.
8. Junarker S.R., Mechanics of Structures, Vol. II, Charorbar Book Stall.
9. Timoshenko S.P, Young D.H., Theory of structures, McGraw Hill
10. Thadani B.N, Desai J.P, Structural mechanics, Weinall Book Corporation.
11. Punmia B.C., Strength of materials and theory of structures, Vol.II, Laxmi publications.

## ENGG. ECONOMICS AND CONSTRUCTION MANAGEMENT

**C 404** **2+2**

### Part A
### Engineering Economics

**Module 1**

**Indian Industries:** Industrial pattern-Industrial growth-Inadequacies of the program of industrialisation-Role of the public sector-problems and prospects of privatization-multinational corporations and their impacts on the Indian economy-inflation-demand pull and cost push-effects of price increases.

**Module 2**

**Accountancy:** Objectives of accounting – management accounting and financial accounting – journal – ledger – the trial balance – balance sheet – profit and loss account.

**Module 3**

**Financial management:** The Indian financial system – types of banks and their functions – long term financing – the stock market – functions and problems faced by the stock market – Industrial finance – loans and return of loans – cost benefit analysis – methods of appraising profitability – pay back method – average rate of return – internal rate of return – net present value.

### Part B
### Construction Management

**Module 4**

**Introduction to job planning and Management:** Bar charts and mile stone charts - work breakdown structure - C P M and PERT networks - Network and time estimates - Earliest expected time - Forward pass and backward pass - Time estimates - related problems.

**Module 5**

**Project costs analysis:** Cost Vs Time curve - optimum duration- related problems - updating, resource allocation - resource smoothing – resource leveling - Network compression - Compression limited by crashing - float- parallel critical paths - crashed critical paths – most economical solution.

**Module 6**

**Industrial Relations:** Payment of wages Act - Minimum wages Act - Employees State Insurance Act –Workers participation in management – labour welfare and social security – Industrial safety and welfare provision – role of state in labour welfare – role of labour welfare officers social security principles and practice.

**References**


1. A.N.Agarwal, Indian economy, Wishwa prakashan.
2. Prasanna Chandra, Fundamentals of financial management, Tata McGraw Hill.
3. Ruddar Datt, K.P.M. Sundaram, Indian economy, S.Chand &Co.
4. James.D.Steevens, Techniques for Construction Network Sheduling, McGraw Hill.


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5. S.C.Sharma, Management of Systems, Khanna Publishers.
6. T.R.Banga, S.C.Sharma, Industrial Organisation and Engineering Economics. Khanna Publishers.
7. L. S. Srinath, PERT and CPM Principles and Applications, East – West Press.

## SURVEYING - II

**C405** **3+2**

**Module 1**

**Triangulation:** triangulation figures – classification of triangulation systems – selection of triangulation stations – intervisibility and heights of stations – station marks – signals and towers – base line – choice – instrument and accessories – measurement of base lines – corrections – satellite stations – need, reduction to centre – extension of base.

**Module 2**

**Theory of errors and triangulation Adjustments**: Kinds of error – laws of weights – principles of least squares – determination of most probable value of quantities – probable error – distribution of error to the field measurements – normal equation – Method of corrections – Adjustment of simple triangulation figures.

**Module 3**

**Hydrographic surveying** – Equipment – Methods of locating soundings – reduction and plotting of soundings – use of sextants and station pointer. Geodesy – shape of earth – effects of curvature – spherical excess – convergence of meridians.

**Module 4**

**Terrestrial photogrammetry** – General principles – photo theodolite – horizontal position of a point from photogrammetric measurements – elevation of a point – determination of focal length of lens. Aerial photogrammentry – aerial camera – scale of vertical photograph – relief displacement on a vertical photograph – principle of parallax – stereoscopic pairs – flight planning – radial line method – flying height and overlaps – remote sensing – concepts of remote sensing – ideal remote sensing system.

**Module 5**

**Field Astronomy:** - Definitions – celestial sphere – co-ordinate systems – astronomical triangle – sidereal, apparent and mean solar time – corrections to astronomical observations – determination of azimuth, latitude and longitude – different methods.

**References**

1. T. P. Kanetkar and Kulkarni, Surveying and leveling Vol. II, A.V.G. Publications, Pune.
2. B. C. Punmia, Surveying and leveling Vol. II, Laxmi Publications (P) LTD, New Delhi.

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3. Thoms M.Lillerand, Remote sensing and image interpretation, John Wiley & Sons, Inc. New York.
4. Dr. K.R. Arora, Surveying Vol. II, Standard Book House, New Delhi.

## CIVIL ENGINEERING DRAWING - II

**C406** **0+3**

Preparation of design, sketches and working drawings as per area and functional requirements.
Working drawings for

1. Residential buildings: Flat and pitched roof – cottages, bungalows and flats (single storied and double storied) (4 sheets)
2. Public buildings – schools, offices, libraries, restaurants, commercial complexes (3sheets)
3. Preparation of site plan and plan as per building rules. (2 sheets)
4. Plumbing: water supply and sanitary drawings for residential buildings. (1 sheet)

The student is expected to know local building rules and national building code provisions. The student is expected to prepare sketch design for clients and submission drawings for approval

**References**

1. Balagopal & T. S. Prabhu, Building drawing & detailing, Spades Publishers and distributors, Calicut.
2. Shah & Kale, Building Drawing, Tata Mc Graw Hill. New Delhi.
3. B.P.Varma, Civil Engineering drawing and House Planning, Khanna Publishers, Delhi.
4. Gurucharan Singh, Subhash Chander Sharma, Civil Engineering drawing, Standard Publishers distributors, Delhi.
5. National Building code, Kerala building byelaws.

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## HYDRAULICS LABORATORY

**C407** **0+3**

### PART A -FLOW

1. Study of taps, valves, pipe fittings, gauges, pitot tubes, watermeters and current meters.
2. Determination of metacentric height and radius of gyration of floating bodies.
3. Hydraulic coefficients of orifices and mouth pieces under constant head method and time of emptying method.
4. Calibration of venturimeter, orifice meter and water meter.
5. Calibration of rectangular and triangular notches.
6. Determination of Darcy's and Chezy's constant for pipe flow.
7. Determination of Chezy's constant and Mannings number for open channel flow.
8. Determination of discharge coefficient for Plug-Sluices.

## PART B - MACHINERY

1. Study of centrifugal, self priming and reciprocating pumps; impulse and reaction turbines
2. Performance characteristics of centrifugal pump.
3. Performance characteristics of reciprocating pump.
4. Performance characteristics of self priming pump.
5. Performance characteristics of Pelton wheel .
6. Performance characteristics of Francis turbine.
7. Performance characteristics of Kaplan turbine.

## SURVEYING PRACTICAL - II

**C408** **0+3**

1. Measurement of vertical angles using theodolite.
2. Solution to problems on heights distances by observations using a theodolite.
3. Traversing using a theodolite – distribution of errors using gale's traverse table.
4. Determination of constants of the transit theodolite.
5. Heights and distances – using the stadia Tacheometer Principles.
6. Heights and distances – using tangential tachometry.
7. Setting out a simple circular curve by offsets from long chord.
8. Setting out a circular curve by Rankine's method.
9. Setting out a building – Foundation marking.
10. Study of total station.

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# FIFTH SEMESTER

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## ENGINEERING MATHEMATICS - IV

**CMELPA501** **3+1+0**

**Module 1**

**Complex Integration:** Line Integral –Cauchy's integral theorem- Cauchy's integral formula-Taylor's series-Laurent's series- zeros and singularities-Residues- residue theorem-Evaluation of real integrals using contour integration involving unit circle and semicircle.

**Module 2**

**Numerical solution of algebraic and transcendental equations:** Successive bisection method-Regula falsi method - Newton –Raphson method – solution of system of linear equations by Jacobi's iteration method and Gauss-Siedel method.

**Module 3**

**Numerical solution of ordinary differential equation:** Taylor's series method-Euler's method –Modified Eulers method - Runge – Kutta method (IV order)-Milne's predictor corrector method.

**Module 4**

**Z – Transforms:** Definition of Z transform- properties –Z transform of polynomial functions – trigonometric functions, shifting property, convolution property- inverse transform – solution of $1^{st}$ & $2^{nd}$ order difference equations with constant coefficients using Z transforms.

**Module 5**

**Linear programming:** graphical solution – solution using simplex method (non – degenerate case only) – Big-M method,two phase method- Duality in L.P.P.- Balanced T.P. – Vogels approximation method – Modi method.

**References**


1. Ervin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern limited.
2. Dr. B.S.Grewal, Numerical methods in Engineering & Science, Kanna Publishers.
3. Dr. B.S.Grewal, Higher Engineering Mathematics, Kanna Publishers.
4. Dr. M.K.Venkitaraman, Numerical methods in Science & Engineering, National Publishing Company.
5. P.C.Tulsian & Vishal Pandey, Quantitative techniques Theory & Problems, Pearson Education Asia.
6. Churchill and Brown, Complex variables and applications, McGraw-Hill.
7. Panneer Selvam, Operations research, PHI.
8. S Arumugam, A.T.Isaac & A Somasundaram, Engineering Mathematics Vol. III, Scitech publications
9. T.K.M.Pillai, G.Ramanaigh & S.Narayanan, Advanced Mathematics for Engg. Students Vol. III- S.Vishwananthan printers & publishers.


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## DESIGN OF CONCRETE STRUCTURES - I

**C502** **2+2**

**Module 1**

**Working stress method:** Introduction- permissible stresses-factor of safety – behaviour of R.C.C beams –assumptions-under reinforced –over reinforced and balanced sections. Theory of singly and doubly reinforced beams.

**Module 2**

**Limit state method**: Concepts-assumptions –characteristic strength and load-partial safety factors-limit states-limit state of collapse –limit state of serviceability. Theory of singly and doubly reinforced rectangular sections in flexure-design of simply supported and flanged beams.

**Module 3**

**Behaviour and design of one way and two way slabs**-Continuous slabs-analysis using method recommended by BIS -arrangements of reinforcement in slabs. Design of flat slab.

**Module 4**

**Design of columns:** Limit state method- I S specifications-design of columns with lateral and helical reinforcement-members subjected to combined axial load and bending.

**Module 5**

**Design of footings**-Isolated footing with axial and eccentric loading-combined footing. Stair cases-introduction to different types-design of simply supported flights-cantilever steps.

**References**


1. Relevant IS codes. (I.S 456, I.S 875,SP 16)
2. Park R and Pauloy T, Reinforced concrete structures, John Wiely & sons Inc.
3. Purushothaman P, Reinforced concrete structural elements-Behaviour, Analysis and Design, Tata McGraw Hill publishing company Ltd.
4. Unnikrishna Pillai S. & D.Menon, Reinforced concrete design, Tata McGraw Hill Publishing company Ltd.
5. Mallick S.K., Reinforced concrete, Oxford & IBH Publishing company.
6. Varghese P.C., Limit state design of Reinforced concrete, Printice Hall of India Pvt Ltd.
7. Ashok .K. Jain, Reinforced concrete- Limit state design, New Chand & Bose.


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## STRUCTURAL ANALYSIS - II

**C503** **2+2**

**Module 1**

Statically indeterminate structures-degree of indeterminacy-force and displacement methods of structural analysis. Force method of analysis of indeterminate structures - Method of consistent deformation-analysis of fixed beams and continuous beams. Clapyron's theorem of three moments- analysis of fixed and continuous beams Minimum strain energy-Castigliano's second theorem-analysis of indeterminate beams, portal frames and trusses.

**Module 2**

**Displacement method of analysis of statically indeterminate structures:** Slope deflection method-fundamental equations-analysis of continuous beams & portal frames (with sway and without sway) - Moment distribution method-analysis of continuous beams & portal frames (with sway and without sway).

**Module 3**

**Theories of Elastic Failure:** Maximum principal stress theory- maximum shear stress theory - maximum principal strain theory – Mohr's theory. Influence line diagrams for statically indeterminate structures: Muller Breslau's principle-Influence lines for reactions-shear force-bending moment-propped cantilever-continuous beams and fixed beams

**Module 4**

**Matrix methods:** Classification of structures-static& kinematic indeterminacy Stiffness method-coordinate systems-element stiffness matrix - Direct stiffness method - structure stiffness matrix-assembly of structure stiffness matrix from element stiffness matrix-equivalent joint load – incorporation of boundary conditions –analysis of beams and frames (rigid & pinjointed).

**Module 5**

**Flexibility method:** Flexibility influence coefficients - flexibility matrix-analysis of beams & frames (rigid and pinjointed).

**References**


1. Weaver &Gere, Matrix Analysis of Structures, East West Press.
2. Moshe F. Rubinstein – Matrix Computer Analysis of Structures- Prentice Hall, 1969.
3. Meek J.L., Matrix Structural Analysis, McGraw Hill,1971.
4. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co.1996.
5. Smith J.C. Structural Analysis, Macmillian Pub.Co.1985.
6. Rajesekharan & Sankarasubramanian,G., Computational Structural Mechanics, Prentice Hall of India, 2001.
7. Mukhopadhyay M., Matrix Finite Element Computer and Structural Analysis, Oxford & IBH,1984.
8. Wang C.K.& Solomon C.G., Introductory Structural Analysis, McGraw Hill.1968.
9. Pezemieniecki, J.S, Theory of Matrix Structural Analysis, McGraw Hill Co., 1984


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10. Sadhu Sindh, Strength of Materials, Khanna Publishers, 1988.
11. Seeli F.B.&Smith J.P., Advanced Mechanics of Materials, John Wiley &Sons, 1993.
12. Norris & Wilbur, Elementary Structural Analysis, McGraw Hill.
13. Junarker S.R., Mechanics of Structures, Vol. II, Charorbar Book Stall.

## COMPUTER PROGRAMMING

**C 504** **2+2**

**Module 1**

**Basic concepts of operation of a computer:** Operating system - drives, directories and files - types of files -COM, EXE, BAT - booting - operating system commands - creating, editing, listing and copying files - different levels of programming languages - high level languages - compilers and interpreters - compiling, linking and running - structured programming - program planning - algorithms, flowcharts - simple examples.

**Module 2**

**Introduction to C language:** Character set -operators - constants and variables - data types - use of control statements - if, for, while, do-while, switch - conditional assignment - use of built in I/O functions - writing small programs.

**Module 3**

**Functions**: Declaration - passing parameters by value and by reference - writing trigonometric, algebraic and string handling functions - recursion – scope rules - storage classes - macros.

**Module 4**

**Arrays**: Declaration and handling - sorting - pointers and arrays - pointers as parameters to functions - structures and unions - array of structures - sorting of strings - linked lists.

**Module 5**

**Data files:** Reading, writing and appending data files - binary files - transfer of data in blocks - command line arguments - operation on files at command line.

**References**

1. Balaguruswamy, Programming in C, Tata Mc Graw Hill.
2. Kern Ingham & Ritchie, The C programming language, Prentice Hall.
3. Byron S Gottfried, Programming with C, Tata Mc Graw Hill.
4. Y. Kenetker, Let us C, BPB Publications.
5. V. Rajaraman, Programming with C.
6. Y. Kenetker, Exploring C, BPB Publications.

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## ENGINEERING GEOLOGY

**C 505** **3+1**

**Module 1**

**Introduction**: Various branches of geology - Relevance of Geology in Engineering. Geologic time scale.

**Physical Geology**: Geomorphic processes-Rock weathering-Formation of soils-soil profiles-soils of India – Geologic work and engineering significance of rivers and oceans.

**Module 2**

**Dynamic Geology:** Interior constitution of the earth-Various methods to study the interior-crust, mantle, core-lithosphere-asthenosphere-major discontinuities-Moho, Guttenberg, Lehmann- composition of different layers-sima & sial.

**Plate tectonics**: Lithospheric plates-diverging, converging and transform boundaries-their characteristic features-midoceanic ridge, benioff zone and transform faults-significance of plate tectonic concept.

**Earthquake**: Elastic rebound theory-types of seismic waves-cause of earthquake-intensity and magnitude of earthquake-Locating epicentre and hypocenter-effect of earthquake-distribution of earthquake-earthquake resistant structures.

**Module 3**

**Mineralogy**: Definition and classification-important physical properties of minerals-colour, streak, lusture, transperancy, cleavage, fracture, hardness, form, specific gravity and magnetism. Study of the diagnostic physical properties and chemical composition of the following rock forming minerals: 1.Quartz, 2.Feldspar, 3.Hypersthene, 4.Auguite, 5. Hornblende, 6. Biotite, 7.Muscovite, 8.Olivine, 9.Garnet, 10.Fluorite, 11.Tourmaline, 12.Calcite, 13.Kyanite, 14. Kaolin, 15. Serpentine.

**Petrology**: Definition and classification-important structures and textures of igneous sedimentary and metamorphic rocks-diagnostic texture, mineralogy, engineering properties and uses of following rocks:

Igneous rocks: 1. Granite, 2. Syenite, 3. Diorite, 4. Gabbro, 5. Peridotite, 6.Dolerite, 7.Basalt 8.Pegmatite.

Sedimentary rocks: 1. Conglomerate, 2. Breccia, 3. Sandstone, 4. Limestone, 5. shale.Metamorphic rocks: 1. Gneiss, 2. Schist, 3. Slate, 4. Marble, 5. Quartzite, 6. Mylonite, 7. Pseudotachyllite.

Special Indian rock types: 1. Charnockite, 2. Khondalite, 3. Laterite.

**Module 4**

**Structural Geology**: Definition-outcrop-stratification-dip and strike. Folds-definition- parts of fold-classification-recognition of folds in the field- Faults-definition-parts of a fault-classification-recognition in the field-effects of faulting and subsequent erosion on outcrops. Joints-definition-classification. Unconformites-definition-classification recognition in the field. Effects of all the above described structures in the major engineering projects like reservoirs, dams, tunnels and other important structures.

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**Module 5**

**Engineering Geology:** Mass movement of earth materials-Landslides-definition, classification, causes of land slides and their corrections-Geological considerations in the selection of sites for reservoirs and dams. Geological considerations in Tunnel constructions and mountain roads-rocks as building materials.

**Hydrogeology**: Groundwater table-abundance and advantages-aquifer-acquiclude-acquifuge-artesian conditions and artesian wells-cone of depression–perched water table.

**Recommended field work**: Field trip to quarries or geologically significant places to learn - in site character of rocks in quarries/outcrops-measuring strike and dip of a formation-tracing of outcrops.

**References**


1. Arthur Holmes, Physical geology, Thomas Nelson.
2. Parbin Singh, Engineering & general geology, K.Katria & sons, New Delhi.
3. HH.Read, Rutleys elements of mineralogy, George Allen & Unwin Ltd, London.
4. G.W.Tyrell, Principles of petrology, B.I. Publications, Bombay.
5. M.P.Billings, Strucutural geology, Aisa publishing house, New Delhi.
6. Krynine&Judd, Engineering geology & geotechniques, Tata McGraw hill, New Delhi.
7. David Keith Todd, Groundwater hydrology, John Wiley & sons, New York.


## GEOTECHNICAL ENGINEERING - I

**C506** **3+1**

**Module 1**

**Soil formation and soil types**: Residual soil and transported soil-Soil structure-Basic structural units of clay minerals. Simple soil properties: three phase systems - void ratio - porosity - degree of saturation - moisture content - specific gravity - unit weight relationships.

**Laboratory and field identification of soils:** Determination of water content, specific gravity, determination of field density by core cutter and sand replacement method, grain size analysis by sieve, hydrometer and pipette analysis - Atterberg limits and indices - field identification of soils. Classification of soils: Principles of classification - I. S. classification - plasticity chart - Sensitivity and thixotropy.

**Module 2**

**Permeability of soils:** Darcy's law - factors affecting - constant head and falling head test - permeability of stratified deposits. soil- water system - classification of soil water - capillarity of soils - principles of effective stress.

**Seepage of soils:** seepage pressure, critical hydraulic gradient - quick sand condition - flownet diagram for isotropic and anisotropic soils - phreatic line in earth dams - exit gradient- protective filters.

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**Module 3**

**Shear strength:** Shear strength parameters - Mohr's circle – Mohr Coulomb strength theory -direct, triaxial, unconfined and vane shear tests- Drainage conditions - UU, CD and CD tests - choice of test conditions for field problems - measurement of pore pressure-critical void ratio and liquefaction.

**Module 4**

**Compaction:** Objects of compaction - proctor test and modified proctor test - concept of OMC and Max. dry density - Zero air void line - factors affecting compaction - effect of compaction on soil properties - field methods-.of compaction - control of compaction.

**Stability of slopes:** types of failures of soil slopes - Swedish circle method - ($\phi$) = 0 analysis and C - ($\phi$) analysis. Friction circle method -Taylor's stability number and stability charts.

**Module 5**

**Compressibility and consolidation of soils:** void ratio - pressure relationship - concept of coefficient of compressibility - coefficient of volume change and compression index - normally loaded and pre loaded deposits - determination of preconsolidation pressure - Terzaghi's theory of one dimensional consolidation - time rate of consolidation - time factor - degree of consolidation - square root time and log time - fitting methods - coefficient of consolidation - calculation of void ratio - height of solids methods and change in void ratio method - settlement analysis.

**References**


1. Murthy V. N.S, Soil Mechanics and Foundation Engineering, Nai Sarak, Delhi.
2. Jumkis A .R., Soil Mechanics, Calgotia Book Source Publishers.
3. Gopal Ranjan and A .S .R .Rao, Basic and Applied Soil Mechanics, New Age International Publishers.
4. Punmia B. C., Soil Mechanics and Foundation Engineering, Laxshmi Publications, New Delhi.
5. Arora K. R., Soil Mechanics and Foundation Engineering, Standard Publishers, Distributors.
6. V. Narasimha Rao and Venkatramaiah, Numerical Problems, Examples and Objective Questions in Geotechnical Engineering, Orient LongMan Publishers.
7. Lambe & Whitman, Soil Mechanics, John Wiely Publications.


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## COMPUTING TECHNIQUES LAB (C)

**C 507** **0+3**

1. Familiarisation with the computer system - PCs - LAN Peripherals.
2. Fundamentals of operating system like DOS, WINDOWS etc.,(Use of files, directories, internal commands, external commands,editors and compilers.
3. Familiarisation with packages like Wordstar, dbase, lotus, MS Office.
4. Familiarisation with data processing packages like FOXPRO etc,.
5. Familiarisation of application softwares - like Grapher, Surfur, Hardward Graphics - 3.

6. Familiarisation of drawing Softwares - AUTOCAD, Auto Architect, 3D Studio.
7. Programming with C as per syllabus of computer programming.

## GEOTECHNICAL ENGINEERING LABORATORY

**C508** **0+3**

1. Determination of specific gravity, water content and particle size distribution by hydrometer method / pipette method.
2. Determination of field density of soil by sand replacement method and core cutter method.
3. Determination of Atterberg limits.
4. Proctor's compaction tests (light and heavy).
5. Permeability tests for cohesive and cohesionless soil.
6. Direct shear test.
7. Triaxial shear test.
8. Unconfined Compression test.
9. Vane shear Test.
10. Consolidation test.
11. Study on Collection and Field Identification of Soil and Sampling Techniques.

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# SIXTH SEMESTER

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## STRUCTURAL ANALYSIS - III

**C601** **2+2**

**Module 1**

**Approximate methods of frame analysis:** Frames under lateral loading-portal method – cantilever method. Frames under vertical loading –substitute frame method. Space frames – tension coefficients-tension coefficient method applied to space frames

**Module 2**

Kani's method-continuous beams & frames (with and without sway). Beams curved in plan- analysis of cantilever beam curved in plan -analysis of curved balcony beams- analysis of circular beams over simple supports.

**Module 3**

**Elementary theory of elasticity:** State of stress at a point- stress tensor- equilibrium equations-stresses on arbitrary plane- transformation of stresses- principal stresses-strain components – strain tensor- compatibility equations- boundary condition equations- octahedral stresses.

**Module 4**

Two dimensional problems- plane stresses - plane strain – compatibility equations in two dimensional cases- Airy's stress functions- biharmonic equations- equilibrium equations in polar coordinates – compatibility equation and stress functions in polar coordinates- bending of cantilever loaded at ends.

**Module 5**

Plastic theory – ductility of steel- plastic bending of beams- evaluation of fully plastic moment – plastic hinge – load factor – method of limit analysis- basic theorems- collapse load for beams and portal frames.

**References**


1. Timoshenko S.P., Theory of Elasticity, McGraw Hill.
2. Sreenath, Advanced Mechanics of Solids
3. Sadhu Sindh, Strength of Materials, Khanna Publishers, 1988.
4. Seeli F.B.&Smith J.P., Advanced Mechanics of Materials, John Wiley & Sons, 1993.
5. Vazirani & Ratwani, Analysis of Structures, Khanna Publishers, New Delhi.
6. B.C. Punmia, Theory of Structures, Vol. II, Laxmi Publishers, New Delhi.
7. P.S.David, Analysis of continuous beams and rigid frames
8. Coats, Coutie, & Kong, Structural Analysis, ELBS & Nelson, 1980.
9. Kinney J.S., Indeterminate Structural Analysis, McGraw Hill, 1957.
10. Prakash Rao D.S., Structural Analysis, Universal Press Ltd, Hyderabad, 1997.


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## DESIGN OF STEEL STRUCTURES

**C602** **2+2**

**Module 1**

Loading standards - I.S structural sections - I.S specifications - design of tension members - riveted and welded connections - design of simple and compound beams - laterally supported and unsupported.

**Module 2**

Compression members - design of columns - short and long columns - axial and eccentric loading - built up columns-moment resisting connections - lacing and battening - column base - slab base - gusseted base - grillage foundation.

**Module 3**

Water tanks - rectangular, circular and pressed steel tanks – connections - analysis and design of supporting towers.

**Module 4**

Light gauge steel structures - introduction - type of sections - local buckling - stiffened and multiple stiffened elements - beams with and with out lateral supports.

**Module 5**

Chimneys- types - self supporting & guyed – stresses in chimneys – design of chimney stack, breech opening, base plate, connections and foundations.

**References**


1. Relevant I.S Codes. (I.S 800, I .S 875, Steel Tables)
2. Ramamrutham S, Design of steel and timber structures, Dhanpat Rai & sons, Delhi.
3. Ramchandra, Design of steel structures Vol. I & II, Standard book house, Delhi.
4. Gaylord & Gaylord, Design of steel structures, Tata McGraw-Hill.
5. Graham W. Owens& Peter .R. Knowles, Steel Designers Manual, Blackwell scientific publications.
6. B.C.Punmia, Design of steel structures, Laxmi publications.


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## TRANSPORTATION ENGINEERING - I

**C603** **3+1**

**Module 1**

**Introduction:** Comparison of highway and railway. Modern developments - Surface elevated and tube railways.

**Design of railway track:** Component parts of a railway track - their requirements and functions - Typical cross section - conning of wheels - wear and creep of rails - rail fastenings - Train resistances and evaluation of loading capacity.

**Geometric design of railway track:** Horizontal curves, radius – super elevation - cant deficiency - transition curves - gradients - different types - Compensation of gradients.

**Module 2**

**Railway operation and control:** Points and Crossings – Design features of a turn out - Types of railway track - Functions - Details of station yards and marshalling yards - Signaling and interlocking - Principles of track circuiting - Control of train movements by absolute block system - automatic block system - centralised traffic control systems.

**Module 3**

**Tunnel Engineering:** Tunnel sections - types, size and shapes - tunnel surveying - alignment, transfering centre, grade into tunnel - tunnel driving procedure - tunnelling through soft soil (Fore Poling Method) and tunneling through hardsoil (Cantilever Car Dump Method) Tunnel lining, ventilation - lighting and drainage of tunnels.

**Module 4**

**Harbour Engineering:** Classification of harbours and the effect of tides, winds and waves in the location and design of harbours; Break waters - necessity and functions - different types - forces acting on break water - design principles— construction of break waters - general study of pier heads - quays, landing stages - wharves, jetties, transit sheds and warehouses - channel demarcation - signal characteristics (Beacons, buoys, channel lighting - light houses).

**Module 5**

**Dock Engineering:** Functions and types of docks, dry docks, floating docks, slip ways, dock gates and caissons. Dredging - mechanical and hydraulic dredgers - general study of bucket ladder - dredger, grab dredger and dipper dredgers.

**References**


1. S.C. Rangawala, Railway Engineering, Chartor Publishing House
2. Saxena, Arora., Railway Engineering, Dhanpat rai & Sons
3. Subhash C. Saxena, Railway Engineering, Dhanpat rai & Sons
4. R. Srinivasan, Harbour, Dock & Tunnel Engineering, Chartor Publishing House
5. S.P.Bindra, Acourse in docks and Harbour Engineering, Dhanpat rai & Sons


## WATER RESOURCES ENGINEERING - I

**C604** **3+1**

**Module 1**

**Irrigation:** Definition-necessity of irrigation - environmental effects of irrigation - sources of water - planning concepts of irrigation schemes- irrigation systems-lift and flow irrigation – modes of irrigation - layout of irrigation schemes - historical development and irrigation in India through ages. Soil-water-plant relation – classes and availability of soil water- water requirement for crop - optimum moisture for crop growth - depth of water and frequency of irrigation - crop seasons and important crops in India. Crop period and base period - duty, delta and their relationship - factors affecting duty - commanded areas and

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intensity of irrigation. Consumptive use of water - evapotranspiration - determination of consumptive use - irrigation efficiencies.

**Module 2**

**Basic concepts of hydrology:** Hydrological cycle and its components - rainfall - rain gauge- mean precipitation over a catchment area - run off - factors affecting runoff - hydrograph - direct run off and base flow - unit hydrograph - S. hydrograph – applications of unit hydrograph.

**Estimation of runoff:** Empirical formula, infiltration method, rational method - flood estimation - flood frequency, unit hydrograph method and empirical formula.

**Module 3**

**Flow irrigation:** canal system - classification of canals and their alignment - requirements of a good distribution system-balancing depth - section of canal. Design of canals in alluvial soils - silt theories - non silting and non scouring velocity. Kennedy's theory -Lacey's theory - design of unlined canal using the two theories in alluvial soils - bed load and suspended load - canal outlets - requirements of good canal outlets - non modular - semi modular - modular outlets.

**Module 4**

**Ground water:** Definitions- porosity - specific yield - specific retention - storage coefficient-coefficient of permeability and transmissibility. Ground water velocity- Darcy's equation - flow towards wells - Dupit's theory of aquifers. Wells-shallow wells - deep wells - yield of an open well - constant level pumping test and recuperation test - tube wells - strainer, cavity and slotted tube wells-factors governing the selection of site and type of tube wells. Springs, Infiltration galleries and wells.

**Module 5**

**Reservoir planning:** Investigation - selection of site - storage zones in a reservoir - mass inflow curve - demand curve - calculation of reservoir capacity and safe yield from mass inflow curve - reservoir sedimentation - reservoir sediment control - single purpose reservoirs - multi purpose reservoirs - useful life of a reservoir. River training works: guide banks, groynes and marginal bunds – flood control - causes - methods of flood control - principles of flood routing. Soil conservation: water logging and its control - reclamation of salt affected land.

**References**


1. P.M.Modi, Irrigation-water recourses and water power, Standard book house, Delhi.
2. S.K Garge, Irrigation and hydraulic structures, Khanna Publishers, Delhi
3. R.K.Linsley, M.A.Kholar&J.L.H.Paulhur, Hydrology for Engineers, Mc Grawhill book co., New York.
4. Bharat Singer, Fundamentals of Irrigation Engineering.
5. V.B.Priyani, Irrigation and Waterpower Engg, Charota Book stall Anand.
6. Dr.B.C.Punmia&Dr.Pande.B.B.Lal, Irrigation & Water Power Engineering, Laxmi Publications.


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## GEO TECHNICAL ENGINEERING - II

**C 605** **3+1**

**Module 1**

**Site investigation and Soil exploration:** Objectives - planning - reconnaissance methods of subsurface exploration-test pits, auger borings - rotary drilling - depth and spacing of borings - bore log - soil profile - location of water table-sampling - disturbed and undisturbed samples. Standard Penetration test - Static and dynamic cone penetration test - field vane shear test - Geophysical methods.

**Stress Distribution:** Boussinesque's and Westergaard's equations for vertical pressure due to point loads and u.d.l. - assumptions and limitations - pressure bulb - Newmark charts and their use.

**Module 2**

**Earth Pressure:** General & local State of plastic equilibrium. Earth pressure at rest - active and passive. Rankine's and Coulomb's theories of cohesionless and cohesive soils - influence of surcharge and water table.

**Rehban's and Culman's graphical methods:** Sheeting and bracings in shallow and deep excavations.

**Sheet Piles:** Common Types of Sheet Piles – Uses of Sheet pile walls

**Module 3**

**Bearing capacity:** Definitions - ultimate and allowable - plate load test - factors affecting - Terzaghi's and Skempton's analysis - bearing capacity factors and charts - effect of watertable - bearing capacity from building codes andSPT values - Methods of improving bearing capacity - vibroflotation and sand drains.

**Settlement analysis:** Distribution of contact pressure estimation of immediate and consolidation settlement - causes of settlement - permissible, total and differential settlement - methods of reducing differential settlement.

**Module 4**

**Foundation:** General consideration - Functions of foundation - shallow and deep foundation - different types of foundation -Selection of type of foundation-steps involved.

**Footings**: Design of individual, continuous and combined footings - footings subjected to eccentric loading - proportioning footings for equal settlement.

**Module 5**

**Raft foundation:** Bearing capacity equations - design procedure - floating foundation.

**Pile foundation:** Uses of piles - Classification of piles - Determination of load carrying capacity of axially loaded single vertical pile (static & dynamic formulae) pile load tests - negative skin friction - group action & pile spacings - settlement of pile group.

**Caissons:** Open, box, and pneumatic caissons, construction details of well foundation - problems of well sinking.

**Note**

Structural design of foundations is not contemplated in this course.

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**References**


1. Arora K. R, Soil Mechanics & Foundation Engineering, Standard Publishers , Distributors.
2. Joseph E.Bowles, Foundation Analysis and Design, McGraw Hills Publishing Company.
3. Ninan P. Kurian, Modern Foundations, Tata McGraw Hills Publishing Company.
4. Peck, Hansen & Thornburn, Foundation Engineering.
5. W.C. Teng, Foundation Design.
6. Hans. F. Winterkorn & Hsai Yang Fang, Foundation Engineering Hand Book, Van Nostrand Reinhold Company.


## QUANTITY SURVEYING VALUATION AND SPECIFICATIONS

**C606** **2+2**

**Module 1 & 2 (24 hrs.)**

Purpose of estimates- different methods-Preparation of detailed estimates and abstracts for RCC Single storey buildings - R C. Footings, Columns – T- Beams. Preparation of bar bending schedule for R. C. works such as beams and slabs.

**Module 3 (8 hrs.)**

Preparation of specification for common materials of construction and its items of works with reference to IS specifications. Cost of materials at source - different types of conveyance and rates - head loads - preparation of conveyance statement - cost of materials at site.

**Module 4 (8 hours)**

Analysis of rates for earth works, mortars, RCC Works, plastering, brick works, stone works, laterite work, Pointing, form work, flooring - different types, wood works - reinforcement works.

**Module 5 (6 hours)**

Valuation - explanation of terms - material value, rate, years purchase - freehold and lease hold purchase - depreciation - methods of calculating depreciation - straight line method - constant percentage method, sinking fund method - and quantity survey method. Methods of valuation of land - comparative method - abstractive method. Methods of valuation of property - rental method - direct comparison with capital cost - valuation based on profit - valuation based on cost - development method - depreciation method.

**References**


1. Schedule of rates, KPWD
2. PWD Data Book
3. Dutta, Estimating and costing,S Dutta & Company, Lucknow
4. Rangawala S.C., Estimating & costing, Charator Anand, Delhi
5. I.S: 1200- 1968 - Methods of measurements of building and civil engineering.


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## MATERIAL TESTINGB LABORATORY - II

**C607** **0+3**

1. **Tests on cement.**
   a) Standard consistency, initial and final setting time.
   b) Compressive strength of mortar cubes.
   c) Specific gravity.
   d) Soundness.
   e) Fineness.
2. **Tests on fresh concrete.**
   a) Compaction factor test.
   b) Slump test.
   c) Vee-Bee test.
   d) Flow table test.
   e) Ball penetration test.
3. **Tests on hardened concrete.**
   a) Compressive strength of concrete cubes.
   b) Compressive strength of concrete cylinder.
   c) Splitting tensile strength.
   d) Modulus of elasticity.
   e) Flexural strength.
4. **Tests on RC beam**
5. **Tests on aggregates.**
   a) Aggregate crushing value for coarse aggregate.
   b) Specific gravity of coarse and fine aggregate.
   c) Bulking of fine aggregate.
   d) Bulk density and percentage voids of coarse aggregate.
   e) Grain size analysis of coarse and fine aggregate.
6. **Tests on bricks.**
   a) Compressive strength. b) Water absorption. c) Efflorescence.
7. **Tests on roofing tiles.**
   a) Transverse strength. b) Water absorption.
8. **Tests on flooring tiles.**
   a) Transverse strength. b) Water absorption. c) Abration tests.
9. **Compression tests on Laterite blocks**
10. **Study of**
    a) Strain measurements using electrical resistance- strain gauges.
    b) Nondestructive test on concrete.

**Note**

All tests should be done as per relevant BIS.

## COMPUTER AIDED DESIGN - I

**C608** **0+3**

**Module 1**

History and overview of CAD- popular CAD packages – advantages of CAD over manual drafting and design – hardware requirements – Configuration and installation of the CAD package.

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**Module 2**

**Creation of 2D drawings**: Menu structures- Menu bars, Screen menu, Pull down menu and Toolbars. Setting up units, limits, snap, grid, ortho mode etc. Controlling the drawing and drawing display – zoom, pan, regeneration, redraw. Drawing aids and tools - Osnap settings, point filters, inquiry commands, concept of UCS Modify tools – Erase, undo, redo, copy, move, rotate, offset, fillet, chamfer, array, scale, extend, break, explode, stretch, properties. Creation of blocks and symbols, using layers, color, linetype, ltscale etc. Dimensioning – Styles – Dim variables, scaling, formatting, annotation, QDIM adding text to drawing – multiline text, text styles, editing text. Working with multiple drawings, printing and plotting.

**Module 3**

**Creation of 3D drawings:** Concept of 3D Drawings, working with views in 3D using view point, Real-time 3D rotation, concept of UCS in 3D, multiple active work planes. 3D modeling techniques- wire modeling, surface modeling, surface revolution, tabsurf, rulesurf, edgesurf, and 3D face, region modeling, solid modeling, fillets and chamfer, editing faces of 3D solid & shelling. Calculating mass properties and interference Creating perspective and sectional perspective views of 3D models. Shading and rendering - assigning material, landscapes, mapping, lights and scenes etc.

**Module 4**

**AutoLISP**: Introduction of AutoLISP- Data types, signs and symbol conventions, user defined functions, variables and functions. Writing your own commands.

**Module 5**

1. Planning and designing of residential buildings (2D only)
2. Planning and designing of public buildings (2D only)
3. Term project – To prepare sketch design for Client and submission drawings for approval (Using National Building code provisions and Local Building rules)

**References**


1. Reference Manual of the package.
2. National building code of India.
3. Shah & Kale, Building Drawing, Tata McGraw Hill.
4. Balgopal T.S. Prabhu, Building Drawing and Detailing, SPADES, Calicut.
5. Sham Tickoo, Understanding AutoCAD 2002, Tata McGraw Hill.
6. Sham Tickoo, AutoCAD 2002 with Applications, Tata McGraw Hill.


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# SEVENTH SEMESTER

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## DESIGN OF CONCRETE STRUCTURES - II

**C701** **2+2+0**

**Module 1**

**Prestressed concrete**: I. S. Specifications - general principles - methods and systems of prestressing - losses of prestress - design of simply supported rectangular beams.

**Module 2**

**Retaining walls**: Types-Earth pressure diagrams- modes of failure- design of cantilever and counter fort retaining walls ("L" not included)

**Module 3**

**Design of continuous beam**: using coefficients given in IS: 456 - design of circular beams -uniformly loaded and supported on symmetrically placed columns.

**Module 4**

**Domes**: membrane stresses in spherical and conical domes –design of domes with uniformly distributed and concentrated loads - openings - ring beams.

**Module 5**

**Water tanks:** Types - design of ground supported and overhead water tanks- rectangular and circular with flat bottom-flexible and rigid joints – design of staging- columns and bracings - IS code method.

**References**


1. Relevant IS codes.(I.S 456, I.S 875,SP 16)
2. Park R and Pauloy T, Reinforced concrete structures, John Wiely & sons Inc.
3. Purushothaman P, Reinforced concrete structural elements-Behaviour, Analysis and Design, Tata Mc Graw Hill Publishing company Ltd.
4. Unnikrishna Pillai .S & D.Menon, Reinforced concrete design, Tata Mc Graw Hill Publishing Company Ltd.
5. Mallick S.K, Reinforced concrete, Oxford & IBH Publishing Company.
6. Varghese P.C, Limit state design of Reinforced concrete, Printice Hall of India Pvt Ltd.
7. Ashok .K. Jain, Reinforced concrete- Limit state design, New Chand & Bose.
8. Krishna Raju, Prestressed Concrete, Oxford and I B H Publishing companyLtd.
9. Ramamruthum S., Design of Reinforced concrete structures, Dhanpat Rai Publishing co.
10. Punmia B.C, Reinforced concrete structures Vol II, Lakshmi Publications


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## WATER RESOURCES ENGINEERING - II

**C702** **3+1+0**

**Module 1**

Dams: definitions - classifications - factors governing the selection of the type of dam and site of the dam- investigation for a dam site. Gravity dam: forces acting - combination of forces for design - modes of failure and stability requirements - elementary profile and practical profile - principal and shear stress - base width of elementary profile by stress and stability criteria-stresses developed in the elementary profile - low dam and high dam - methods-of design of gravity darn (introduction only) - joints - keys water stops – opening and galleries and shaft - foundation treatment - brief description on type of spill ways.

**Module 2**

Arch dams: types of arch dams - forces acting -design of arch dams on thin cylinder theory - introduction of other methods of design - thick cylinder theory - trial load analysis and elastic theory. Buttress dam - types - advantages and disadvantages. Earthen dam - types of earth dams - design criteria - selection of a dam - phreatic line - stability analysis - different dam sections to suit available materials and foundation - rock fill dams materials of construction - impervious membrane type and earth core type (brief description only)

**Module 3**

Diversion head works: function and component parts of diversion head works - effect of construction of weir on the regime of river- causes of failure of weirs on permeable foundation. Bligh's creep theory and its limitations - Lane's weighted creep theory - Khosla's theory and design of impermeable foundation - design of vertical drop weir - silt control devices - silt excluder, silt ejector.

**Module 4**

Design and drawings emphasizing the hydraulic aspects of the following structures: (1) Regulators-design of head regulator and cross regulator. (2) Canal falls- trapezoidal notch fall- vertical drop fall sarda type and glacis fall. (3) Cross drainage works –aqueduct and syphon aqueduct.

**Module 5**

Water power engineering: Classification of hydel plants- runoff river plants, storage plants and pumped storage plants - low, medium and high head schemes - investigation and planning - fore bay – intakes - surge tanks - penstocks - powerhouse – selection of turbine-Scroll casing - draft tube - tailrace definition of gross head - operating head - effective head - firm power –secondary power- load factor, capacity factor and utilization factor.

**References**


1. P. M. Modi, Irrigation-water resourses and water power, Standard book house.
2. S. K.Garg, Irrigation and hydraulic structures, S. K.Garg, Khanna publishers
3. R. K. Linsley, M. A. Kholer, L. H. Paulhur, Hydrology for Engineerers, Tata Mc Graw Hill
4. Bharat Singer, Fundamentals of Irrigation Engineering


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5. V. B. Priyani, Irrigation and water power Engg. , Charotar Book stall.
6. B C Punmia, Pande B B Lal, Irrigation and water power engineering, Laxmi Publications.
7. R.S.Varshney, S.C.Guptha, R.L.Guptha, Theory and design of irrigation
8. Structures, Vol II, Nemchand &brothers, Roorkee.

## TRANSPORTATION ENGINEERING - II

**C703** **2+1+0**

**Module 1**

**Classification, alignment and surveys** -classification of highways - historical development of road construction, typical cross section of roads in urban and rural areas - definitions of various cross sectional elements - requirements and factors controlling alignment of roads, engineering surveys for highway location.

**Geometric design of highways**: pavement surface characteristics, camber and width requirements, sight distances - over taking zone requirements and related problems. Design of horizontal alignment - speed - radius – super elevation - extra widening - transition curves, methods of attainment of super elevation - related problems.Design of vertical alignment - gradient and grade compensation - sight distance requirements on summit and valley curves -simple problems on design of vertical alignment.

**Module 2**

**Traffic Engineering**: traffic characteristics-various traffic studies and their applications . Traffic control devices- Traffic signs, markings, traffic signals and traffic islands. Types of road intersection - kerb parking - principles of highway lighting - (Design of traffic signals not expected).

**Module 3**

**Highway materials**: Road aggregates - their desirable properties and tests. Bituminous materials - properties and tests - sub grade soil - desirable properties.

**Highway construction and maintenance**: Bituminous surface dressing and pavement construction - cement concrete construction and joints in concrete pavements - types and causes of failures in flexible and rigid pavements, highway drainage.

**Pavement design**: Basic difference between flexible and rigid pavements -factors affecting their design - designof flexible pavements-CBR, GI & IRC methods.

**Module 4**

Aircraft characteristics- regional planning, selection of site for airport - factors to be considered. Imaginary surfaces - approach zone and turning zone, obstructions and zoning laws. Runway orientation and layout of runways: use of wind rose diagrams, basic runway length and corrections required. Methods of classification of airports. Stopway, clearway and taxiway design requirements.

**Module 5**

Aprons: loading aprons - factors controlling size and number of gate positions - aircraft parking systems - holding apron. Facilities required in the terminal building - facilities for movement of baggage and passengers. Use of blast fences,

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typical airport layout - airport markings - marking of runways, taxiways etc. Airport lighting: lighting of runways approaches, taxiways and aprons. Air traffic control -airways, navigational aids and landing aids.

**References**


1. S. K.Khanna, C. E. G. Justo, Highway engineering, Nem Chand Publications.
2. L .R. Khadiyali, Traffic Engineering and Transport Planning, Khanna Publishers.
3. S.K. Khanna, M. G. Arora, S.S. Jain, Airport Planning & Design, Nem Chand Publishers
4. S. C. Rangwala, Airport Engg., Charotar Publishing Co.
5. Horenjeft, Robert & Francise Mc Keivy, Planning and design of airports, Mc Graw Hill
6. G V Rao, Principles of transportation and High way Engineering, Tata Mc Graw Hill, New Delhi.
7. Robert. G. Hennes, Martin Ekse, Fundamentals of Transportation engineering, Tata Mc Graw Hill.
8. Theodore M Matson, Wilbur.S.Smith, Frederick.W.Hurd, Traffic Engineering, Mc Graw Hill.


## ARCHITECTURE AND TOWN PLANNING

**C704** **2+1+0**

**Module 1**

Principles of architectural Design:

Definition of architecture: factors influencing architectural development-characteristic features of a style-historical examples. Creative principles: function/strength, aesthetics - deciding the space and form - detailed analysis of factors influencing the space - activity space, circulation space and tolerance space - Factors influencing form- form perception - form expressive of function-form related with material and Structural system. Design principles - elements of composition - point, line, plane, texture, colour etc. - mass and scale, proportion, rhythm, balance and unity - iconic, canonic and analogic design -consideration of comfort factors such as acoustics, lighting, ventilation and thermal aspects.

**Module 2**

Functional planning of buildings: Occupancy classification of buildings'-general requirements of site and building - building codes and rules - licencing of building works. Functional planning of building such as residential, institutional, public, commercial, industrial buildings - the process of identifying activity areas and linkages - drawing built diagrams - checking for circulation, ventilation, structural requirements and other constraints preparing sketch plan and working drawings - site plans.

Kerala Municipal acts – planning regulations of corporations and developmental authorities – Kerala building bye laws.

**Module 3**

Building services: Vertical Transportation: stairs - layout and details of different types of timber - masonry, steel and concrete stairs - pre-cast concrete stairs,

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elevators - types - traction, hydraulic operation - passenger, service goods elevators - design considerations of passenger elevators - handling capacity - arrangement of lifts - positioning, escalators, features- operation arrangement - ramps. Ventilation and air conditioning - ventilation requirements -natural and mechanical ventilation - air movement - cross ventilation - effect of orientation - radiation - evaporation, calculation of air conditioning load - summer and winter air conditioning. Plumbing services: typical details of water supply and sewage disposal arrangements for residence, hospitals and hostel buildings - standard requirements.

**Module 4**

Town planning theory: Evolution of towns: problems of urban growth - beginning of planning acts - ideal town - garden city movement - concept of new towns and conservative theory - comprehensive planning of towns- Survey and analysis of town: fare maps - land use classification - transportation network - housing demographic arid social surveys - economic studies - environmental aspects. Theories of land use planning, transportation planning and housing development. Urban area lineation: urban influence zone - urban region concept of regional planning.

**Module 5**

Planning Process: Concept of master plan: structural plan, detailed town planning scheme and act.

Estimating future needs: planning standards for different land use allocation for commerce, industries, public amenities, open areas etc. planning standard for density distributions-density zone, planning standards for traffic networks - standards of roads and paths - provision for urban growth-growth models. Plan implementation: town planning legislation and municipal acts - planning control development schemes - urban financing - land aquisitions - slum clearance schemes - pollution control aspects.

**References**


1. Banister Fletcher, History of World Architecture, Taraporevalas.
2. Broadbent, Theory of Architecture Design, John Wiley Sons
3. Gallien, Urban Pattern, D.Van Nostrand CD. Inc.
4. Nelson P. Low's, Planning to Modern City
5. Rangwala, Town Planning, Charotar Publishing House.
6. S.C Agarwala, Architecture and Town Planning, Dhanpatrai &sons.


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## ENVIRONMENTAL ENGINEERING - I

**C705** **3+1+0**

**Module 1**

Scope of Environmental Engg. population trends resource use - effect on the balance of ecosystem and natural resources. Water supply Engineering: Rural and Urban water supply systems - water requirements - consumption for various purposes, percapita demand, factors affecting percapita demand, variations in the rate of consumption, fire demand, design period, forecasting population. Quality

of water: impurities in water and their importance - water borne diseases - sampling of water for tests - analysis of water - physical, chemical and bacteriological tests - MPN total coliforms, fecal coliforms by A-1 medium. WHO and Indian standards for drinking water.

**Module 2**

**Collection of water**: intakes - location, types, principles of design and construction. Transmission of water: free flow and pressure conduits - pipe materials - hydraulics-of flow - design of pipes - Indian standards for pipes.

Pumps: Classification - rotary, reciprocating, centrifugal pumps, hand pumps submersible pumps - selection of pumps - location of pumping stations.

Distribution of water: pumping system, gravity system, pumping and storage system distribution reservoirs -storage capacity of balancing reservoir, pipe grids, methods of analysis of network. Appurtenances in the distribution system - meters, valves, fire hydrants etc. pipe laying, testing & disinfections of mains. Detection and prevention of leaks in distribution system-cleaning and maintenance of distribution system, pipe corrosion and its control.

Water supply of buildings: house connections - overhead tanks.

**Module 3**

**Introduction**: Sanitation, sewage, sewer, and sewerage systems, sewage treatment and disposal. Sanitary Plumbing - Sanitary Fixtures, traps, soil pipe, anti-siphonage pipes, systems of plumbing. House drainage: Principles-inspection chamber, ventilation, testing of drain, connection of house drain to street sewer. Sewerage systems – separate, combined and partially combined systems, situation for adoption, collection pattern.

**Quantity of sewage**: sanitary sewage - sources, factors affecting. Fluctuations in sewage flow, peak factor.

**Characteristics of sewage**: physical, chemical and biological characteristics and analysis, sampling, population equivalent relative stability-cycles of decay.

**Storm sewage**: Factors affecting, intensity of rainfall, rational and empirical formula, time of concentration, intensity - duration curve and formula.

**Design of sewers**: Flow formula, minimum and maximum velocity of flow, effect of variation of discharge on velocity, use of partial flow diagrams, design of circular sewers, longitudinal and cross section of sewer lines.

**Module 4**

**Construction of sewers**: Materials of sewers, crown corrosion, sewer joints, planning, preparation of layout and construction of sewers and testing of sewers, cleaning and maintenance, ventilation of sewers. Sewer appurtenances: inlets, catch basins, clean outs, manholes, drop manholes, lamp holes/flushing tanks, grease and oil traps, inverted siphons, storm regulators. Sewage pumping: pumping stations - types of pumps - capacity of pumps - design of pumps.

Natural methods of wastewater disposal: land disposal -. Sewage farming - disposal by dilution - self purification of streams - oxygen sag curve - dilution into sea, comparison of disposal methods.

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**Module 5**

**Air pollution**: Types of pollutants, sources, health effects, Monitoring.
**Noise pollution**: Sources, effects. Solid waste management: Type and source of solid waste, characteristics, collection, transportation and processing- Disposal-composting, sanitary land fill, incineration

**References**


1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.
2. M.N. Rao & H.V.N. Rao, Air Pollution, Tata Mc Graw Hill Pvt. Ltd., New Delhi.
3. S. K. Garg, Environmental Engineering Vol. I & II, Khanna Publishers, New Delhi.
4. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.
5. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.


## OPTIMIZATION TECHNIQUES (ELECTIVE - I)

**CMELRTA 706-1** **3+1+0**

**Module1**: **Classical optimization techniques**

Single variable optimization – Multivariable optimization with no constraints – Hessian matrix – Multivariable saddle point – Optimization with equality constraints – Lagrange multiplier method - Multivariable optimization with inequality constraints – Kuhn-Tucker conditions.

**Module 2**: **One-dimensional unconstrained minimization**

Elimination methods – unrestricted search method – Fibonacci method – Interpolation methods – Quadratic interpolation and cubic interpolation methods.

**Module 3**: **Unconstrained minimization**

Gradient of a function – Steepest descent method – Newton's method – Powells method – Hooke and Jeeve's method.

**Module 4**: **Integer – Linear programming problem**

Gomory's cutting plane method – Gomory's method for all integer programming problems, mixed integer programming problems.

**Module 5: Network Techniques**

Shortest path model – Dijkstra`s Algorithm – Floyd`s Algorithm – minimum spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm.

**References**


1. S.S. Rao, Optimization theory and application, New Age International P. Ltd.
2. A.D. Belegundu, T.R. Chandrupatla, Optimization Concepts and applications in Engineering, Pearson Education Asia.
3. F. S. Budnick, D. McLeavey, R. Mojena, Richard D, Principles of Operations Research for Management, Irwin, INC.
4. H. A. Taha, Operation Research an introduction, Eastern Economy Edition.
5. R. Panneerselvam, Operations Research, PHI.


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## THEORY OF PLATES (ELECTIVE - I)

**C706-2** **3+1+0**

**Module 1**

Plates- Introduction- classification of plates- thin plates and thick plates – small deflection theory and large deflection theory – basic concepts of two imensional theory of elasticity – fourth order differential equation for generalized bending problems (derivation in next module)

**Module 2**

Pure bending of plates – slope and curvature of slightly bent plates – relation between bending moment and curvature in pure bending – stresses – variation– plates subjected to lateral loadings -small deflection theory of thin plates – Love- Kirchhoff's theory – assumptions– derivation of fourth order differential equation

**Module 3**

Solution techniques for fourth order differential equation – boundary conditions – simply supported, built- in and free edge – Navier's solution for simply supported rectangular plates – uniformly distributed and concentrated load.

**Module 4**

Strain energy – pure bending of plate – bending of plates by lateral loads – Mindlin's theory – assumptions - equilibrium equations – stress variations – comparative study with Love- Kirchhoff's equations.

**Module 5**

Circular plates – polar coordinates – differential equation of symmetrical bending of laterally loaded circular plates- uniformly loaded circular plates – circular plates loaded at the centre

**References**


1. Lloyd Hamilton Donnell, Beams, plates and shells, Mc Graw Hill, NewYork.
2. Timoshenko, W Krieger, Theory of plates and shells, Mc Graw Hill.
3. Owen F Hughes, Ship structural design, John Wiley & Sons, New York, 1983.
4. William Muckle, Strength of ship structures, Edqward Arnold Ltd, London, 1967.


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## PRESTRESSED CONCRETE (ELECTIVE - I)

**C706-3** **3+1**

**Module 1**

Introduction: Basic concept of prestressing - Advantages of prestressed concrete over reinforced concrete - materials for prestressed concrete and their characteristics. Uniform prestress distribution in prestressed concrete - nonuniform prestress distribution - moments of resistance.

**Module 2**

Systems and methods of prestressing- pre-tensioning systems - post tensioning systems - Thermo elastic prestressing - chemical prestressing.Behavior of prestressed concrete beams in flexure : load - deflection curves for prestressed concrete beams - Interpreting bending tests - Microcracks and visible cracks - Failure.

**Module 3**

Losses in prestress: purpose of assessing losses - counteracting elastic loss-loss of prestress in case of nonuniform prestress - creep, shrinkage, relaxation and achorage losses - friction loss in prestress -graphical solution of friction losses - overcoming friction losses.

**Module 4**

Elastic design of sections for flexure: design of a simply supported beam with symmetrical sections of post tensioned and pretensioned type- tension members.

**Module 5**

Bearing and anchorage zone- statically indeterminate structure-continuous beams-primary moment –secondary moment- resultant moment – Concordant cable profile-Gyons theorem.

**References**


1. N. Krishna Raju, Prestressed Concrete, Tata Mc Graw Hill Publishing Co. Ltd, New Dehi.
2. S K Mallick, A P Gupta, Prestressed concrete, Oxford and IBI Series.
3. R. H. Evans, Bennet E W, Prestressed concrete theory and design, Chapman and Hall, London.
4. T. Y. Lin, Design of Prestressed Concrete Structures, Asia Publishing House.


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## GROUND IMPROVEMENT TECHNIQUES (ELECTIVE - I)

**C706-4** **3+1+0**

**Module 1**

Necessity of soil improvement-selection of improvement method- mechanical stabilization-effect on engineering properties-dewatering-well-point system-electro osmosis-pre-loading- sand drains- methods of installation-vibro-flotation-stone columns.

**Module 2**

Chemical stabilization- cement stabilization- factors affecting soil cement mixing-admixtures- lime stabilization-effect of lime on soil properties-construction of lime stabilized bases-bituminous stabilization- thermal stabilization- electrical stabilization.

**Module 3**

Introduction to grouts and grouting- basic functions – groutability ratio – classification of grouts-properties of grouts- fluidity, bleeding potential, rigidity and thixotropy, strength and permeance- grouting applications-seepage control in

soil under dams and for cut off walls- seepage control in rock under dams- stabilization grouting for under pinning.

**Module 4**

Earth Reinforcement- mechanism and concept- stress strain relationship of reinforced soil-design theories and stability analysis of retaining wall-tie back analysis-coherent gravity analysis- application areas of earth reinforcement

**Module 5**

Geotextiles: Soil reinforcement with geotextiles- classification- concepts- geotextiles as separators, filters, and drainage media-damage and durability of geotextiles

**References**


1. M.J.Tholinson - Foundation design and construction Robert M.Koerner - Construction and Geotechnical methods in Foundation Engineering
2. C.J.F.P.Jones - Earth Reinforcement and Soil structures
3. R.A.Jewell - Soil Reinforcement with Geotextiles
4. Donald P.Coduto - Geotechnical Engineering. Principles and Practices Prentice Hall India


## CONCRETE TECHNOLOGY (ELECTIVE - I)

**C706-5** **3+1+0**

**Module 1**

**Concrete materials**: cement manufacture - chemical composition hydration - types of cement- tests for cement - setting and hardening - Aggregates - Classification - requirements - size - shape - texture - Tests for aggregates - Alkali aggregate reaction - grading of aggregate - sieve analysis - Flakiness index - Elongation Index Impact value-abrasion value -Water - general requirements - quality of water.

**Module 2**

**Fresh Concrete**: Workability - factors affecting - measurement of workability - different tests for workability - segregation - bleeding - process of manufacture of concrete - Batching - mixing - transportation - compaction - curing of concrete - curing methods - admixtures in concrete - air entraining agents - Accelerators – Retarders -workability agents - Damp proofing agents - Miscellaneous admixtures - quality control.

**Module 3**

Elastic properties of Concrete - factors affecting modulus of elasticity - Strength of concrete: w/c ratio - gel/space ratio - Gain of strength with age. - accelerated curing tests - maturity concept of concrete - effect of maximum size of aggregate on strength - relation between compressive and tensile strength - revibration - high speed slurry mixing - creep - shrinkage - factors affecting.

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**Module 4**

**Durability of concrete**: - sulphate attack - methods of controlling sulphate attack. Durability of concrete in sea water - action of organic acids, mineral oils, sugar etc. on hard concrete - thermal properties of concrete - Fire resistance cracks in concrete–Remedies, Testing of Hardened concrete. flexural strength - comparison of cuube test and cylinder test - Indirect tension test methods -concrete mix design - IS methods - ACI methods - mean strength - characteristic compressive strength - Non distructive testing of concrete.

**Module 5**

**Special aggregates**: light weight - artificial - natural - special concrete - no - fine concrete- high density concrete - Sulphur infilterated concrete - fibre reinforced concrete - polymer concrete polymer impregnated concrete - polymer cement concrete - properties of polymer concrete - special concreting methods - cold Weather concreting, hot weather concreting - Ferrocement.

**References**


1. Krishna Raju N, Concrete Technology
2. A.M. Neville, Properties of concrete
3. M.S. Shetty, Concrete Technology


## TRAFFIC ENGINEERING AND MANAGEMENT (ELECTIVE-I)

**C706-6** **3+1+0**

**Module 1**

Traffic management - scope of traffic management measures - restrictions to turning movements - one way streets - tidal flow operation - regulation of traffic - Need and scope of traffic regulations- Motor Vechicle Act - Speed limit at different locations- regualtion of the vechicle - regulations concerning the driver rules of the road enforcement.

**Module 2**

**Highway capacity**: Its importance in transportation studies - basic, possible and practical capacity - determination of theoretical maximum capacity -passenger car units - level of service - concept in HC manual - factors affecting level of service.

**Module 3**

**Design of Intersection**: Design of at grade & grade seperated intersection - rotary intersection - capacity of rotary intersection - traffic signals - design of fixed timesignal - pretimed signalised intersection - performance - Websters approach for the design.

**Module 4**

**Traffic Safety**: causes of road accidents - collection of accident data - influence of road, the vehicle .the driver, the weather and other factors on road accident - preventive measures.

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**Module 5**

**Traffic Flow**: theory of traffic flow - scope - definition and basic diagrams of traffic flow- basic concepts of light hill - Whitham's theory - Car 'following theory and queuing

**References**


1. Khadiyali L.R. Traffic Engineering and Transport planning, Khanna Tech Publishers
2. Khanna O.P and Jesto C.G; Highway Engineering, Nem Chand Publishers
3. Martin, Whol, Traffic system Analysis for Engineers
4. Donald Drew, Traffic Flow Theory


## OBJECT ORIENTED PROGRAMMING (ELECTIVE - I)

**C706-7** **3+1+0**

**Module 1**

Introduction to OOP: Basic concepts objects-classes-data abstraction-inheritance-polymorphism-dynamic binding-virtual functions-advantages of OPP over procedure oriented programming-object oriented languages. Introduction to C++ - C++ character set - C++ tokens-data types constants and variables - declaration of variables - operators, expression, and statements-type compatibility - type casting- I/O operators <<and >>) cascading of 1/0 operators.

**Module 2**

Control flow and iterative statements standard input-output streams arrays: one dimension array-multidimensional array- array Initialization. Structures: definition-referencing structure elements. Function prototypes-argument data types-returning values and their types – scope - rules of functions and variables – built - in functions.

**Module 3**

Classes and Objects: Class declaration - data member functions private and public members class function definition member function definition - private and public member functions methods - creating objects - accessing class data members-accessing member functions - constructors and destructors – declaration, definition and use.

**Module 4**

Advanced features: Dynamic memory allocation-pointers –new and delete operators-pointer variables- pointers to objects-accessing member functions-classes with pointers to objects- accessing member functions - classes with pointers-copy constructor-static members-friend classes-friend functions-operator overloading File handling in C++: File pointers F-stream classes open (), close () read (). write () functions-detecting end of file.

**Module 5**

Polymorphism and Inheritance: Function overloading-base class derived class-class conversion-visibility modes-private, public and protected members-single

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inheritance -privately derived and publicly derived - making protected member inheritable - access control-virtual functions-dynamic binding- abstract classes-concept of multiple inheritance.

**References**


1. Stanely, Lipman, C++ primer
2. Balaguruswammy, Object Oriented Programming with C++, Tata Mc Graw Hill
3. Robert Lafore, Turbo C++
4. Gordenkeith, Data Abstraction and OOP in C++
5. Strostraup, C++ Programming Language
6. David Parsons, Object Oriented Programming with C++, B P B Publications
7. Y.Kanetkar, Let Us C++, BPB Publications.


## OPEN CHANNEL AND COASTAL HYDRAULICS (ELECTIVE - 1)

**C706-8** **3+1+0**

**Module 1**

Parameters of open channel flow - uniform and non uniform flow normal depth - conveyance - friction formula - specific energy - specific force - diagram - critical depth - application to problems. Critical flow computation - section factor - hydraulic exponent for critical flow computation and its use for trapezoidal channel.

**Module 2**

Hydraulic jump - sequent depths - dimensionless equation of the jump - loss of head - the jump at the feet of a spillway - criteria for the formation of a jump - use of jump as an energy disspiator. Control of jump by sills - stilling basins.

**Module 3**

Non-uniform flow - friction slope - differential equation of non-uniform flow - the 12 type of surface profiles - the point of control - computation by Bresse's method and the simplified step method.

**Module 4**

Water waves - classification into periodic progressive, periodic oscillatory, oscillatory and stationary waves - ocean waves - wave period - wave length and celerity. General expression for the celerity of deep Water - gravity wave and shallow water gravity wave - determination of the wave length and celerity for any water depth given the deep water wave amount as wave energy (no proof). Wave deformation - transformation of waves on a slope (description only) reflection of waves at a vertical sea wall. Clapotis - wave refraction - breaking of waves (description only).

**Module 5**

Wind generated waves - wave forecasting - significant wave height - breakwaters - different types. Coastal erosion with special reference to the Kerala Coast - shore protection measures - sea walls - tetrapods. groynes and'beach nourishment.

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**References**


1. 1.S.M.Woodword, C.J.Posey, Hydraulic of Steady Flow in Open Channels
2. F. N. Henderson, Open Channel Flow
3. A. I. Ippen, Estuary and Coast line Hydrodynamics
4. K. E. R. I. Peechi, Coastal Engineering Publications
5. V. T. Chow, Open Channel hydraulics, Mc Graw Hill
6. Robert .M. Sorensen, Basic coastal engineering, John Willy & Sons


## AIR POLLUTION CONTROL (ELECTIVE - 1)

**C 706-9** **3+1+0**

**Module 1**

Introduction - Significance of air pollution studies, factors that contribute to air pollution - possibilities to air pollution abatemant - air pollution legislation - Techno - administrative aspects of air pollution - Emission and noise standards of Kerala State Pollution Control board.

**Module 2**

Gaseous pollutants-source, chemistry, adverse effects on plants, animals and human beings, properties - tolerance levels - carbon monoxide, carbon dioxide, aldehydes, hydrocarbons - compounds of sulphur, compounds of Nitrogen, Oxidants, Hydrogen fluoride - Control of gaseous pollutants - Automobile pollution control.

**Module 3**

Particulates in the air - source, nature and adverse effects - control of particulates - settling, filtration, collection in fluids, electrostatic precipitation, conversion to harmless and useful products. Meteorology related to atmosphere - pressure, temperature, lapse rates - humidity - condensation - wind direction and velocity. Effects of meteorological parameters on transport and diffussion. Atmospheric Electricity.

**Module 4**

Optics of the atmosphere - Effects of air pollutants on atmospheric visibility - methods of measurement of visibility - Introduction to noise pollution. Photochemical reactions of the atmosphere.

**Module 5**

Purpose and principles of measurement of (1) High volume sampler (2) Exhaust gas analyser (petrol and diesel) (3) Stack sampler (4) Sound level meter - industrial hygiene and in plant safety to workers.

**References**


1. Henry C Perkins, Air pollution, Mc Graw Hill Pvt Ltd, NewDelhi.
2. Arthur C Stern, Air pollution, Vol I, II, III, IV, V, Academic Press, NewYork.
3. Noel De Nevers, Air pollution control Engineering, Mc Graw Hill International Edition, Mc Graw Hill Inc, New Delhi.
4. M. N. Rao, H V N Rao, Air pollution, Tata Mc Graw Hill Pvt Ltd, NewDelhi.


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## REMOTE SENSING AND ITS APPLICATIONS (ELECTIVE - I)

**C706-10** **3+1+0**

**Module 1**

**Principles and concepts**: Introduction and definition of remote sensing terminology- principles and methods of remote sensing- electro-magnetic radiation and spectrum- radiation sources-interference- atmospheric effects on remote sensing- atmospheric window –energy interaction with surface features- different types of platforms- sensors and their characteristics-orbital parameters of a satellite- multi concepts in remote sensing.

**Module 2**

**Aerial photogrammetry**: Definition- types of photographs- geometry of photographs – parallax - pair of photographs- height determination- flight planning stereoscopy.

**Module 3**

**Interpretation of images**: Aerial photo interpretation – basic elements- techniques of photo interpretation- application of aerial photo interpretation- photographs versus maps- interpretation of satellite images- ground truth collection and interpretation and verification- advantages of multi date and multi band images.

**Module 4**

**Imagery**: Landsat imagery- thermal infrared imagery- Radar imagery- digital image processing- comparison with image types- applications of satellite imagery- merits- limitations-comparison with aerial photographs.

**Module 5**

**Applications:** Applications in water resources management- land use mapping and monitoring- soil sciences- geology- agriculture- forestry - oceanography.

**References**


1. Thomas M. Lillesand & Raiph W. Kiefer, "Remote sensing and image interpretation", John Wiley Sons.
2. Floyd F. Sabins, "Remote sensing principles and interpretation", Freeman and company.
3. Campbell J. B, "Introduction to remote sensing", The Guilford press, London.
4. Curran P.J., "Principles of remote sensing", Longman, London.
5. Engmen E.T and Gurnay R. J.,"Remote sensing in hydrology", Chapman and Hall.
6. Wolf P.R., "Elements of photogrammetry", McGraw Hills.


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## TRANSPORTATION ENGINEERING LAB

**C707** **0+0+3**

**TEST ON SOIL**

1.Califormia bearing ratio method.

**TEST ON BITUMEN**

2. Softeningpoint of Bitumen
3. Ductility test on Bitumen
4. Specific gravity of Bitumen
5. Flash and fire point test
6. Stripping value test
7. Viscosity using Viscometer

**TESTS ON ROAD AGGREGATES**

8. Aggregate crushing value test
9. Impact value test
10. Specific gravity test
11. Shape tests - Flakiness index and elongation index
12. Los angles abrasion test
13. Bulk density, specific gravity, void ratio and porosity of coarse aggregate, water absorbtion.

**TESTS ON MIXES**

14. Marshell stability value
15. Determination of bitumen content by bitumen extractor.

## COMPUTER AIDED DESIGN II

**C708** **0+0+3**

**Module I and II**

- **INTRODUCTION**
  Overview and the Environment of STAAD-III Package.
- GENERAL DESCRIPTION
  Type of structure, Unit systems, structure geometry and Co-ordinate systems, global co- ordinate system, Local co-ordinate systems
- STAAD III Commands- Using Edit Input-Command Formats-Text Input.
- STAAD PRE- Graphical Input Generation-"Concurrent" Verifications-Library- Geometry Generation – Dimensioning.
- STAAD POST – Graphical Post Processing – Animation – Icons – Isometric View – Zooming-Results of Analysis & Design – Query reports.
- LOAD – Member Load, Element Load, Joint Load, Floor Load, Self weight Command, Load case no, Load Combination .Load Generation for Wind Load, Seismic Load and Moving Load
- FINITE ELEMENT ANALYSIS & Dynamic Analysis.
- DESIGN for Concrete and Steel Structures using IS: 456 and IS 800 respectively.
- STAAD INTDES – Interactive Design Series for slabs, retaining walls and footings.

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**Note**

The student has to practice the above topics by working out problems in

1. Analysis and design of steel trusses, Steel and RCC framed structures.
2. Analysis and design of multi-storied framed structures.
3. Analysis and design of RCC and steel water tanks.

**Module III & IV**

Project management using CPM/PERT Software
(Microsoft Project /PRIMAVERA software)

1. Practice on the GUI of the software and Input of Date
2. Practice on Creating Bar Charts/Ghant charts
3. Practice on creating CPM/PERT charts and finding out critical path.
4. Practice on resource allocation and leveling of resources.
5. Practice on Project Monitoring (Cost &Time)
6. Plotting and printing of various charts and project

**Note**

The student has to practice the above topics by doing Project Management for Turn key projects related to Civil Engineering applications.

**References**


1. STAAD III Reference Manual
2. MS Project/PRIMAVERA Reference Manual


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# EIGHTH SEMESTER

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## ADVANCED STRUCTURAL DESIGN

**C801** **2+2+0**

**Module 1**

Road bridges: I. R. C. Specifications - slab bridges -T-Beam bridges - box culvert - bearings.

**Module 2**

Shell structures: General principles for membrane theory for symmetrical uniformly distributed load - design of a simply supported single barrel cylindrical shell for membrane stresses - beam method. Folded plates: general principles - structural behaviour of plates (design not required)

**Module 3**

Industrial buildings: roof loads - analysis and design of trusses - design of purlins - design of bracing – supporting system.

**Module 4**

Design of plate girders and gantry girders - riveted and welded compound sections.

**Module 5**

Steel bridges: - I. S. Specifications - design of highway and railway bridges of plate girder type.

**References**


1. I. R. C. Bridge code, Indian Railway Bridge code, I. S. 456, I. S
2. Victor J.D., Design of Concrete Bridges, Oxford& I B H Publishing Company, New Delhi.
3. Krishna Raju, Advanced Design of Concrete Structures, Oxford& I B H Publishing Company, New Delhi.
4. Ramchandra, Design of Steel Structures. Vol II, Standard Book House. Delhi.
5. Ramaswamy G.S., Design and Construction of Concrete Shell Roofs, Mc Graw Hills


## FINITE ELEMENT ANALYSIS

**C802** **3+1+0**

**Module 1**

Introduction to FEM-Historical development-Idealization of actual structures-Mathematical model-General procedure of FEA-Displacement approach. Solution techniques- Gauss Elimination – Frontal solver (concepts only)

**Module 2**

Finite element analysis- -Energy principles- Principle of Stationary Potential Energy- Complementary Energy - Variational approach -Stable- Unstable-Neutral equilibrium-Virtual work- Principle of virtual forces – Principle of virtual displacements.

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**Module 3**

Shape functions-Lagrangian and Hermition Interpolation – Polynomials – General coordinates-Area coordinates-Compatibility –$C_0$ and $C_1$ elements-convergence criteria- conforming & nonconforming elements – Patch test

**Module 4**

Stiffness matrix-Bar element-Beam element-Triangular elements - Constant Strain Triangle-Linear Strain Triangle- Isoparametric elements-Numerical Integration - Gauss Quadrature.

**Module 5**

General plate bending elements- Plate bending theory – Kirchhoff's theory – Mindlin's theory – Introduction to locking problems- preventive measures – reduced integration – selective integration. Axysymmetric elements- Introduction to shell elements

**References**


1. O C Zienkiewicz,.Finite Element Method, fourth Edition,McGraw Hill,
2. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley &Sons.
3. Stephen P.Timoshenko& Krieger, S.W., Theory of Plates and Shells, McGraw Hill.
4. C.S.Krishnamoorthy, Finite Element Analysis, Tata McGraw Hill .New Delhi, 1987.
5. S.Rajasekharan, Finite Element Analysis, Wheeler Publishing Co., &Sons.1993.
6. T.Kant, Finite Element Methods in Computational Mechanics, Pergamons Press.
7. K.J.Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall,
8. Mukhopadhyay M., Matrix Finite Element Computer and Structural Analysis, Oxford &IBH, 1984.
9. Irving H.Shames, Energy &Finite Element Methods in Structural Mechanics.
10. Desai C.S.&Abel J.F., Introduction to Finite Element Methods, East West Press.


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## BUILDING TECHNOLOGY AND MANAGEMENT

**C803** **3+1+0**

**Module 1**

**Concrete Mix Design:** General concepts. BIS method of mix design, American standards of mix design, IS-method of mix design, Durability concepts in mix design - Requirements and tests of materials required for mix design.-Fibre reinforced concrete- High performance concrete.

**Form work**. General arrangements – general requirements – common faults – materials for form work – form work arrangements – form work design – loads on forms – design procedure – form work vibration for compaction of concrete – stripping time and shoring.

**Module 2**

**Prefabricated construction:** Advantages, foundation units, wall panels, frames for opening, walls–units for roofs and floors – low cost roof systems. Hollow

concrete blocks, Ferro cement – use and application – modular co-ordination – method of production – flow line method – station method – manufacturing process for structural units.

**Codification and Standerdisation- Value analysis:** Various methods and techniques.

**Module 3**

**Construction company organization:** Different types of organizational set up – construction team – objectives of civil engineering management – duties and responsibilities of a civil engineer – functions of construction management. Technical planning.

**Site organization:** Organization of labour, resources, materials, method of execution of the project – inspection and quality control- safety in construction.

**Module 4**

**Materials Management:** Functions of materials management – inventory control techniques.

**Construction contracts:** Item rate contract – Lump-sum contract –Labour contract – Negotiated contract – Global contract – Percentage contract – Cost plus percentage contract- Cost plus fixed fee contract- Cost plus fluctuating fee contract – Target contract – All in contract.

**Module 5**

**Claims manual for a construction organization:** Law of contract - Extra work and deviation order – claims – owner's claim – sub contractor's claim – disputes and arbitration – consequences of mistake in contracts – terms and conditions of contract – contract documents – earnest money – security deposit – warranty period – contract signed under coercion – contract signed by minors, insane or drunken persons – authority to agree and find, validity of an oral agreement – conditions and warranties – express terms and implied terms – voidable contracts and their performance – illegal and voidable contracts – liability for tort in contract- litigation – breach of contract and remedies – discharge of contract – equity, privity of contract – transfer of contractual rights and obligations.

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**References**


1. M .S Shetty, concrete technology, S. Chand & Co.
2. S. P Arora, Building constructions, Dhanpat Rai & sons, New Delhi.
3. B. L Gupta, Amit Gupta, Construction Management and accounts, standard publishers and Distributions.
4. Construction Management and accounts – V .N Vazirani.
5. National Building code of India – Indian standards.
6. Construction Engineering & Management, S. Seetharaman, Umesh
7. Publications, Delhi.

## ENVIRONMENTAL ENGINEERING - II

**C804** **3+1+0**

**Module 1**

Introduction: Storage of water - effect of storage on quality of water, general layout of treatment plant - surface water and ground water. Aeration, purpose of aeration. Sedimentation - plain sedimentation, theory of sedimentation, continuous flow sedimentation tanks. Chemically aided sedimentation - necessity, theory of coagulation and flocculation - generally used coagulants, dosage, feeding, mixing devices, clariflocculators, design of flash mixers clarifiers and clarifloculators.

**Module 2**

Filtration - Theory of filtration, filter media - sand for filtration. Classification of filters - design, construction, control, operation and maintenance of rapid sand filters and slow sand filters. pressure filters, dual media & multimedia filters.Disinfection: requirements of a good disinfectant, chlorination - action, application, and dosage chlorine demand, pre chlorination, post chlorination, double chlorination, super chlorination, breakpoint chlorination, chloramination. Other disinfectants. Miscellaneous treatment methods: color, odour and taste removal, iron and manganese removal, deflouridation, removal of hardness, desalination.

**Module 3**

Introduction; Objectives of waste water treatment - Effluent standards, KSPCB Standards, BIS Standards. Layout of conventional treatment plant - preliminary, primary, secondary and tertiary treatments in general. Preliminary process: screens - types of screens, design, disposal of screenings; comminutors, grit chamber - function, design, construction and operation, disposal of grit , detritus tank, skimming tank -function, design and operation, disposal of skimmings Sedimentation: Theory of sewage sedimentation - design, construction and operation, rectangular and circular tanks, disposal of sludge.

**Module 4**

Biological process: principle and theory of biological treatment. Sewage filtration: Trickling filters - design, construction and operation. Activated sludge process: Design, construction and operation of conventional and extended aeration, aeration methods. Miscellaneous methods- Stabilization ponds, Oxidation ditch, Aerated lagoons, rotating biological contactors; disinfection of sewage effluents.

**Module 5**

Sludge treatment and disposal: quantity of sludge, characteristics of sludge, sludge thickening, digestion, conditioning and disposal, design of sludge digesters only. Septic Tanks: Design (as per Ministry of urban development) construction, disposal of effluents, cleaning of tanks, Imhoff tanks.

Sewage treatment by high rate anaerobic methods: Anaerobic digestion, suspended growth, contact process, UASB, attached growth, filters, expanded bed - only basics (Ref. Wastewater Engineering by Metcalf and Eddy - 3rd Edn.)

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**References**


1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.
2. S. K. Garg, Environmental Engineering Vol. I & II, Khanna Publishers, New Delhi.
3. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.
4. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.
5. Metcalf & Eddy, Waste water Engg. 3rd Edn., Mc Graw Hill International Editions.
6. Mark J Hammer, Water and waste water technology, John Wiley and sons, Inc.


## ADVANCED MATHEMATICS (ELECTIVE - II)

**CMELRT 805-1** **3+1+0**

**Module 1 Green's Function**

Heavisides, unit step function – Derivative of unit step function – Dirac delta function – properties of delta function – Derivatives of delta function – testing functions – symbolic function – symbolic derivatives – inverse of differential operator – Green's function – initial value problems – boundary value problems – simple cases only

**Module 2 Integral Equations**

Definition of Volterra and Fredholm Integral equations – conversion of a linear differential equation into an integral equation – conversion of boundary value problem into an integral equation using Green's function – solution of Fredhlom integral equation with separable Kernels – Integral equations of convolution type – Neumann series solution.

**Module 3 Gamma, Beta functions**

Gamma function, Beta function – Relation between them – their transformations – use of them in the evaluation certain integrals – Dirichlet's integral – Liouville's extension of Dirichlet's theorem – Elliptic integral – Error function.

**Module 4 Power Series solution of differential equation**

The power series method – Legendre's Equation – Legendre's polynomial – Rodrigues formula – generating function – Bessel's equation – Bessel's function of the first kind – Orthogonality of Legendre's Polynomials and Bessel's functions.

**Module 5 Numerical solution of partial differential equations.**

Classification of second order equations- Finite difference approximations to partial derivatives – solution of Laplace and Poisson's equations by finite difference method – solution of one dimensional heat equation by Crank – Nicolson method – solution one dimensional wave equation.

**References**


1. Ram P.Kanwal, Linear Integral Equation, Academic Press, New York.


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2. Allen C.Pipkin, Springer, A Course on Integral Equations, Verlag.
3. H.K.Dass, Advanced Engg. Mathematics, S.Chand.
4. Michael D.Greenberge, Advanced Engg. Mathematics, Pearson Edn. Asia.
5. B.S.Grewal, Numrical methods in Engg.&science, Khanna Publishers.
6. R.F. Hoskins, Generalized functions, John Wiley and Sons.
7. Bernard Friedman, Principles and Techniques of Applied Mathematics, John Wiley and sons
8. James P.Keener, Principles of Applied Mathematics, Addison Wesley.
9. P.Kandasamy, K.Thilagavathy, K.Gunavathy Numerical methods, S.Chand & co.

## THEORY OF SHELLS (ELECTIVE - II)

**C805-2** **3+1+0**

**Module 1**

Structural behaviour of shells-classification of shells-translational and rotational shells-ruled surfaces-methods of generating the surface of different shells-hyperbolic paraboloid-elliptic paraboloid-conoid-Gaussian curvature-synclastic and anticlastic surfaces.

**Module 2**

Classical theories of shells-thin shell-thick shell-small deflection theory-stress resultants and deformations of shells without bending.

**Module 3**

Cylindrical shells-membrane theory of cylindrical shells-free body diagram of a cylindrical shell element-formulation of equilibrium equation.

**Module 4**

Bending theory of cylindrical shells-stresses and deformation of circular cylindrical shells-pressure vessels-cylindrical shells with uniform internal pressure-free body diagram of a differential cylindrical shell element- formulation of equilibrium equation.

**Module 5**

Finite element application on cylindrical shells-introduction to shell elements-flat elements-axisymmetric elements- degenerated elements-general shell element.

**References**

1. Timoshenko, W Krieger, Theory of plates and shells, Mc Graw Hill.
2. Gol'oenveizen, Theory of elastic thin shells, Pergaman Press, 1961.
3. J Ramachandran, Thin shells theory and problems, Universities press.
4. Novoshilov V V,Theory of thin elastic shells, P Noordoff, Groningen,1959.
5. Baker E H, Kovalesky and Flrish, Structural analysis of shells, Mc Graw Hill, New York.
6. Kraus H, Thin elastic shells, Wiley, New York, 1967.
7. Ramaswamy G S, Design and construction of concrete shell roofs, Mc Graw Hill, New York.
8. Wilhelm Flugge, Stresses in shells, Springs, Verlog, Berlin.

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## ADVANCED STEEL STRUCTURES (ELECTIVE - II)

**C805-3** **3+1+0**

**Module 1**

**Microwave and Transmission Towers**: Introduction - Loads - Analysis of Microwave & Transmission towers - Design of members - Design of foundation - Design of Connections - Application using STAAD, SAP.

**Module 2**

**Pre-Engineered Metal Buildings**: Introduction - Loads - Metal cladding - Design of cold formed secondary framing - Optimization design of main frames - Wind bracing - Frame connections (haunch, ridge) - Column base connections (fixed, pinned) - Application using STAAD, STRAP.

**Module 3**

**Multi-storey Buildings**: Introduction - Anatomy of structure - Loads - Design of columns - Design of composite beams - Design of composite floor - Bracings – Connections - Application using STAAD, STRAP.

**Module 4**

**Space Frames**: Introduction - Structural types - Loads - Design of single layer barrel vault - Design of single layer dome - Design of double layer flat - Design of node connectors - Application using STAAD, SAP.

**Module 5**

**Construction**: Tolerances: Fabrication tolerances - Erection tolerances, Fabrication: Economy - Shop activities - Quality management, Erection: Method statement - programme – Machineries, Fire Protection: Regulations - Structural performance - Methods of protection, Corrosion Resistance: Corrosion process - Effect of environment - Protection methods.

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**References**


1. Ram Chandra, Design of Steel Structures, Vol. II, Standard Book House, New Delhi.
2. Alexander Newman, Metal Building Systems: Design and Specifications,
3. Graham W. Owens, Peter R. Knowles, Steel Designers Manual, Blackwell Scientific Publications, Oxford, ISBN 0-632-03881-0.
4. Ramamrutham S., Design of Steel Structures, Dhanpat Rai Publishing Co., New Delhi, 2001, ISBN 81-87433-36-1.
5. Ramaswamy G. S., Suresh G. R., Analysis, Design and Construction of Steel Space frames, Thomas Telford Ltd., 2002, ISBN 0-7277-30142.
6. Edwin H. Gaylord, Jr., Charles N. Gaylord, Design of Steel Structures, McGraw-Hill, Inc., Singapore, ISBN 0-07-112623-6.
7. IS: 800 - 1984, Use of Structural Steel in General Building Construction, BIS, New Delhi.
8. IS: 802, Use of Structural Steel in Overhead Transmission Line Towers, BIS, New Delhi.
9. IS: 875 - 1987, Code of practice for Design Loads (Parts I, II & III), BIS, New Delhi.

10. IS: 806, Code of practice for use of Steel Tubes in General Building Construction, BIS, New Delhi.
11. IS: 1161, Specification for Steel Tubes for Structural Purposes, BIS, New Delhi.

## HIGHWAY AND AIRFIELD PAVEMENTS (ELECTIVE - II)

**C805-4** **3+1+0**

**Module 1**

Pavement types: stress distribution in pavements - theoretical subgrade conditions and traffic loadings Basic difference between flexible and rigid pavements - design factors - wheel load - equivalent single wheel load - repetition of loads - elastic modulii - climatic variations.

**Module 2**

Design of flexible pavements: group index method - CBR method - IRC recommendations - Me Load method - Burmister's layer theory.

**Module 3**

Design of rigid pavements: radius of relative stiffness - critical load positions - Westergaard's stress equation - Bradley's stress coefficients - design charts.

**Module 4**

Temperature stresses in concrete pavements: Westergaard's concept - wrapping stress - functional stress - combination of stresses.

Design of joints in concrete pavements: expansion joints - construction joints - design of dowel bars - tie bars - IRC recommendation.

**Module 5**

Evaluation of pavement condition: pavement instrumentation - types of pavement distress - roughness and skid resistance. Environmental influence and effects-pavements maintenance and overlays.

**References**

1. Bindra B.S, Highway Engineering, Danpat Rai and Sons.
2. H.J.Yoder, Principles of Pavement Design, John wiley and sons
3. Khanna O.P, Justo C.G., Highway Engineering, Nem Chand Publishers
4. IRC Standard specifications for Construction of Flexible and rigid pavements

## ADVANCED FOUNDATION DESIGN (ELECTIVE - II)

**C805-5** **3+1+0**

**Module 1**

Machine foundations: basic theory of vibrations-free and forced vibration of single degree of freedom with and without damping-two degrees of freedom with and without damping-dynamic soil properties-mass spring model and constants-elastic half space approach-determination of dynamic soil constants in laboratory and field based on IS code provisions. Modes of vibration of block foundation –

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natural frequency of foundation of soil system by Barkan's approach-methods of analysis-Barkan's method. Vertical translations, sliding, rocking, yawing (IS code method)

**Module 2**

Design of machine foundations: Static and dynamic design criteria-permissible amplitude of vibrations for different types of machines. Foundations for reciprocating machines- design criteria- calculation of induced forces and moments- multi cylinder engines-Foundations subjected to impact type of forces (hammer)-design data-design criteria-vibration isolation.

**Module 3**

Sheet Pile walls and Cofferdams: types and uses of sheet piles-design of cantilever sheet pile walls in granular and cohesive soils-anchored bulkhead-free earth support and fixed earth support method-coffer dams-uses- braced and cellular cofferdams.

**Module 4**

Special Foundations: Foundation for special structures such as water tanks, silos, cooling towers, guyed structures, ground storage tanks, chimneys, telecommunication towers, transmission line towers-foundation for under ground conduits- foundation for coastal and offshore structures-pre-stressed foundations. Shell Foundations-structural form and efficiency-different types.

**Module 5**

Foundations in Special soils: Foundation in expansive soil, soft and compressible soils, problems associated with foundation installation- ground water lowering and drainage- shoring and underpinning-different methods-damage and vibrations due to constructional operations

**References**


1. Bowles.J.E, Foundation Analysis and DesignMc Graw Hill Publishing Company.
2. N.P.Kurian, Modern foundations Tata Mc Graw Hill Publishing company
3. Srinivasulu P, Vaidyanathan C.V Handbook of Machine foundations
4. IS 2974-part I toV.
5. IS 5249


## INDUSTRIAL WASTE ENGINEERING (ELECTIVE - II)

**C805-6** **3+1+0**

**Module 1**

Introduction: Environmental pollution - Magnitude of the industrial waste problem in India - damage caused by industrial waste pollution. Effect of industrial wastes on streams and sewerage systems: Computation of organic waste loads on streams - Streeter phelps, Churchill and Thomas methods.

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**Module 2**

Stream sampling: stream protection measures - effluent and stream standards. Characteristics of industrial wastes: physical, chemical and biological. retreatment of industrial wastes: waste volume reduction, waste strength reduction - neutralization, equalization and proportioning.

**Module 3**

Theories of treatments processes: removal of suspended solids by sedimentation and flotation, removal of colloidal solids by coagulation - removal of inorganic solids by evaporation & ion exchange. Removal of organic solids: lagooning, activated sludge treatment - extended aeration, step aeration, trickling filters. High rate anaerobic treatment - up flow and down flow filters: up flow anaerobic sludge blanket reactor - Disposal of sludge solids. Joint treatment of treated and untreated wastes with domestic sewage - discharge of raw and treated wastes to streams.

**Module 4**

Major industrial Wastes and their treatment: pulp and paper industry - oil refinery - textile industry - tannery.

**Module 5**

Treatment of industrial waste: canning - dairy - sugar - distillery.

**References**


1. M Narayana Rao, Waste water treatment, Rational methods of design and Industrial practice, Oxford & IBH Publishing Co. Pvt. Ltd, Bombay.
2. Nelson Leonard Nemerow, Theories and practices of industrial waste treatment, Addison-Wesley Publishing Co., Inc.
3. C Fred Gurnham, Principles of industrial waste treatment, John Wiley & Sons, Inc., New York.
4. W Wesley Eckenfelder Jr., Industrial water pollution control, International Edition, Mc Graw Hill Inc, New Delhi.
5. Hardam Singh, Industrial Waste water management Hand Book, Mc Graw Hill, NewDelhi.


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## ADVANCED HYDROLOGY (ELECTIVE - II)

**C805-7** **3+1+0**

**Module 1**

Introduction: Hydrologic cycle-history of hydrology - application in engineering: water resources in the world - water resources in India. Weather and hydrology: Thermal circulation - effects of earth's rotation - effect of land and water distribution - migratory systems - fronts - measurement of temperatures - Lapse rate of temperatures - geographic distribution of temperatures - time variations of temperatures - properties of water vapour- Measurement of humidity - geographic distributions of humidity - time variations in humidity-geographic variations of wind - time variations of wind - scanning and predicting weather.

**Module 2**

Precipitation: types of precipitation - measurement of precipitation recording gauges - automatic gauges radars -estimation of missing data and adjustment of records - mean areal depth of precipitation -rain gauge network- design principles- depth area duration curves - Hectograph and mass curve of rainfall - analysis of rainfall data - moving average curves - design storms - probable maximum precipitation curves snowfall and measurement. Determination of snowmelt. Water Losses:.Evaporation-evaporation pans – evapometre, control of' reservoir evaporation - soil evaporation - transpiration - estimation of evapo transpiration - infiltration - infiltration curves - determination of infiltration- irifiltration indices - water shed leakage - water balance.

**Module 3**

Runoff: Catchment characteristics - classification of streams - factors affecting- run off, run off estimation by empirical formulae, curves infiltration method, rational method, overland flow hydrograph and unit hydrograph, method. Hydrographs: Separation of stream, flow components - hydrograph separation - unit hydrograph - assumption - derivations of unit hydrograph - unit hydrograph of complex storms - instantaneous unit hydrograph - synthetic unit hydrograph.

**Module 4**

Floods: Definition of standard project flood - maximum probable flood - probable maximum precipitation and design flood - estimation of peak flood-flood control. Measures - flood forecasting techniques- flood routing - analytical and graphical methods of flood routing. Sedimentation: The erosion process - factors controlling erosion - suspended load, bed load - estimation of sediment load (basic principles and statement of important.equations only) measurement of sediment load - reservoir sedimentation - control of reservoir sedimentation.

**Module 5**

Probability analysis of hydrological data: mean, median, mode, mean-deviation, standard deviation, variances and skewness of data normal, gamma, poisons, log normal and pears and type III distributions - flood, frequency by fuller's, Gumbel's, Powel and Ven Te chow methods.

Mathematical models in hydrology: definition of stochastic models, deterministic models-conceptual models and empirical models- optimisation of models and efficiency of models - method of determining 1UH by the s-curve hydrograph, convolution integral and conceptual models - synthetic stream flow - flow at ungauged sites - by multiple regression - reservoir mass curve - flood forecasting.

**References**


1. H. M.Reghunath, Hydrology, Wiley Easten Ltd., New Delhi.
2. Santhosh Kumar Garg, Hydrology and flood control engineering, Khanna Publishers
3. R.K. Linsley, M. A. Kholar, Hydrology for engineers, Tata Mc Graw Hill.


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## APPLIED GEOLOGY (ELECTIVE - II)

**C805-8** **3+1+0**

**Module 1**

**Plate tectonics:** Plate tectonics and drift of continents-Pangaea and drift of Indian plate-formation of Himalayas-Tectonic frame work of South India -Tectonic movements-their significance-methods of detecting tectonic movements - radar interferometry & global positioning system.

**Earthquake:** Earthquakes in relation to plate tectonics-global seismic belts - seismic zones of Inida-seismicity of South India-earthquakes in Kerala - earthquake resistant structures-prediction of earthquake-defusing earthquake-Reservoir induced seismicity.

**Module 2**

**Structural geology:** Clinometer & Brunton compass-Measuring of strike and dip using clinometer/Brunton compass-Basic idea of toposheets-Lineaments-definition-singificance-techniques of identifying lineaments-major lineaments in South India and Kerala.

**Remote sensing:** Basic concepts-electromagnetic radiation, spectral windows, spectral signatures, sensors, false colour images, geocoded images.
Remotesensing satellites-Landsat.

**Aerial photography:** Basic concepts-stereopairs, stereoscopic vision, stereoscope-Limitations of aerial photography.

**Applications:** Interpretation of imageries (brief description only). Application of satellite imageries and aerial photographs in geological and hydrogeological studies.

**Module 3**

**Hydrogeology - General:** Groundwater-importance and availability-Aquifers-confined and unconfined-Artesian wells-Geologic formations as aquifer-laterite-sandy layers-weathered rock-fractured crystalline rock- their distribution in Kerala-Structures used for tapping groundwater-Open well, Bore well, Tube well & Filterpoint well (construction techniques not expected). Saline water intrusion.

**Module 4**

**Hydrolgeology - Groundwater exploration techniques:** Hydrogeological, geophysical & geobotanical methods-Geophysical method-resistivity survey-Wenner and Schlumberger configurations-interpretation of resistivity curve-curve matching technique.

**Groundwater recharge:** Natural & artificial. Structures used for artificial recharge-checkdams, subsurface dams, open well & bore well. Selection of site for subsurface dams-salient features.

**Module 5**

**Practical Work:** Identification of important rock forming **minerals**: 1.Quartz, 2.Feldspar, 3.Hypersthene, 4.Auguite, 5. Hornblende, 6. Biotite, 7.Muscovite, 8.Olivine, 9.Garnet, 10.Fluorite, 11.Tourmaline, 12.Calcite, 13.Kyanite, 14. Kaolin, 15. Serpentine. Identification of common **rock types**: Igneous rocks: 1. Granite, 2. Syenite, 3. Diorite, 4. Gabbro, 5. Peridotite, 6.Dolerite, 7.Basalt, 8.Pegmatite.Sedimentary rocks: 1.Conglomerate, 2.Breccia, 3.Sandstone,

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4.Limestone, 5.shale.Metamorphic rocks: 1. Gneiss, 2. Schist, 3. Slate, 4. Marble, 5. Quartzite, 6. Augen gneiss, 8. Mylonite, 9. Pseudotachyllite.
Special Indian rock types: 1. Charnockite, 2. Khondalite, 3. Laterite.
**Recommended Field work**: Field trips to learn identification of faults/lineaments in the field and groundwater exploration techniques.

**References**


1. Arthur Holmes, Physical geology, Thomas Nelson.
2. Arthur D. Howard, Geology in environmental planning, McGraw Hills, New Delhi.
3. M.P.Billings, Strucutural geology, Asia Publishing house, New Delhi.
4. N.W. Gokhale, A manual of problems in structural geology, CBS Publishers & distributors, New Delhi.
5. Thomas M. Lillesand & Raiph W. Kiefer, Remotesensing and image interpretation, John Wiley Sons, New York.
6. K.K.Rampal, Text book of photogrametry, Oxford & IBH Publishing company, New Delhi.
7. David Keith Todd, Groundwater hydrology, John Wiley & sons, New York.
8. H.M. Regunath, Groundwater, Willey Eeastern Ltd.
9. HH.Read, Rutleys elements of mineralogy, George Allen & Unwin Ltd, London.
10. G.W.Tyrell, Principles of petrology, B.I. Publications, Bombay.
11. E.G. Ehler & H. Blatt, Petrology-igneous, sedimentary & metamorphic, CBS Publishers & distributors, Delhi.


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## STRUCTURAL DYNAMICS AND STABILITY ANALYSIS (ELECTIVE - III)

**C806-1** **2+1+0**

**Module 1**

Introduction-problems in nature-steady state problem-dynamic problem-stability problem (Eigen value problem)-introduction to dynamic loading-D'Alembert's equation of equilibrium-inertia force-effect of damping-Hamilton's principle.

**Module 2**

Single degree of freedom system-idealisation-free vibration-natural frequency-resonance-forced vibration-lumped mass-consistent mass.
solution techniques-determinant search procedure-Householders method

**Module 3**

Introduction to stability analysis-energy principles-stable, unstable and neutral equilibrium-fourth order differential equation for generalized bending problems-elastic instability of columns-Euler's theory-assumptions-limitations. General treatment of column stability problem as an Eigen value problem-various modes of failure for various end conditions- both ends hinged-both ends fixed-one end fixed other end free- one end fixed other end hinged

**Module 4**

Beam column-beam column equation-solution of differential equation for various lateral loads-udl and concentrated loads-solutions for various end conditions-both ends hinged-both ends fixed-one end fixed other end free- one end fixed other end hinged.

**Module 5**

Finite element application to dynamics-element stiffness matrix and mass matrix of a beam element. Finite element application to stability analysis- finite element stability analysis-element stiffness matrix –geometric stiffness matrix-derivation of element stiffness matrix and geometric stiffness matrix for a beam element.

**References**


1. Ray W Clough, Joseph Penzien, Dynamics of structures, Mc Graw Hill, Kogabusha Ltd.
2. Ziegler H, Principles of structural stability, Blarsdell, Wallham, Mass, 1963.
3. Thompson J M, G W Hunt, General stability of elastic stability, Wiley, New York.
4. Timoshenko, Gere, Theory of elastic stability, Mc Graw Hill, New York.
5. Don O Brush, B O O Almorth, Buckling of Bars, plates and shells,
6. Cox H L, The buckling of plates and shells, Macmillam, New York, 1963.
7. O C Zienkiewicz ,.Finite Element Method ,fourth Edition,McGraw Hill,
8. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley &Sons.


## INTERNET PROGRAMMING AND JAVA (ELECTIVE - III)

**C806-2** **2+1+0**

**Module 1**

**Internet**: Definition-principles of internet working-protocols TCP/IP.
E-mail- architecture and services. World wide web- definition- linking of documents in www-URL-DNS. Major categories of websites over Internet. HTML-Tags and writing pages.

**Module 2**

Importance of Java – advantages - method of byte codes - object oriented programming concepts in Java-data types – variables – arrays – operators - control statements.
Classes: Overloading – inheritance - packages and interfaces - exception handling-built in exceptions.

**Module 3**

**Threads**: Multi threading-string handling-an overview of important packages and interfaces used in Java-Java.util, Java.io.

**Module 4**

**Applet**: applet class-event handling-overview of event classes.
**AWT**: working with windows-graphics-text-AWT controls-layout managers-menu-images.

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**Module 5**

Databases-JDBC connectivity- introduction to swing, RMI, servlets, COM, CORBA, Java Beams.

**References**


1. MK Goel, Internet,
2. Herbert Schildt, Java the complete reference, Tata Mc Graw Hill.
3. Steven Holzner, Java 2 Black book, Wiley Dreamtech
4. Joseph L Weber, Using Java, Prentice Hall India New Delhi.
5. James Gosling, Java Programming.


## TRAFFIC AND TRANSPORTATION PLANNING (ELECTIVE - III)

**C806-3** **2+1+0**

**Module 1**

Statistical methods for Traffic Engineering: definition and probability - probability distribution – Poisson, Binomial and normal distribution. Applications in traffic engineering: sampling theory and significance testing - linear regression and correlation - simple problems.

**Module 2**

Systems approach to transport planning: stages in transport planning - trip generation - introduction and definitions – factors affecting trip generations and attraction - Multiple linear regression analysis - category analysis - Modal split analysis.

**Module 3**

Trip Distribution: growth factor methods - synthetic methods. Trip Assignment: purpose, general principle - assignment techniques.

**Module 4**

Parking: Parking problems - desirable parking space standards for different land use -common methods of on- street parking, off-street parking facilities, parking surveys.

Street illumination: Definition of common terms - types and location of lanterns on straight roads and junctions avoiding glare.

**Module 5**

Transportation Economics: Road user cost-Motor Vehicle operation cost - fixed and variable costs - road user benefits - principles of economics - analysis through annual cost - rate of return and benefit cost ratio methods - worked out problems.

**References**


1. Khadiyali L.R. Traffic Engineering and Transport planning, Khanna Tech Publishers
2. Hutchinson "Principles of Urban transport systems Planning
3. Martin & Whol Traffic system Analysis for Engineers
4. Donald Drew Traffic Flow Theory


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## ENVIRONMENTAL GEOTECHNICS (ELECTIVE - III)

**C806-4** **2+1+0**

**Module 1**

Clay mineralogy and soil structure: Gravitational and surface forces-inter sheet and inter layer bonding in the clay minerals- Basic structural units of clay minerals- isomorphous substitution – kaolinite mineral- montmorillonite mineral- illite mineral- electric charges on clay minerals – base exchange capacity- diffused double layer- adsorbed water- soil structure- methods for the identification of minerals (introduction only).

**Module 2**

Effect of environment on Geotechnical properties of soils: Effect of drying on Atterberg limits.-Volume change behaviour- factors controlling resistance to volume change- general relationship between soil type, pressure and void ratio.- importance of mineralogical composition in soil expansion. Activity- sensitivity- causes of sensitivity-influence of exchangeable cations, pH and organic matter on properties of soils. Permeability of soils- hydraulic conductivity of different types of soils – Darcy's law and its validity- factors affecting permeability

**Module 3**

Wastes and Contaminants (introduction only): sources of wastes-types of wastes- composition of different wastes- characteristics and classification of hazardous wastes- generation rates- ground water contamination- sources of ground water contamination- transport mechanisms-potential problems in soils due to contaminants.

**Module 4**

Disposal and containment technics: Criteria for selection of sites for waste disposal- hydrological aspects of selection of waste disposal sites- disposal facilities- subsurface disposal technics-disposal systems for typical wastes (sketches only)

**Module 5**

Containment control systems- liners and covers for waste disposal- rigid liners- flexible liners. Ground modification technics in waste management – waste modification- ground modification- mechanical modification-hydraulic modification- chemical modification.

**References**


1. Mitchell, J (1976), " Fundamentals of soil behaviour", John Wiley and sons, New York
2. Lambe, T. W & Whitman, R. V (1979), " Soil Mechanics ", John Wiley and Sons, New York.
3. Gopal Ranjan & A.S.R Rao (1991), " Basic and Applied Soil Mechanics, Wiley Eastern Ltd., New Delhi.
4. Wilson, M. J (1987), " A Hand book of Determinative methods in Clay Mineralogy", Chapman and Hall, New York.


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5. Robert M. Koerner (1984), "Construction and Geotechnical methods in Foundation Engineering", McGraw Hill Book Co., New York.
6. Yong R. N. (1992), " Principles of contaminant Transport in Soils, "Elsevier, New York.
7. Ramanatha Iyer T. S (2000), "Soil Engineering Related to Environment", LBS centre.

## SOIL STABILITY ANALYSIS (ELECTIVE - III)

**C806-5** **2+1+0**

**Module 1**

Ground water seepage- Laplace's equations for two dimensional flow- quick sand condition- construction of flownets- confined and unconfined flow-seepage in anisotropic soil conditions-piping-design of filters.

**Module 2**

Stability of earth slopes-modes of slope stability- analysis of slope stability problems- Swedish circle method- Friction circle method- Taylor's stability chart-Bishop's method- stabilization measures- instrumentation.

**Module 3**

Landslides: Introduction- movements associated with landslides-causes of landslides-consequences, classification and analysis of landslides-investigation of landslides-instrumentation-methods of preventing landslides.

**Module 4**

Earthquake effects on soil foundation system: earth quakes- ground shaking-liquefaction- ground deformations-seismic provisions in building codes

**Module 5**

Underpinning: Introduction-reasons-pit underpinning-pile underpinning-driven underpinning piles-shoring-special underpinning methods-moving structures

**References**

1. Hans.F.Winterkorn and Hsai Yang Fang Foundation Engineering handbook - Van Nostrand Reinhold Company
2. Bowles E.J. Foundation analysis and Design. Mc Graw Hill Publishing Co.
3. Gopal Ranjan and A.S.R.Rao Basic and applied Soil mechanics New Age International Publishing Company
4. Donald.P.Coduto Geotechnical Engineering –Principlesand practices, Prentice Hall India

## ENVIRONMENTAL IMPACT ANALYSIS

**C806-6** **2+1+0**

**Module 1**

Concepts of environmental impact analysis-Environmental protections, legislations, laws and Acts-air quality legislation-energy legislation-fish and wild life resources legislation-historical preservation legislation-factors for

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consideration in assessing environmental impact concept-short term vs. long term effects.

**Module 2**

Socio impact analysis-physical, social, aesthetic and economic environment-examples of types of socio impact analysis.

**Module 3**

Air quality impact analysis-air pollutants-sources-atmospheric interactions-environmental impact-assessment methodology, case studies. Noise impact analysis-effects of noise on people-estimating transportation noise impact-examples

**Module 4**

Water quality impact analysis-water quality criteria and standards-modelling-water quality impact by projects like High ways, power plants, agriculture and irrigation, forest management, vegetation and wild life impact analysis.

**Module 5**

Assessment methodologies-impact on biota-summerisation of environmental impact-checklist method.

**References**

1. John G Rau, David C Wooten, Environmental impact Analysis Handbook, Mc Graw Hill Book Company, New Delhi, 1980.

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## ENVIRONMENTAL ENGINEERING LAB

**C807** **0+0+3**

1. Determination of (a) solids - total, suspended, dissolved, fixed, volatile, settleable SVI.
2. pH Value.
3. Conductivity.
4. Chemical oxygen demand.
5. D. 0. and Biochemical Oxygen Demand.
6. Jar test and Turbidity.
7. Chlorine demand and residual chlorine.
8. Determination of iron.
9. Determination of sulphates.
10. Acidity and Alkalinity.
11. Hardness.
12. Nitrogen - various forms.
13. M. P. N. Fecal coliforms using A-l medium.
14. Measurment of smoke density for diesel vehicles.
15. Measurment of H C and CO of exhaust from petrol driven vehicles.
16. Measurment of suspended particulate matter in ambient air.

## PROJECT / SEMINAR

**C 808** **0+0+4**

Each student is required to present a technical paper on a subject approved by the department. The paper should in general reflect the state of the art. He/she shall submit a report of the paper presented to the department. In addition to the seminar he/she shall undertake a project work (as a team or individually) in the 7th semester itself in consultation with the guide(s). On completion of the project work, he/she shall present the work done before a panel of staff members, and submit a report of the project work done to the department.

## VIVA -VOCE

**C809**

A comprehensive Viva-voce examination will be conducted to assess the student's overall knowledge in the specified field of engineering. At the time of viva-voce, certified reports of seminar and project work are to be presented for evaluation.

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# B.TECH. DEGREE COURSE

## SYLLABUS

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# MECHANICAL ENGINEERING BRANCH

# THIRD SEMESTER

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## ENGINEERING MATHEMATICS - II

**CMELPA 301** **3+1+0**

**Module 1 Vector Differential Calculus**

Differentiation of vector functions - scalar and vector fields – gradient, divergence and curl of a vector function – their physical meaning – directional derivative – scalar potential, conservative fields – identities – simple problems.

**Module 2 Vector Integral Calculus**

Line, surface and volume Integrals – work done by a force along a path – Application of Green's theorem, Stokes theorem and Gauss divergence theorem.

**Module 3 Function of Complex Variable**

Definition of analytic functions and singular points – derivation of C.R. equations in Cartesian co-ordinates – harmonic and orthogonal properties – construction of analytic function given real or imaginary parts – complex potential – conformal transformation of function like $z^n$, $e^z$, $1/z$, $\sin z$, $z+k^2/z$ – bilinear transformation – cross ratio – invariant property – simple problems.

**Module 4 Finite Differences**

Meaning of $\Delta$, $\nabla$, E, $\mu$, $\delta$ - interpolation using Newton's forward and backward formula – central differences – problems using stirlings formula – Lagrange's formula and Newton's divided difference formula for unequal intervals.

**Module 5 Difference Calculus**

Numerical differentiation using forward and backward differences – Numerical integration – Newton – Cote's formula – trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – simple problems. Difference equations – Solution of difference equations.

**References**


1. Advanced Engg. Mathematics - Erwin Kreyszig, Wiley Eastern Ltd.
2. Higher Engg. Mathematics - Grawal B.S., Khanna Publishers
3. Numerical Methods in science & Engg. -M.K.Venkataraman, National Publishing Co
4. Numerical Methods - S.Balachandra Rao and G.K.Shantha, Uty. press
5. Advanced Engg. Mathematics - Michael D.Greenberg, Prentice-Hall
6. Theory and Problems of Vector analysis - M.R.Spiegel, Schaum's outline series, McGraw – Hill


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## MACHINE DRAWING - I

**M 302** **0+0+4**

Conversion of pictorial views into orthographic views-dimensioning techniques-preparation of drawing- screw threads-different forms-conventional representation-sketching-orthographic views of hexagonal bolts and nuts-dimensional drawing-squareheaded bolts and nuts-sketching of different types of lock nuts and locking devices and foundation bolts.

Forms of rivet heads-rivetted joints-lap and butt joints with single and multiple riveting in chain and zig-zag arrangements-dimensional drawing. Sketching of conventional representation of welded joints.

Fully dimensioned and sectional drawings of the following: -
Joints-cottered joints (spigot and socket, sleeve and cotter, gib and cotter) - knuckle joint. Shaft couplings - types of keys - plain and protected types of flanged couplings - bushed pin type flexible coupling - Oldhams coupling.

Pipe joints-spigot &socket joint - flanged joint - union joint –Amstrong (hydraulic) joint.
Shaft bearings and supports - journal bearing, plummer block - footstep bearing-wall bracket - ball bearings.

Steam engine parts - stuffing box - cross head - connecting rod - eccentric.
I.C.Engine parts-piston, connecting rod.

**References**


1. Machine Drawing - N.D.Bhatt
2. Machine Drawing - P.I.Varghese
3. Machine Drawing - P.S.Gill


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## FLUID MECHANICS

**M 303** **2+2+0**

**Module 1**

Introduction-Proprties of fluids- pressure, force, density, specific weight, compressibility, capillarity, surface tension, dynamic and kinematic viscosity-Pascal's law-Newtonian and non-Newtonian fluids-fluid statics-measurement of pressure-variation of pressure-manometry-hydrostatic pressure on plane and curved surfaces-centre of pressure-buoyancy-floation-stability of submerged and floating bodies-metacentric height-period of oscillation.

**Module 2**

Kinematics of fluid motion-Eulerian and Lagrangian approach-classification and representation of fluid flow- path line, stream line and streak line. Basic hydrodynamics-equation for acceleration-continuity equation-rotational and irrotational flow-velocity potential and stream function-circulation and vorticity-vortex flow-energy variation across stream lines-basic field flow such as uniform

flow, spiral flow, source, sink, doublet, vortex pair, flow past a cylinder with a circulation, Magnus effect-Joukowski theorem-coefficient of lift.

**Module 3**

Euler's momentum equation-Bernoulli's equation and its limitations-momentum and energy correction factors-pressure variation across uniform conduit and uniform bend-pressure distribution in irrotational flow and in curved boundaries-flow through orifices and mouthpieces, notches and weirs-time of emptying a tank-application of Bernoulli's theorem-orifice meter, ventury meter, pitot tube, rotameter.

**Module 4**

Navier-Stoke's equation-body force-Hagen-Poiseullie equation-boundary layer flow theory-velocity variation- methods of controlling-applications-diffuser-boundary layer separation –wakes, drag force, coefficient of drag, skin friction, pressure, profile and total drag-stream lined body, bluff body-drag force on a rectangular plate-drag coefficient for flow around a cylinder-lift and drag force on an aerofoil-applications of aerofoil- characteristics-work done-aerofoil flow recorder-polar diagram-simple problems.

**Module 5**

Flow of a real fluid-effect of viscosity on fluid flow-laminar and turbulent flow-boundary layer thickness-displacement, momentum and energy thickness-flow through pipes-laminar and turbulent flow in pipes-critical Reynolds number-Darcy-Weisback equation-hydraulic radius-Moody;s chart-pipes in series and parallel-siphon losses in pipes-power transmission through pipes-water hammer-equivalent pipe-open channel flow-Chezy's equation-most economical cross section-hydraulic jump.

**References**


1. Hydraulics and Fluid Mechanics - Lewitt
2. Fluid Mechanics - I.H.Shames
3. Fluid Mechanics - B.S.Massey
4. Fluid Mechanics - K.L.Kumar
5. Hydraulics and Fluid Mechanics - R.K.Bhansal
6. Hydraulics and Fluid Mechanics - Mody and Seth


## METALLURGY AND MATERIAL SCIENCE

**M 304** **3+1+0**

**Module 1**

*Crystallography:* Crystal structural determination, crystallographic directions and planes, miller indices, packing of atoms in solids, atomic packing factor, co-ordination number- A*morphous structure*, glass transition temperature -- Effects of crystalline and amorphous structure on mechanical and optical properties -- *Mechanism of crystallization:* Homogeneous and heterogeneous nuclei formation, dendritic growth and grain boundary irregularity, grain size effects on mechanical & optical properties - *Changes within solid materials*: *Structural imperfections:*

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Point defects - line defect: edge, screw dislocation, burgers vector, forest of dislocations, role of dislocation in the deformation of metals - Surface imperfections: role of surface defect on crack propagation etc – *Mode of plastic deformation*: mechanism of slip & twinning, dislocation climb & cross slip, dislocation sources, frank-read source – D*iffusion* in solids, fick's laws, applications.

**Module 2**

*Cold working*, strain hardening, recovery, re-crystallization, grain growth, grain size and its effects on mechanical properties-- Hot working, super plasticity – Reasons for alloying, phase transformation phase rules, single phase, multi phase equilibrium diagrams, solid solutions, inter metallic compounds – Equilibrium diagram reactions: monotectic, eutectic, eutectoid, peritectic, peritectoid -- Polymorphism – Detailed discussion of Iron-Carbon diagram with microstructure changes in ferrite, austenite, cementite, graphite, pearlite, martensite, bainite.

**Module 3**

Definition and aims of *heat treatment*- Annealing, spheroidizing, normalizing, hardening, tempering, austermpering, martempering with microstructure changes -- *Surface treatment*: Diffusion methods: carburizing, nitriding, cyaniding -- Thermal methods: flame hardening, induction hardening – Deposition methods: hot dipping and coating, impregnation, metal spraying, metal cladding – *Various strengthen mechanisms in metals:* work hardening, grain boundary hardening, grain size reduction, solid solution hardening, dispersion hardening.

**Module 4**

*Alloy steels:* Effects of alloying elements on: dislocation movement, polymorphic transformation temperature, formation and stability of carbides, grain growth, displacement of the eutectoid point, retardation of the transformation rates, improvement in corrosion resistance, mechanical properties -- Nickel steels, chromium steels, etc – Effects on steels, containing molybdenum, vanadium, tungsten, cobalt, silicon, copper and lead – high speed steels - - *Cast irons:* classifications, gray, white, malleable and spheroidal graphite cast iron, composition, microstructure, properties and applications - *Principal non ferrous alloys* like aluminum, beryllium, copper, magnesium, nickel, study of composition, microstructure, properties and applications- Reference shall be made to the phase diagrams whenever necessary.

**Module 5**

*Fracture:* Bonding forces and energies, cohesive strength of metals - Griffith theory — Crack initiation, growth and crack arrest – Effect of plastic deformation on crack propagation – Factors leading to crack propagation - Cleavage, intercrystalline, brittle, ductile fracture -- Influence of slip on fracture – Effect of impact loading on ductile material and its application in forging etc.-- *Fatigue:* stress cycles – Effects of stress concentration, size effect, surface texture on fatigue – Corrosion and thermal fatigue – Mechanism of fatigue failure -- *Creep:* Creep curves – Structural change – Mechanism of creep deformation.

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**References**


1. Avner S.H. – Introduction to Physical Metallurgy – McGraw Hill.
2. Callister William. D. – Material Science and Engineering. – John Wiley.
3. Guy A.G. – Essentials of material science. – McGraw Hill.
4. Dieter George E. – Mechanical Metallurgy. – McGraw Hill.
5. Higgins R.A. – Engineering Metallurgy part-I. – ELBS.
6. Mans Chandra – Science of Engineering Materials Vol. 1, 2, 3. – Macmillan.
7. Reed Hill E. Robert – Physical Metallurgy Principles. – East West Press.
8. Richards C.W. – Engineering Material Science.
9. Van Vlack – Elements of material Science. Addison – Wesley.
10. www. msm. com. ac. uk / online teaching.


## THERMO DYNAMICS

**M 305** **2+2+0**

**Module 1**

Fundamental concepts-Scope and limitations of thermo dynamics- Thermo dynamic systems – different types of systems-macroscopic and microscopic analysis-continuum-Properties-State-Processes- -Thermo dynamic equilibrium-Equation of state of an ideal gas-PVT system-Real gas-Real gas relations-Compressibility factor-Law of corresponding states.

**Module 2**

Laws of thermo dynamics-Zeroth law of thermo dynamics-Thermal equilibrium-Concept of temperature –Temperature scales-Thermometry-Perfect gas temperature scales. Work and Heat-First law of thermo dynamics-concept of energy-first law for closed and open systems-specific heats- internal energy and enthalpy- Steady flow energy equation- Joule Thompson effect.

**Module 3**

Second law of thermo dynamics-Various statements and their equivalence-Reversible process and reversible cycles – Carnot cycle-Corollaries of the second law-Thermo dynamic temperature scale- Clausius inequality-Concept of entropy-Calculation of change in entropy in various thermo dynamic processes-Reversibility and irreversibility-Available and unavailable energy – Third law of thermo dynamics.

**Module 4**

Thermo dynamics relations-Combind first and second law equations-Helmholtz and Gibbs functions – Maxwell relations- equations for specific heats, internal energy, enthalpy and entropy – Clausius- Clapeyron equation – applications of thermo dynamic relations.

**Module 5**

Properties of pure substances – PVT, PT and TS diagrams,Mollier diagrams-Mixture of gases and vapours-mixture of ideal gases-Dalton's law-Gibbs law – Thermo dynamic properties of mixture-mixtures of ideal gases and vapours-Psychrometic principles-Psychrometic chart-Applications.

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**References**


1. Engineering Thermodynamics - P.K.Nag,
2. Thermodynamics - J.F.Lee and F.W.Sears.
3. Engineering Thermodynamics - Spalding and Cole
4. Engineering Thermodynamics - M.Achuthan
5. Thermodynamics - Keenan
6. Thermodynamics - Obert
7. Thermodynamics - Holman
8. Heat and Thermodynamics - M.N.Zemansky
9. Thermodynamics - Rogers, Pearson


## STRENGTH OF MATERIALS AND STRUCTURAL ENGINEERING

**M306** **3+1+0**

**Module 1**

**I Stress and strain** - Bars of varying cross - sections – composite sections - temperature stresses. Principal stresses and planes-Mohr's circle representation of plane stress.

**Module 2**

Shear force and bending moments -Cantilever-simply supported and overhanging beams-concentrated and U. D. loadings analytical method. Relation between load. SF and BM. Theory of simple bending- bending and shear stress distribution rectangular, circular and 1-sections.

**Module 3**

Slope and deflection of simply supported beams and cantilevers- Double integration- Macaulay's Method-moment area method- conjugate beam method.

**Module 4**

Torsion of circular shafts-solid and hollow shafts- power transmitted by shafts. Close-coiled and open coiled spring- leaf spring. Thin cyliders and jhick cylinders subjected to internal and external pressures- compound pipes -wire wound pipes-strain energy-axial loads, gradually and suddenly applied load-impact loads.

**Module 5**

Columns and sturts- short and long columns-Euler's theory-Ran kine's theory - Eccentrically Loaded columns-column with initial curvature. General description only of simple and compound steel, beams, columns and column foundation-principle of reinforced concrete. Reinforcements detailing in R. C. Slabs, beams, columns & footings (No problem expected)

**References**


1. Timoshenko.S.P, Strength of Materials, Part 1,D.Van Nostrand company, Inc.Newyork.
2. Popov E.P., Engineering Mechanics of solids, Prentice Hall of India, New Delhi.


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3. Punmia B.C, Strength of Materials and Mechanics of structures, Vol 1,Lakshmi Publications, New Delhi.
4. Vazirani V.N., Ratwani N. M, Analysis of Structures, Vol 1, Khanna Publishers, New Delhi.
5. Kazimi S.M.A., Solid Mechanics, Tata Mc Graw Hill.
6. William A Nash, Strength of Materials, Mc Graw Hill.
7. Ryder G.H., Strength of Materials, ELBS.
8. Arthur Morley, Strength of Materials, ELBS, Longman's Green& Company.

## FLUID MECHANICS LABORATORY

**M 307** **0+0+3**

1. Study of plumbing tools and pipe fittings
2. Study of taps, valves, gauges, pitot tubes, watermeters and current meters
3. Determination of metacentric height and radius of gyration of floating bodies.
4. Hydraulic coefficients of orifices and mouthpieces under constant head method and time of emptying method.
5. Calibration of venturimeter, orifice meter and water meter
6. Calibration of rectangular and triangular notches
7. Determination of Darcy's and Chezy's constant for pipe flow
8. Determination of critical velocity in pipe flow.
9. Determination of minor losses in pipe flow
10. Experimental verification of Bernoulli's theorem
11. Determination of Chezy's constant and Mannings number for open channel flow.
12. Determination of discharge coefficient for Plug-Sluices

## STRENGTH OF MATERIALS LABORTAORY

**M308** **0+0+3**

1. Tests on springs (open and close coiled)
2. Bending Test on Wooden Beams using U. T. M.
3. Verification of Clerk. Maxwell's Law of reciprocal deflection and determination of E for steel.
4. Torsion Pendulum (M.S. wires. Aluminum wires and brass wires)
5. Torsion test using U.T. M. on M. S. Rod, torsteel and High Tensile steel.
6. Torsion Test on M. S, Road
7. Shear Test on M.S. Rod.
8. Fatigue Test
9. Impact Test (Izod and Charpy)
10. Hardness Test (Brinell, Vicker's and Rebound)
11. Strut Test.

**Note**

All tests should be done as per relevant BIS

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# FOURTH SEMESTER

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## ENGINEERING MATHEMATICS - III

**CMELRPTA 401** **3+1+0**

**Module 1**

*Ordinary Differential Equations:* Linear Differential equations with constant coefficents - Finding P.I. by the method of variation of parameters – Cauchys equations- Linear Simultaneous eqns- simple applications in engineering problems.

**Module 2**

Partial Differential Equations: Formation by eliminating arbitrary constants and arbitary Functions - solution of Lagrange Linear Equations –Charpits Method – solution of homogeneous linear partial differential equation with constant coefficients – solution of one dimensional wave equation and heat equation using method of separation of variables – Fourier solution of one dimensional wave equation.

**Module 3**

*Fourier Transforms:* Statement of Fourier Integral Theorems – Fourier Transforms – Fourier Sine & Cosine transforms - inverse transforms - transforms of derivatives – Convolution Theorem (no proof) – Parsevals Identity - simple problems.

**Module 4**

*Probability and statistics:* Fundamentals of probability, Bayes theorem - Binomial law of probability - The binomial distribution, its mean and variance - poisson distribution as a limiting case of binomial distribution - its mean and variance - fitting of binomial & poisson distributions - normal distribution - properties of normal curve - standard normal curve - simple problems in binomial, poisson and normal distributions.

**Module 5**

*Population & Samples:* Sampling distribution of mean ($\sigma$ known) –Sampling distribution of variance, F and Chi square test – Level of significance - Type 1 and Type 2 errors – Test of hypothesis – Test of significance for large samples – Test of significance for single proportion, difference of proportions, single mean and difference of means (proof of theorems not expected)

**References**


1. Higher Engineering Mathematics - B.S. Grewal, Khanna Publishers
2. Engineering Mathematics Vol. II -3rd year Part A & B - M.K. Venkataraman, National Publishing Company
3. Elements of Partial Differential Equations - Ian N.Sneddon, McGrawhill International Edn.
4. Miller and Fread's Probability and statistics for engineers – Richard A Johnson, Pearson Education Asia / PHI
5. A text book of Engineering Mathematics (Volume II) – Bali and Iyengar, Laxmi Publications Ltd.
6. Advanced Engg. Mathematics Erwin Kreyszig, Wiley Eastern Ltd.
7. Probability and statistical inferences – Hogg and Tanis, Pearson Education Asia


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## THEORY OF MACHINES - I

**M 402** **2+1+0**

**Module 1**

**Kinematics:** Links, pairs, chain, mechanisms, machines, inversion of single and double slider crank, quadric cycle chains-kinematic diagram-expression for degree of freedom- equivalent curves- coupler curves-spatial mechanisms-manipulations-velocity analysis by instantaneous center method-Kennedy's theorem- velocity and acceleration of various mechanisms by analytical and graphical method-Coriolis component of acceleration-analytical treatment of slider crank and four bar chain-Klein's construction-locating instantaneous center-velocity and acceleration image.

**Module 2**

**Linkage Synthesis:** Precision points-graphical synthesis of slider crank mechanisms, rocker mechanisms, four bar linkage-overlay method-number synthesis-basic features of mechanical synthesis-graphic and analytical methods of dimensional synthesis-kinematic synthesis-approximate and exact synthesis.

**Module 3**

**Mechanisms:** Pantograph, approximate straight line, straightline mechanisms-engine indicator mechanisms-steering gear-Davis and Ackerman type-quick return- Whitworth, slider crank mechanism-Hooke's joint, Scott-Russel, Watt and grasshopper mechanisms.

**Module 4**

**Brakes and clutches:** Shoe, double block, long shoe, internally expanding shoe, band, band & block, hydraulic, mechanical, air and powerbrakes-braking of avehicle-cone, single plate, multiple, centrifugal clutches.

**Dynamometers**: Pony brake. rope brake, epicyclic train, belt transmission and torsion dynamometers-effort and power.

**Module 5**

**Gears**: Condition for constant velocity ratio-law of gearing-conjugate teeth action-tooth forms-standard modules and tooth proportions-contact ratio-interference-spur, helical, bevel, spiral, and hypoid gears- gear forces.

**References**


1. Theory of Machines - Thomas Bevan
2. Mechanisms and Machine Theory - Ambedkar
3. Theory of Mechanisms and Machines - A.Ghosh & A.K.Mallick
4. Theory of Machines - V.P.Singh, Pearson
5. Theory of Machines - P.L.Bellaney
6. Theory of Machines and Mechanisms - J.E.Shigley & J.J.Uicker


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## HYDRAULIC MACHINES

**M 403** **2+2+0**

**Module 1**

*Dynamic Action of Fluid:* Momentum and angular momentum equation applied to control volume – impact of jet – flow of an incompressible fluid over fixed and moving vanes – workdone and efficiency – reaction principle – propulsion of ships. Dimensional analysis – Rayleigh' s method – Buckingham's Pi theorem – nondiamesional parameters in fluid mechanics and fluid machinery – principle of similitude, geometric and dynamic similarity – model studies.

**Module 2**

*Euler`s turbine equation:* velocity triangles – impulse and reaction turbines – Pelton wheel, Francis turbine Kaplan turbine – construction features and performance characteristics – non dimensional parameters for comparative study of turbine performance – unit speed, unit power, unit quantity, run away speed, geometric similarity – model laws – effect of specific speed on speed, runner size, flow type etc. – theory of draft tube – speed regulation of turbines – selection, type and speed of turbines.

**Module 3**

*Pumping machinery:* General classification –Dynamic pumps - working of centrifugal pumps, priming, vapour pressure, wear rings, hydraulic balancing, Classification of impellers, impeller shapes – types of casings – materials for pumps & medical use – principle of operation Euler`s head equation – velocity diagrams – losses in pumps – circulatory flow – pre rotation – efficiency – non dimensional parameters – specific speed – effect of change of diameters & speed - performance pump characteristics: main, operating, ISO efficiency characteristics curves – surging – NPSH – selection of pumps from performance curves, suction & delivery pipe sizing, motor rating - equivalent length of pipe, simple head loss calculation in pipe lines & fittings – Principle of similitude – axial trust – multistage pumps – propeller pumps – pump in parallel & series operation.

**Module 4**

Theory, efficiency, performance curves & application of self-priming pump, jet pump, airlift pump, slurry pump & hydraulic ram - Positive displacement pumps: reciprocating pump, effect of vapour pressure on lifting of liquid – indicator diagram – acceleration head – effect of friction – use of air vessels – work saved – Slip - efficiency – pump characteristics – applications. Condition monitoring of pumps: temperature on bearing, vibration in equipmets, noises – vibration measurement and fault diagnosis. Cavitation in fluid machines – installations susceptible to cavitation – collapse of bubble theory – Thoma`s prameter – factors affecting cavitation in pumps and turbines – Abrasive wear of pumps - prevention of cavitation damage.

**Module 5**

*Positive displacement Rotary pumps:* Gear, screw, vane, root pumps – rotary axial & rotary radial piston pumps - theory, efficiency, performance curves, effect of surface texture & materials of construction on performance – applications.

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Hydraulic accumulator, intensifier & lift – principle of operation- Hydraulic symbols, hydraulic cranes, hydraulic capstan, hydraulic press.

**References**


1. Abdulla Sheriff - Hydraulic machines, standard publishers.
2. Govinda Rao N. S. - Fluid flows machines, TMH.
3. Jagadishlal. - Hydraulic machines, metropolitan publishers.
4. Pippinger. - Industrial hydraulics.
5. Centrifugal and axial flow pumps - Wiley & sons. – Stepanoff John A. J.
6. Lewitt E. H. - Hydraulic & Fluid Mechanics


## MACHINE TOOLS

**M 404** **2+1+0**

**Module 1**

**Types and classification of lathes**: Specifications-method of holding work and tool, accessories, attachments-operations and types of tools for each operation-tool room lathe- duplicating lathe-Capstan and Turret lathe-horizontal and vertical automatics-single spindle and multi-spindle screw machines-manufacture of cylindrical bolts, stepped bolts, shafts-profile turning. Drilling and boring machines:- types and specifications-description of tool and work holding devices-boring tools and reamers-drilling of holes, countersinking and counterboring operations-boring of cross holes-manufacture of bushes.

**Module 2**

**Shaping, planing and slotting machines:** Types and specifications-quick return motion-hydraulic feed and its advantages-automatic feed-speed, feed and depth of cut-work holding devices-types of operation and examples of work done-shaping of V-blocks, planing of guide gibs, slotting of keyways. Broaching machines:- types-cutter-processes-internal and external broaching-broaching of spline-bores. Milling machines: - types, specifications, operations and milling cutters-Indexing head and its use-method of indexing-dividing head-milling of plane surface, keyways, slides and hexagons.

**Module 3**

**Grinding, Horning and Lapping:** Types and methods of operations-tool and cutter specifications-surface finish obtainable-method of evaluation of surface finish-roughness-super finishing-burnishing-ultrasonic impact grinding-grinding of shafts and bores-methods of gear cutting-form cutters-gear generating machines-gear hobbing -straight, spiral, worm, helical, and bevel gear cutting-gear finishing and gear shaping operations-gear errors.

**Module 4**

**Numerical Control (NC) machine tools:** Elements, classification (basics only)-NC tooling-design of NC/CNC tooling-automated chip less process.

**Automatic machines:** Semiautomatic multi tool central lathes-automatic cutting of machines- Swiss type automatic screw machines, multi spindle automatic

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special purpose machine tools- program controlled machine tools-copying machines.

**Module 5**

**Computers in production technology:** CIM-computer simulation of manufacturing process and systems-cellular manufacturing-FMS - just in time production-management of toolroom-machining centers-automatic tool changing-manufacture of ICs, PCBs, Ceramic circuit boards, and advanced PCBs-expert systems in manufacturing-unmanned machining- trends in automated factory.

**References**


1. Production Technology - R.K.Jain
2. All about Machine tools - Gerling
3. Workshop Technology: Vol. 1,2 and 3 - W.A.J.Chapman
4. Production Technology - H.M.T.
5. Machine Tools: Vol. 1, 2, 3 and 4 -Acherkan
6. Manufacturing Science & Technology, Vol. 2 -Suresh Daleela
7. Manufacturing Engineering &Technology - S.Kalpakjian, S.A.Schmidt


## ELECTRICAL TECHNOLOGY

**M 405** **3+1+0**

**Module 1**

**Transformer - emf equation:** No load current - equivalent circuit - regulation - efficiency. Determination of regulation and efficiency from O.C. and S.C. tests - cooling of transformers.

**D.C. motors:** Back emf - speed and torque equation - starting and speed control - testing of D.C. motors - brake test - swinburn's test.

**Module 2**

**Alternators - construction details:** Type - emf equation (winding factor need not be derived) - synchronous impedance - regulation by emf and mmf method. Synchronous **Motors:** Principle of operation - method of starting.

**Three phase induction motor:** Production of rotating magnetic field equivalent circuit-torque equation - torque slip characteristics - no load and blocked rotor tests - starting and speed control.

**Single phase motor:** Double revolving theory - capacitor start capacitor run induction motors – applications.

**Module 3**

Industrial drives - electric drives - advantages - individual drive and group drive - factors affecting choice of motor - mechanical characteristics of A.C. and D.C. motors - motors for particular applications like textile mill, steel mill, paper mill, mine, hoists, crane etc. - size and rating of motor – motor Selection for intermittent loads. Electric traction - Different systems of traction - comparison – track electrification - different systems - traction motor characteristics - electric braking - plugging -Dynamic and regenerative braking.

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**Module 4**

Basic principle of transistor amplifier - R.C. coupled amplifier- F.B. amplifier - Basic principle. Oscillators - basic principle - typical R.C. and L.C. oscillator circuits (no analysis) –Astable multivibratior Pulse circuits - wave shaping circuits like simple clipping, clamping R.C. differentiating, integrating circuits - simple sweep generator. CRO - basic principle of cathode ray tube - deflection methods – block schematic of CRO - measurement of current, voltage and frequency.

**Module 5**

Power semiconductor devices: Power diodes - SCR's - Principle of operation of SCR's - two transistor analogy of SCR - characteristics - SCR rating (basic principle only). High frequency heating - induction and dielectric heating – resistance heating Resistance welding - block schematic of resistance welding scheme

**References**


1. Perfomance and design of D C machines – Clayton
2. Perfomance and design of A C machines – M G Say
3. Electrical Traction – Dover A T
4. Industrial and Power electronics – Harish C Rai
5. Electronic principles S K Sahdev


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## MACHINE DRAWING - II

**M 406** **0+0+4**

Assembly and working drawings of the following: -

1. Valves: - Feed checkvalve, stop valve, spring loaded safety valve, Ramsbottom safety valve, lever safety valve, deadweight safety valve, blow off cock.
2. Pulleys: - Fast and loose pulleys, speed cone or stepped pulley.
3. Clutches: - Single plate clutch, cone friction clutch.
4. Machine elements: - lathe spindle, screw jack, machine vice, lathe tool post.

**References**


1. Machine Drawing - N.D.Bhatt
2. Machine Drawing - P.I.Varghese
3. Machine Drawing - P.S.Gill


## HYDRAULIC MACHINES LABORATORY

**M 407** **0+0+4**

Study of hydraulic turbines – Pelton wheel, Francis & Kaplan turbines – force due to impact or jet on vanes – velocity triangles – specific speed – types of casings – governing – cavitation – draft tubes - performance characteristics – applications.

Study of dynamic pumps: Centrifugal pump - velocity triangles – priming - vapour pressure, wear rings, hydraulic balancing - casings – impellers – specific speed – cavitation - selection of pumps from performance curves, suction & delivery pipe sizing, motor rating, equivalent length of pipe, crane co. table, simple head loss calculation in pipe lines - applications. Theory, efficiency, performance curves & application of self-priming pump, jet pump, airlift pumps slurry pump & hydraulic ram.

Condition monitoring of pumps: temperature on bearing, vibration in equipmets, noises – vibration measurement and fault diagnosis. Study of positive displacement pumps – Reciprocating pumps – single & multi cylinder – Air vessel – indicator diagram - - performance characteristics – applications. Positive displacement Rotary pumps: Gear, screw, vane, root pumps – rotary axial & rotary radial piston pumps - theory, efficiency, performance curves, effect of surface texture & materials of construction on performance - applications.

**Experiments**

Performance characteristic tests on Pelton wheel (Load test & best speed).
Performance characteristic tests on Francis turbine (Load test & best gate opening).
Performance characteristic tests on Kaplan turbine (Load test & best gate, vane angle opening).
Performance characteristic tests on single stage, multi stage centrifugal pumps at constant speed & at variable speed. Actual & predicted curves.
Performance characteristic tests on self-priming pump, Jet pump, Airlift pump and deep well pump
Performance characteristic tests on axial flow pump.
Performance characteristic tests on Hydraulic ram.
Vibration measurement and computer aided fault diagnosis of a centrifugal / self-priming / Gear / Reciprocating pump.
Performance characteristic tests on reciprocating pump at constant speed.
Performance characteristic tests on Gear pump.
Performance characteristic tests on Screw pump.

**References**


1. Abdulla Sheriff. - Hydraulic machines, standard publishers.
2. Govinda Rao. N. S - Fluid flows machines, TMH.
3. Jagadishlal - Hydraulic machines, metropolitan publishers.
4. Pippinger - Industrial hydraulics.
5. Stepanoff john A.J. -Centrifugal and axial flow pumps, Wiley & sons.


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## ELECTRICAL & ELECTRONICS LABORATORY

**M408** **0+0+4**

### ELECTRICAL MACHINES LAB

1. Efficiency and regulation of single phase transformer by direct loading.
2. Equivalent circuit of transformer from open and short circuit test-calculation of efficiency and regulation at various loads and power factors.
3. Regulation of alternator by emf and mmf methods.
4. Starting of cage induction motor using star-delta switch - performance characteristics.
5. No load and blocked rotor test on slip ring induction motor - equivalent circuit - torque-slip characteristics.
6. a) O.C.C. of D. C. shunt generator - critical resistance.-critical speed.
   b) External and internal characteristics of D C shunt generator.
7. Load test on D. C. series motor.
8. Swinbume's test -Pre determination of efficiency.
9. Study of single phase induction motor, determination of performance characteristics.

### ELECTRONICS LAB

1. Diode characteristics
2. Transistor characteristics- C.B, C.E configurations
3. Pulse circuits
4. Rectifier circuits
5. Sweep generator
6. R C Coupled amplifier
7. R C Oscillator, L C Oscillator
8. Astable multivibrator

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# FIFTH SEMESTER

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## ENGINEERING MATHEMATICS - IV

**CMELPA501** **3+1+0**

**Module 1**

Complex Integration: Line Integral –Cauchy's integral theorem- Cauchy's integral formula-Taylor's series-Laurent's series- zeros and singularities-Residues- residue theorem-Evaluation of real integrals using contour integration involving unit circle and semicircle.

**Module 2**

Numerical solution of algebraic and transcendental equations: Successive bisection method-Regula falsi method - Newton –Raphson method – solution of system of linear equations by Jacobi's iteration method and Gauss-Siedel method.

**Module 3**

Numerical solution of ordinary differential equation: Taylor's series method-Euler's method –Modified Euler's method - Runge – Kutta method (IV order)-Milne's predictor corrector method.

**Module 4**

Z – Transforms: Definition of Z transform- properties –Z transform of polynomial functions – trigonometric functions, shifting property, convolution property-inverse transform – solution of $1^{st}$ & $2^{nd}$ order difference equations with constant coefficients using Z transforms.

**Module 5**

Linear programming: graphical solution – solution using simplex method (non – degenerate case only) – Big-M method, two phase method- Duality in L.P.P.-Balanced T.P. – Vogels approximation method – Modi method.

**References**


1. Advanced Engineering Mathematics – Ervin Kreyszig, Wiley Eastern limited.
2. Numerical methods in Engineering & Science – Dr. B.S.Grewal, Kanna Publishers.
3. Higher Engineering Mathematics – Dr. B.S.Grewal, Kanna Publishers.
4. Numerical methods in Science & Engineering – Dr. M.K.Venkitaraman, National Publishing Company.
5. Quantitative techniques Theory & Problems – P.C.Tulsian, Vishal Pandey, Pearson Education Asia.
6. Complex variables and applications – Churchill and Brown, McGraw-Hill.
7. Operations research – Panneer Selvam, PHI
8. Engineering Mathematics vol III – S.Arumugam, A.T.Isaac, Somasundaram, Scitech publications
9. Advanced Mathematics for Engg.students vol III –S.Narayanan, T.K.M.Pillay, G.Ramanaigh, S.Vishwananthan printers & publishers.


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## MANUFACTURING PROCESSES

**M 502** **3+1+0**

**Module 1**

Patterns: - pattern allowances and materials-moulding-core and core prints-types of cores- pattern construction-layout and colour coding-tools-processes-moulding sand constituents, types and testing-moulding machines-moulding procedure-sand conditioning-gating system-cupola operation-pouring and cleaning of castings-defects in castings-inspection and quality control-casting machines-design of dies-centrifugal, continuous, investment, squeeze casting and shell- mould casting- - comparison of casting with other production processes.( include necessary figures)

**Module 2**

Welding: - definition-metallurgy of welding-applications – classification - mechanism-processes-gas welding - details, equipment, fluxes and filler rods - design effect of weld parameters on weld quality-flame cutting-ISI specification for welding. Arc welding applications-equipment –polarity-governing factor in fusion welding-electrodes and types-ISI specification for electrodes –Welding design-butt joint-TIG-GMA-$CO_2$ process. Submerged arc, electroslag plasma arc and flux cored arc welding-resistance, thermit solid state, electron beam and laser welding.Brazing: soldering-explosive welding-inspection and defects in welding-welding of plastics.(include necessary figures )

**Module 3**

Rolling: - principles-types of rolls and rolling mills-semifinished and rolled products- rolling of tubes, wheels, axles, I-beam-thread and gear rolling-friction and lubrication in metal forming-hot and cold rolling-rolling machines-heating and cooling in rolling-strip velocity and roll velocity-roll and roll pass design - Theories of rolling and effect of parameters-load calculation-High velocity forming - energysources - material behaviour - pneumatic, mechanical, electrohydraulic, electromagnetic, and explosive forming.

**Module 4**

Press working: - types of presses and pressworking operations involving shearing, bending, drawing, squeezing-Extrusion: - methods, machines-analysis of rod extrusion-Wire and wire drawing operations-analysis-die angles-simple, progressive and compound dies-plastic and rubber processing-Calendering-transfer, injection and compression moulding.

**Module 5**

Forging: -classification-process-equipments-drawing, deep drawing, punching, blanking tube piercing-spinning and coining-elastic and plastic deformation-hot forging, die forging- machinery for forging-operation-heating in forging-manufacture of drop forging dies, presses-design of forgings and dies-upsetting-forging defects-forging analysis-quality assurance for forging-non destructive testing.

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**References**


1. Workshop Technology - Raghuvanshi
2. Manufacturing Engineering & Technology - S.Kalpakjian and S.A.Schmidt
3. Manufacturing Processes - Begeman
4. Manufacturing Science & Technology; Vol. I - Suresh Daleela
5. Processes and Materials of Manufacture - Roy A.Lindberg


## COMPUTER PROGRAMMING

**M503** **2+2+0**

**Module 1**

Introduction to C language – character set – operators – constants and variables – data types – use of built in I/O functions - use of control statements if, if – else, for, while, do-while and switch – use of logical AND, OR and NOT – pre-processor directive - writing summation of various mathematical series like $e^x$, sin(x), cos(x) etc.

**Module 2**

Arrays – declaration of one dimensional array and its handling – bubble sorting – quick sorting – searching – string handling functions – multidimensional arrays and its handling – structure and union – array of structures – sorting of strings – programs

**Module 3**

Functions – declaration – global and local variables - call by value method – writing different string handling functions – storage classes – passing an array to a function – passing a structure to a function – recursion - macros – programs

**Module 4**

Declaration and use of pointers – call by reference method – pointer to an array – pointer to a structure – array of pointers – pointer to an array – self-referential structure – dynamic memory allocation – linked lists – programs

**Module 5**

Different types of files – reading writing and appending of text and binary files – other various file handling functions - transfer of data in blocks - command line arguments – use of bit-wise AND, OR and NOT.

**References**


1. Programming with C – Schaum's series
2. Programming in C – Balaguruswamy
3. The C Programming Language – Kerningham & Ritchie
4. Let us C – Yaswant Kanetkar
5. Programming with ANSI and Turbo C – Kamthane, Pearson


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## THEORY OF MACHINES - II

**M 504** **2+2+0**

**Module 1**

Static force analysis: - force couples-condititons for equilibrium-free body diagram- analysis of four bar chain-force analysis of slider-crank mechanism-Coulomb friction.

Dynamic force analysis: - D'Alemberts principle-inertia forces-dynamic force analysis of four bar chain, and slider crank mechanism.

**Module 2**

Governors: - terminology; Watt, Porter, Proel, Hartnell, Hartung, Wilson-Hartnell, and Pickering governors-spring controlled governors of gravity type-effort and power-controlling force diagram-quality of governors-effect of friction-insensitiveness-stability-inertia governors- governor speed, torque characteristics of an engine-governor and flywheel.

**Module 3**

Turning moment diagram and Flywheel: - coefficient of fluctuation of energy and speed- energy saved in a flywheel-punching press-dynamically equivalent two mass system-centre of percussion-kinetic equivalence-reversed effective force analysis-piston effort-crankpin effort- crank effort-turning moment diagrams for steam and I.C. engines.

**Module 4**

Gyroscope: - principle-angular acceleration-effect of gyroscopic couple on bearings, airplanes, and ships-stability of automobile and two wheel vehicles-gyroscopic stabilization of sea vessels and grinding mills.

Gear trains: -simple, compound-epicyclic trains with coaxial shafts.

**Module 5**

Cams and Followers: - types-follower motion-SHM-uniform velocity and acceleration- cycloidal - displacement, velocity and acceleration curves-cam profile-reciprocating and oscillating followers-tangent cams-convex and concave cams with footed followers.

**References**


1. Mechanism and Machine Theory - Ambedkar
2. Theory of Mechanism and Machines - A.Ghosh & A.K.Mallick
3. Theory of Machines - V.P.Singh
4. Theory of Machines - P.L.Ballaney
5. Theory of Mechanism and Machines - Joseph Shigley
6. Dynamics of Machinery - Holovanco


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## MECHATRONICS AND CONTROL SYSTEMS

**M 505** **2+2+0**

**Module 1**

Introduction: - Scope of Mechatronics-systems-microprocessor based controllers-mechatronic approach-sensors – transducers - force-velocity – displacement - temperature-inputting data by switches-signal coditioning - operational amplifiers-filtering-multiplexers-data acquisition- modulation. Data presentation systems: - displays-measurement systems-calibration-pneumatic and hydraulic systems-control valves-actuators-mechanical and electrical actyation systems-relays and solenoid switches and proximity pickups.

**Module 2**

Input/Output systems: - ports, interface requirements-adaptors-programmable logic controllers-data-handling- digital communications-system, networks, protocols, interfaces, fault finding-design and mechatronics-design solutions.
Electromechanical systems: CD, DVD ROMs, OCR, Printers-Medical devices: Artificial internal organs-Diagnostic and Therapeutic EMDs.

**Module 3**

Introduction to Control systems Engineering:- concept of automatic control-open loop and closed loop systems-servomechanisms-block diagrams-transfer functions. Representation of control components and systems-Translational and rotational mechanical components-series and parallel combinations-comparators, integrating devices, hydraulic servomotors, temperature control systems, and speed control systems.

**Module 4**

System response: - First and Second order system response to step, pulse, ramp, and sinusoidal input-systems with distance, velocity lag. Control system analysis: - Transient response of simple control systems-Stability of control systems-Routh stability criteria- error analysis.

**Module 5**

Frequency response analysis: - polar, rectangular and logarithmic plots-experimental determination of frequency response-Bode, and Nyquist stability criteria-Gain and phase margin. Root locus of simple transfer functions-transient response from root locus.

**References**


1. Mechatronics - W.Bolton, Pearson
2. Understanding Electromechanical Engineering - Lawrence J.Kamm
3. Mechatronics - Dan S. Necsuleseu, Pearson
4. Control System Engineering - T.J.Nagrath and M.Gopal
5. Automatic Control Theory - Ravan
6. Modern Control Engineering - Katsuhiko Ogata
7. Control Systems - A.Nagoor Kani
8. Modern Control Engineering - Dorf, Pearson


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## THERMAL ENGINEERING - I

**M 506** **2+2+0**

**Module 1**

Steam Engineering: Properties of steam - wet, dry and superheated steam - dryness fraction - enthalpy and internal energy - entropy of steam - temperature entropy diagram - process - Mollier chart - Rankine cycle for wet, dry and superheated steam. Steam Generators - classification - modern steam generators - boiler mountings and accessories.

**Module 2**

Steam nozzles - Mass flow rate - throat pressure for maximum discharge - throat area - effect of friction - super saturated flow.
Steam turbines: velocity triangles, work done, governing, and efficiencies.

**Module 3**

Gas turbine Plants - Open and closed cycles - thermodynamics cycles - regeneration, re heating - inter cooling - efficiency and performance of gas turbines. Rotary Compressors - Analysis of rotary compressors - centrifugal and axial compressors. Combustion - combustion chambers of gas turbines - cylindrical, annular and industrial type combustion chamber - combustion intensity - combustion chambers efficiency - pressure loss combustion process and stability loop.

**Module 4**

Introduction to solar energy - solar collectors - Liquid flat plate collectors - principle - thermal losses and efficiency - characteristics - overall loss coefficient - thermal analysis - useful heat gained by fluid - mean plate temperature - performance - focussing type solar collectors - solar concentrators and receivers - sun tracking system - characteristics - optical losses - thermal performance - solar pond - solar water heating - solar thermal power generation (Description Only)

**Module 5**

Thermal power plants: layout and operation of steam and diesel power plants - coal burners - stockers - cooling ponds & towers - chimneys - draught - dust collectors - precipitators - feed water heaters - evaporators - steam condensers - coal handling - ash handling.

**References**


1. Power plant technology - E. L. Wahid
2. Thermodynamic and heat power engineering - Mathur and Mehta
3. Thermal Engineering - P. L. Ballaney
4. Gas Turbine Theory - Cohen & Rogers
5. Solar Energy Utilization - G. D. Rai
6. Thermal engineering - R.K. Rajput.


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## COMPUTER LABORATORY

**M 507** **0+0+3**

a) Familiarization of operating systems. Use of file directories, editors, compilers and file managers etc.
b) Familiarization of Word processing packages – editing, formatting and printing
c) Familiarization with spread sheet packages for graphical representation of data
d) Introduction to computer aided drafting – drawing simple objects
e) Programming experiments in C to cover control structures functions, arrays, structures, pointers and files

Examples: -

i. Counting characters, lines and words
ii. Checking leap year
iii. Finding sum of digits and reversing a number
iv. Generating Prime numbers, Fibonacci numbers and Angstrom numbers
v. Sine and Cosine series
vi. Sorting of numbers, strings and records
vii. Matrix addition and multiplication
viii. Implementation of dynamic memory allocation
ix. Implementation of linked lists
x. File handling
xi. Problems using Command line arguments

## MACHINE TOOL LABORATORY

**M 508** **0+0+3**

*Study of Centre Lathe*: Origin of the name lath and lathe- specification of lathe- head stock, tail stock, carriage, cross slide, compound rest, guide ways, feed gar box, apron box, micro structural requirement of bed material. Accessories: Chuck, two and three jaws, and faceplate, follow rest, tool post grinder, and centres.

*Study of Machining technology*: Study of metal cutting – tool terminology as per ASA, ISO, DIN standards –merchant's circle, Lee & Shaffer theory, thick & thin zone models - tool materials, coated HSS, ceramic, CBN, diamond etc, inserts, chip breakers -- Tool wear mechanisms, VB determination - Use of Taylor's equation at shop floor - Machineabilty index - Role of specific heat in cutting fluids. – Cutter types and selection – Abrasive machining (Ra values) – Diamond turning of parts (Ra values) - Production of axi – symmetric parts – Production of prismatic components – Hole machining – Gear machining.

*Study of Basic measurement and devices*: accuracy, precision, sensitivity, and standards of measurements, metrology lab; standard and calibration, linear measurements, limit gauges (types and design), Taylor's principle, comparators (optical, mechanical, electrical, pneumatic), slip gauges, optical projector with digital measuring. – Geometrical measurements: angular measurements, vernier and optical protractors, sine bar. - Measurement of light wave interference, flatness and parallelism and round measurement, checking the dimensional accuracy of slip gauges with interference microscope. - *Surface characterization*:

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measurement of surface finishes RMS and CLA values. waviness, cut off, skid, instruments for measurement of roughens of a sand cast surface. slip gauge surface, ground bore of an engine cylinder, importance of surface finish on crack initiation. – *Screw thread terminology*, best wire size, two and three wire methods pitch measurement – Gear metrology (spur gear): run out checking, composite errors, base pitch measurement, profile measurement, checking backlash, alignment errors. – *Advanced measuring devices:* CMM, machine vision, toolmakers microscope, limitations, SEM, & TEM, laser measuring instruments, laser micrometer and alignment test using laser interferometry.

**Experiments**

Measurement of cutting forces in machine tools using dynamometers –process capability study of Machines –grinding of tool angle using tool and cutter grinding machine in a tool room –Turning & taper turning, turning & thread cutting, - Indexing & Gear cutting, pocket milling— Study of tool and machine monitoring systems.- Angular measurements use of sine bar and slip gauges, measurement of angle using clinometer, bevel protractor – calibration of plug and snap gauges using slip gauges – Roundness measurement : cylindricity, concentricity, perpendicularity using dial stand and measuring bench – Surface finish measurement.- Optical profile projector: study of profile of gear tooth, screw threads, other tools – Tool makers microscope: to study tool geometry, screw threads, measurement of turning tool wear of VB & KT values –Flatness measurement of surface table using auto collimator – Lathe alignment test using laser interferometer – gear concentricity tester, gear roll tester and gear tooth measurement.

**Student's assessment, continuous evaluation, awarding of sessional marks, record bonafides, oral examination etc and university examination shall be done by Faculty members.**

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**References**

1. Acharkan. N. -Machine Tool Design Vol. 1 to 4, MIR Publication.
2. HMT- Production Technology, TMH.

# SIXTH SEMESTER

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## MECHANICS OF MATERIALS

**M 601** **2+2+0**

**Module 1**

Definition of stress and strain – components of stress and strain – Hook's law – Plane stress and strain – stress at a point – measurement of strain – strain rosette – Mohr's circle of strains – differential equations of equilibrium – boundary conditions – compatibility equations – stress functions – 2D problems in rectangular co-ordinates – solutions by polynomials of various degrees and effects – Saint Venant's principle – determination of displacements.

**Module 2**

3D stress and strain – principal stresses – strain ellipsoid and director surfaces – stress invarients – determination of maximum and minimum shearing stress – homogeneous deformation – strain at a point – principal axes of strain – principal strain and invarients of strain – differential equations of equilibrium – boundary conditions – conditions of compatibility – determination of displacements – strain energy – uniqueness of solutions.

**Module 3**

2D problems in polar co-ordinates – general equations in polar co-ordinates – stress distribution symmetrical about an axis – pure bending of curved bars – strain components in polar co-ordinates – displacements for symmetrical stress distributions – rotating disk with and without central hole – disk of uniform strength.

**Module 4**

Thick cylinders – spherical shells – compound cylinders –rotating rims and cylinders – long cylinders.

**Module 5**

Curved beams – bending by eccentric loading – crane hooks – c clamp – chain link – columns of machine tools. Photo elastic techniques of study of stress – description only.

**References**


1. Theory of Elasticity - Timoshenko & Goodyear
2. Advanced Mechanics of Materials - Seelv & Smith
3. Advanced mechanics of Solids - L.S.Srinath
4. Mechanics of Solids - Lardner & Archer
5. Introduction to Mechanics of Solids - Ezer P.Popov
6. Mechanics of solids - Mubeen, Pearson


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## METROLOGY AND INSTRUMENTATION

**M 602** **3+1+0**

**Module 1**

*General measurements concepts*: Principles for achieving accuracy; Methods for estimating accuracy and precision, precision Vs accuracy, systematic and constant errors; progressive, random, erratic, drunken errors; statical concepts in metrology, statcial analysis of measurement data, control chart techniques – comparators – *General principle of measurements*: line & end measurements, standards; linear measurements, basic units, and quantities for displacement, mass, time, temperature & optics; systems of limits and fits; selecting & assigning of fits, tolerances for linear dimensions.

**Module 2**

*Gauges:* classification, design of gauges, gauge maker's tolerances, wear allowance, gauges materials & gauge manufactures. *Form measurements*: straightness, flatness, squreness, circularity & cylindricity – Measurement of angles & tapers: sine bars, angle gauges: auto collimator, clinometer & spirit level; taper gauges, bevel protractors.

**Module 3**

*Measurement of surface finish*: surface structure, integrity, texture, roughens, waviness, lay, cut off, RMS & CLA values, roughness values produced by machining processes, instruments for different surface finish measurements, concept of apparent to real area of contact of mating surfaces, applications in clutch plate surface, brake liner, inner race of a bearing, cylinder liner, machine tool guide way, surface to be painted etc & importance of surface finish on crack initiation. *Optical measuring instruments*: interferometry, optical flats, optimeters, and optical projectors, tool maker's microscope, limitations, SEM & TEM.

**Module 4**

*Advanced measuring devices*: Laser interferometry, applications – computer controlled co-ordinate measuring machine; machine vision & non contact CMM - *Gauging and measurements of screw threads*: Gauging methods for manufacturing, screw thread terminology, standard specification, and formulae, tolerance, thread gauge measurement, measuring equipment, application of thread gauges – *Measuring of gears*: Measuring methods for runouts, pitch profile, lead, backlash, tooth thickness, composite elements, inspection equipment.

**Module 5**

*Generalized measurement system*: measurement terminology, input, out put configurations, static characteristics, errors in measurement, drift, noise, accuracy, precision static sensitivity and resolution, loading effects on instruments- *Detector transducer elements*: principles of calibration, applications in measurement of strain, types of strain gauges, application in measurement of load & torque, measurement of force and torque, hydraulic, pneumatic & train gauge type load cells, hydraulic & electric dynamometers, measurement of vibration, vibrometers & accelerometers, theory of seismic instruments - *Temperature measurement*: Use of Bi metals, pressure thermometer thermocouple, optical & radiation pyrometer – magnetic flow meter – thermal conductivity gauges.

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**References**


1. ASME - Hand book of industrial Metrology
2. *Beckwith* - *Mechanical measurements, 5/e, Pearson*
3. Doeblin - Measurement systems, 4/e, McGraw- Hill
4. Hume - Metrology, McDonald
5. Sharpe - Metrology, ELBS
6. Taher - Metrology, ELBS


## THERMAL ENGINEERING - II

**M 603** **2+2+0**

**Module 1**

Working of two stroke & four stroke - Petrol and Diesel Engines (Review Only) - valve timing diagrams - Fuels - Chemical structure - qualities, ratings of fuels - Alternative fuels, Alcohol, vegetable oils, biogas.

Types of Engines - Wankel E/n, Stirling E/n, Stratified charge e/n, VCR E/n, free piston E/n. Fuel air cycle (actual) for petrol and diesel engines - variation of specific heats - heat losses - Dissociation

**Module 2**

Carburation - Air fuel mixture requirements - stoichiometry and excess air calculations - types of carburetors - Fuel injection systems - classifications - fuel injection pump - nozzle - direct and indirect injection - Injection in S. I. Engine - M. P. F. I. System - Ignition system - Battery & Magneto type - firing order - Ignition timing and spark advance - Lubrication systems - types - properties of lubricants - additives for lubricants - Heat rejection and cooling - Theory of engine heat transfer - types of cooling system - Air and liquid system - Super charging & turbo charging.

**Module 3**

Combustion in S. I. E/n - Ignition limits - stages of combustion - combustion quality - Ignition lag - Flame propagation - Abnormal combustion - detonation - effects - Theory, chemistry and control - flash point, fire point & viscosity index - combustion chamber design considerations.

**Module 4**

Combustion in C. I. Engines - Air Fuel ratio in C. I. Engines - Ignition Lag - diesel knock - Controlling Methods - Various stages of combustion - vaporization of fuel droplets and spray formation - Air motion - Swirl - combustion chamber - design considerations.

**Module 5**

Pollutant formation and control in S. I. And C. I. Engine, Nox, CO, Unburned hydro Carbon and particulate - Exhaust gas treatment - catalytic converter - Thermal reaction - Particulate Trap.

Engine operating characteristics - Testing of I. C. Engines - Indicated power - Brake power - Volumetric Efficiency - Heat balance Test - Morse Test - Measurement of exhaust smoke and exhaust emission.

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**References**


1. Internal Combustion Engine Fundamentals - John B. Heywood
2. Internal Combustion Engine and Air Pollution - Obert E. F.
3. Internal Combustion Engine - Lichty L. C.
4. Internal Combustion Engine - V. Genesan
5. A course in internal combustion Engine - Mathur and Sharma.


## HEAT AND MASS TRANSFER

**M 604** **2+2+0**

**Module 1**

Introduction to basic modes of heat transfer - Scope and application of heat transfer principles in engineering practice. Conduction Fourier law - thermal conductivity of solids, liquids and gases - factors affecting thermal conductivity. Thermal heat, conducting equation in Cartesian, cylindrical and spherical co-ordinates - one dimensional steady state conduction with and without heat generation - unsteady state conduction. Conduction through homogenous and composite surfaces plane wall cylindrical and spherical - variable thermal conductivity shape factors - heat flow through corners and edges.

**Module 2**

Convection - Newton's law - concept of boundary layer - significance of Prandtil number - boundary layer equation - flat - plate heat transfer equations by integral method Laminar and turbulent flow of heat transfer in tubes - Forced convection in turbulent flow - Reynolds analogy. Application of dimensional analysis in forced and natural convection. empirical relations, Combined effect of convection and conduction. Over all heat transfer coefficient - critical radius of insulation.

**Module 3**

Heat Exchangers type of heat exchangers. Log mean temperature difference. Design of shell and tube exchangers - NTU method of evaluation of heat exchangers - heat exchange - effectiveness - application of straight rectangular and triangular fins effectiveness of fins.

**Module 4**

Radiation - Nature of thermal radiation - Definitions and concept - Monochromatic and total emissive power - Absorptivity - Reflectivity transmissivity, Black Grey and Real surfaces. Concept of Black body Planks distribution law - Kirchoffs law Wein's displacement law-Geometric factors of simple configuration. Heat exchange by radiation between black surfaces - Large parallel black plate - equal parallel and opposite black squares, discs, black rectangles perpendicular to each other having a common edge-heat exchange by radiation between large parallel planes of different emissivity (no derivations - simple problems with the use of chart and equations)

**Module 5**

Mass transfer - introduction to mass transfer - Pick's law of diffusion in gases. Diffusion coefficient. Analogy between the phenomena of heat transfer and mass

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transfer. Elementary problems. Condensation and boiling - film Drop-wise condensation-film boiling and pool boiling. Bubble growth and collapse-empirical relations for heat transfer with change of phase (description only) Numerical methods in conduction (finite difference and finite element methods description only).

**References**


1. Elements of Heat Transfer - Jacob Hawkins
2. Principles of Heat Transfer - Krieth
3. Heat and Mass Transfer - Fckert & Drake
4. Heat transfer - Holmann
5. Engineering Heat & Mass Transfer - R.K. Rajput.
6. Engineering Thermodynamics and Heat Transfer - Gupta and Rajendra Prasad


## PRINCIPLES OF MANAGEMENT AND ENGINEERING ECONOMICS

**M605** **3+1+0**

### Part A – Principles of Management

**Module 1**

Functions of management: planning, organizing, staffing, directing, motivating, communicating, controlling and coordinating – Organizational structure-line, staff and functional relationship-span of control and delegation.

**Module 2**

Ogranisational behaviour: stress, meaning, causes, effects, strategies for coping with stress-motivation-types of motives, theories of work motivation-group dynamics-nature of work group, group cohesiveness, group performance, group norms. Marketing management: identification of products, pricing, promotion and distribution channels.

**Module 3**

Formation of companies: proprietary and partnership-joint stock, private limited, public limited companies-private sector, public sector, joint sector and co-operative sector.

Wages and incentives: Time and piece rate system, bonus, incentives-monetary and non-monetary Total quality management-re-engineering-management by objectives

### Part B – Engineering Economics

**Module 4**

Basic concepts: Theory of demand and supply-price mechanism-factors of production-land, labour, capital and organization-national income-difficulties in estimation-taxation-direct and indirect-progressive and regressive-black money-inflation-demand pull and cost push-effects of price increases.

**Module 5**

Indian financial system: Reserve bank of India-commercial bank system-public sector banks-development financial institutions-IDBI, ICICI, SIDBI, IRBI-

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investment institutions-UTI-insurance companies-stock market-functions-problems faced by the stock markets-role of the public sector-privatisation-multinational corporations and their impact on the Indian economy.

**References**


1. Benga & Sharma – Industrial Organisation and Management
2. Fred Lufthans – Organisational Behaviour
3. Keith Davis – Human Behaviour at Work
4. Philip Kotler – Marketing Management
5. K.K.Dewett – Modern Economic Theory
6. A.N.Agarwal – Indian Economy
7. Kargaweski – Operation management, Pearson
8. Mazda – Engineering management, Pearson
9. O.P.Khanna - Industrial Engineering & Management


## COMPUTER AIDED DESIGN AND MANUFACTURING

**M 606** **3+1+0**

**Module 1**

Evolution of CAD/CAM and CIM segments of generic CIM, computers and workstation, elements of interactive graphics, input/ out put display, storage devices in CAD - an overview of CIM software - 2D Graphics: line drawing algorithms, DDA line algorithm – circle drawing, bressnham`s circle drawing algorithm– 2D translation, rotation, scaling – clipping -3D Graphics (basic only).
Design process – CAD process: wireframe, surface, solid modeling; Engineering analysis; design review & evaluation, automated drafting – CAD hard ware, software, data presentation, CAD software packages

**Module 2**

Numerical control: Need - advantages & disadvantages – classifications – Point to point, straight cut & contouring positioning - incremental & absolute systems – open loop & closed loop systems – DDA integrator & Interpolators – resolution – CNC & DNC.
*Programmable logic controllers (PLC):* need – relays- logic ladder program – timers - Simple exercises only.
Devices in N.C. systems: Driving devices - feed back devices: encoders, moire fringes, digitizer, resolver, inductosyn, tachometer.

**Module 3**

NC part programming: part programming fundamentals - manual programming – NC co-ordinate systems and axes – tape format – sequence number, preparatory functions, dimension words, speed word, feed world, tool world, miscellaneous functions – programming exercises.
Computer aided part programming: concept & need of CAP – CNC languages – APT language structure: geometry commands, motion commands, postprocessor commands, compilation control commands – programming exercises – programming with interactive graphics.

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**Module 4**

Automated process planning: Process planning, general methodology of group technology, code structures of variant & generative process planning methods, AI in process planning, process planning software.

**Module 5**

Robotics: Industrial robots and their applications for transformational and handling activities, configuration & motion, actuators, sensors and end effectors, feature like work envelop, preçision of movement, weight carrying capacity, robot programming languages.

Vision systems: introduction to intelligent robots.

**References**


1. Craig john - Introduction to Robotics
2. Groover M.P. - CAD/CAM, PHI.
3. Hearn & Baker - Computer graphics (in C version), Prentice Hall.
4. New man & Sproull - Principles of interactive Graphics, McGraw – Hill.
5. Petruzella Frank.D. - Programmable logic controllers.
6. Yoram koren - Numerical control of machine tools, McGraw-Hill
7. Jonn Craig - Introduction to Robotics


## HEAT ENGINES LABORATORY

**M 607** **0+0+ 3**

Study of systems and components of IC Engines and automobiles - study of dynamometers used in engine testing - study of IC Engine repairs and maintenance. Study of boilers, boiler mountings and accessories - study of steam engine parts and systems.

Testing of IC engines • Performance analysis of IC engine using computerized test rig-Load test on petrol and diesel engines- determination of indicated and brake thermal efficiencies - mechanical efficiency - relative efficiency - volumetric efficiency - air-fuel ratio and compression ratio - valve timing diagram - retardation test - Morse test - heat balance - effect of varying the rate of cooling water and varying the speed on the performance characteristics of engines. Testing of steam boiler - boiler trial - steam calorimeters and steam nozzles - performance test on steam engines - performance test on steam turbines.

Testing of fuels and lubricants - determination of flash and fire points of petroleum products - determination of kinematics and absolute viscosity of lubricating oils - determination of calorific

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## ADVANCED MACHINE TOOL LABORATORY

**M 608** **0+0+3**

*Study of Vibration*: two and multi degree freedom systems, signature analysis and preventive maintenance, noise control. Study of Automated process planning: process planning, general methodology of group technology, code structures variant generative process planning methods, AI in process planning.

*Study of Quality circle concepts* – ISO 9000, ISO 4000 series, QS 9000 – quality system standards, TQM, - SQC, control charts for inspection, charts for variables, R charts, six sigma concepts – Taguchi methods.

*Study of Fundamentals of Numerical control*: principles of NC - incremental & absolute positioning, PTP, straight & contouring machining, open & closed loop system - DDA integrator & different interpolators - feed back devices - lead screw - stepper motor - advantages & disadvantages - NC, CNC and DNC - punched tapes – manual part programming, preparatory function, G codes, speed word, feed word, M codes, tool word etc, computer aided part programming, APT languages – tooling for CNC, tooling systems, automatic tool changing tool magazines etc - principles, need of machining centers. *Study of Programmable logic controllers (PLC):* need – relays- logic ladder program – timers; on & off delay timers, cascading & retentive timers – counters; cascading counters. *Study of Tolerance charting techniques*: operational sequences for typical shaft type components, preparation of process drawing for different operation, tolerance worksheets and centrality analysis. *Study of Design of jigs and fixtures*: degree of freedom - principles of location and clamping - principles of jig design – fool proofing - elements of jigs - design of jigs for drilling, reaming – principles of fixture design, locators and different types of clamps – elements of fixture – provision for tool setting – design of fixture for milling, turning, boring, and grinding operations, inspection of assembly fixtures – modular fixturing – concepts and applications – use of software for building fixture – tool design for forging, drop forging dies and auxiliary tools – upset or forging machine dies. *Study of Design of sheet metal blanking and piercing dies*: Die design – power press types – die clearances – cutting forces – punch and die mountings – types of construction – fine blanking – die design fundamentals – materials for dies & allied elements – multiplexing of tools.

**Experiments**

Key way slotting, side & face milling of a rod to make square head – 5mm material removal by Shaping – Drill 10.5 mm. CBR 16 mm, 10 mm deep – Surface grinding, cylindrical grinding and tool grinding - Vibration study of machine tools with an analyser. Preparation of process plans using CAPP software –Planning of experiments for process improvement using software – simulation of factory layout - facilities layout analysis – line balancing – materials requirement planning – inventory analysis – quality assurance using control charts – preparation of process sheet for manufacturing of spindle like & housing type component – preparation of process plan & cost estimation for the manufacture of typical product like submersible pump, three phase motor etc. Preparation of CNC programs for drilling, grooving, parting, linear interpolation, circular interpolation, etc. – Simulate and produce a component has valley shaped undercuts along its lenth, etc. PLC operated solenoid valves. Design of a jig and a

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fixture for drilling & milling operation - Design of assembly, inspection, fixtures - Design of sheet metal working dies: feed strip layout design, force calculations, press tool design (forming & cutting), assembly & dismantling of simple die casting dies - Design & fabrication of simple bending dies – Design of forging dies: product requirement & design of forging dies – study of analysis software for mould flow, melt flow, metal forming.

**Student's assessment, continuous evaluation, awarding of sessional marks, record bonafides, oral examination etc and university examination shall be done by Faculty members.**

**References**


1. Acharkan. N. - Machine Tool Design Vol.1 to 4, MIR Publication.
2. HMT - Production Technology, TMH.
3. Petruzella Frank. D - Programmable logic controllers.
4. Yoram Koren - NC machines tools, McGraw Hill.


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# SEVENTH SEMESTER

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## GAS DYNAMICS AND JET PROPULSION

**M 701** **2+1+0**

**Module 1**

Introduction to gas dynamics: control volume and system approaches acoustic waves and sonic velocity - Mach number - classification of fluid flow based on mach number - mach cone-compressibility factor - General features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

**Module 2**

Isentropic flow of an ideal gas: basic equation - stagnation enthalpy, temperature, pressure and density-stagnation, acoustic speed - critical speed of sound-dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function. Steady one dimensional isentropic flow with area change-effect of area change on flow parameters-chocking- convergent nozzle - performance of a nozzle under decreasing back pressure -De lavel nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies.

**Module 3**

Simple frictional flow: adiabatic flow with friction in a constant area duct-governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct-governing equations - limiting conditions. Steady one dimensional flow with heat transfer in constant area ducts- governing equations - Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy

**Module 4**

Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - Rankine Hugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.

**Module 5**

Propulsion: Air craft propulsion: - types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems. Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion - rocket engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

**References**

1. Compressible fluid flow - A. H. Shapiro

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2. Fundamentals of compressible flow with aircraft and rocket propulsion - S. M. Yahya
3. Elements of gas dynamics - Liepman & Roshko
4. Aircraft & Missile propulsion - Zucrow
5. Gas dynamics - M.J. Zucrow & Joe D.Holfman

## INDUSTRIAL ENGINEERING

**M 702** **2+1+0**

**Module 1**

**Introduction**: Evolution of Industrial Engineering- Fields of application of Industrial Engineering -Functions of Industrial Engineer-Organisational structure of Industrial Engineering Department.

**Production and Productivity**: Types of production-continuous production-intermittent production. Productivity-productivity index-factors affecting productivity-techniques for productivity improvement.

**Value Engineering**: Historical perspective-reasons for poor values-types of values-the different phases of value analysis-applications of value analysis.

**Module 2**

**Plant design**: Plant location-factors influencing plant location. Plant layout-types of plant layout-introduction to layouts based on group technology, just in time and cellular manufacturing systems.

**Material handling**: Principles of material handling-selection of material handling devices-types of material handling equipments.

**Maintenance and replacement of equipments**: Types of maintenance. Depreciation-methods of calculating depreciation. Selection of equipments-methods for replacement studies.

**Module 3**

**Methods Engineering**: Process charts and flow diagrams-Micro motion study-Work measurement techniques.

**Job evaluation and merit rating**: Objectives of job evaluation-Methods of job evaluation. Objectives and uses of merit rating-Merit rating plans.

**Module 4**

**Industrial relations**: Fatigue-Communication in industry-Industrial disputes-Trade unions-Quality circles-BIS-ISO-Labour welfare-Industrial safety-Statutory provisions in labour legislations.

**Ergonomics**: Objectives and applications.

**Module 5**

**Inventory control**: Determination of Economic order quantity and reorder level.

**Quality control**: Destructive and nondestructive testing methods. Statistical quality control-process control charts-acceptance sampling.

**Cost accounting and control**: Elements of cost- Selling price of a product-Types of cost-Allocation of overheads.

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**References**


1. Production system - Riggs
2. Production control - Hiejet
3. Human factors in Engg design - Mc Cormic E.J.
4. Industrial Engg & Management - O.P.Khanna
5. Industrial Organisation & Management - Banga & Sarma
6. Industrial Engg - A.P.Verma
7. Value Engg - Mudge
8. Manufacturing organization & Management - Amrine
9. Time & Motion Study - Lowry
10. Quality Control - Hansen


## REFRIGERATION AND AIR CONDITIONING

**M 703** **2+1+0**

**Module 1**

Principles of refrigeration: Thermodynamics of refrigeration - Carnot cycle, reversed carnot cycle, heat pump, and refrigerating machine- coefficient of performance - unit of refrigeration - refrigeration methods- conventional refrigeration systems. Air refrigeration system- Bell Coleman cycle - C.O.P. capacity work and refrigerant flow requirements in Bell - Coleman cycle.

**Module 2**

Vapour compression system: simple cycle -comparison with Carnot cycle - theoretical, actual and reactive - COP effect of operating parameters on COP - wet, dry and superheated compression - under cooling - actual cycle representation on TS and PH diagrams simple problems. Advanced vapour compression systems - multistage vapour compression systems - flash chamber multiple compression and evaporation systems cascading - simple problems.

**Module 3**

Vapour absorption systems: simple, cycles - actual cycle - ammonia water and lithium bromide water systems - COP - electrolux system. Refrigerant and their properties: Nomenclature - suitability of refrigerants for various applications - unconventional refrigeration methods- Vortex tube, steam-jet, magnetic (cryogenics) refrigeration and thermoelectric refrigeration - applied refrigeration house hold refrigerators - unit air conditioners and water coolers - ice plant cold storage.

**Module 4**

Refrigeration system components: condensers - water and air cooled condensers - evaporative condensers - expansion devises - capillary tube- constant pressure expansion valve - thermostatic expansion valve - float valve and solenoid valve - evaporators - natural convection coils - flooded evaporators - direct expansion coils. Reciprocating compressors: single stage and multistage compressors - work done optimum pressure ratio- effect of interfolding - volumetric efficiency -effect of clearance - isothermal and adiabatic efficiency - compressed air motors.

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Rotodynamic compressors: Screw and vane type compressors - principle of operation - hermetic, semihermetic and open type refrigeration compressors.

**Module 5**

Principles of air conditioning: Psychrometry and psychrometric chart thermodynamics of human comfort - effective temperature - comfort chart applied psychrometry - sensible heat factor - psychometric process-problems. Winter air conditioning: heating load calculations humidifiers and humidistat. Summer air conditioning: cooling load calculations - year round air conditioning - unitary and central systems - principles of air distribution - design of air duct systems.

**References**


1. Refrigeration and air conditioning - Ballaney P. L.
2. Refrigeration and air conditioning - Stocker W. F.
3. Refrigeration and air conditioning - Jordan and Protester
4. Principles of Refrigeration - Roy J. Dossat


## DYNAMICS OF MACHINERY

**M 704** **2+1+0**

**Module 1**

**Balancing: -** Balancing of rotating masses, static balancing and dynamic balancing, Balancing of several masses rotating in same plane, Balancing of several masses rotating in several planes, Balancing machines.

**Balancing of reciprocating masses: -** The effect of inertia force of the reciprocating mass on the engine. Partial primary balance. Partial balancing of locomotive, Hammer blow, Variation of tractive effort, Swaying couple. Coupled locomotives, Balancing of multi cylinder inline engines, v-engines, Radial engines, Direct and Reverse cranks

**Module 2**

**Vibrations: -** Definitions, simple harmonic motion.

Single degree freedom systems: -

**Undamped free vibrations: -** Equations of motion Natural frequency, Energy method, Equilibrium methods, Rayleigh's methods, Equivalent stiffness of spring combinations.

**Damped free vibrations: -** Viscous damping, Free vibrations with viscous damping, over-damped system, critically damped system, under-damped system, Logarithmic decrement, viscous dampers, coulomb damping.

**Forced Vibrations: -** Forced harmonic excitation Rotating unbalance, Reciprocating unbalance. Energy dissipated by damping, vibration isolation and Transmissibility. Vibration measuring instruments.

**Module 3**

**Two degree freedom systems: -** Principal modes of vibration, Rectilinear and angular modes, systems with damping, vibration absorbers, centrifugal pendulum damper, dry friction damper, untuned viscous damper.

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**Multi-degree of freedom system:** - Free vibrations, equations of motion, Influence coefficients method, lumped mass and distributed mass systems, Stodola method, Dunkerly's method, Holzer's method, Matrix iteration method.

**Torsional Vibrations:** - Torsionally equivalent shaft, torsional vibration of two-rotor, three-rotor, and geared systems.

**Module 4**

**Critical speeds of shafts:** - Critical speed of a light shaft having a single disc without damping. Critical speeds of a light cantilever shaft with a large heavy disc at its end.

**Transient vibration:** - Laplace transformation, response to an impulsive input, response to a step input, response to a pulse input, phase plane method, shock spectrum.

**Non-linear vibrations:** - Phase plane, undamped free vibration with non-linear spring forces, hard spring, soft spring, Perturbation method, Forced vibration with nonlinear forces, Duffings equation, self excited vibrations.

**Module 5**

**Noise control:** - Sound propagation, decibels, acceptance noise levels, Air columns, Doppler effect, acousticl measurements, microphones and loud speakers, Recording and reproduction of sound, fourier's theorem and musical scale, Acoustics of buildings, Acoustic impedence filters and human ear.

**References**


1. Theory of Machines - Thomas Bevan
2. Theory of Machines - P.L. Ballaney
3. Mechanical Vibrations, V edition - G.K. Groover
4. Theory of Vibrations with applications, III Edn - W.T. Thomson
5. Mechanical Vibrations - S. Graham Kelly, Schaum's outlines
6. Fundamentals of Vibrations - Leonard Meirovitch, Mac Graw Hill
7. A text book of sound - L.P. Sharma & H.C. Saxena
8. Engineering Noise Control - D.A. Bies & C.H. Hausen.
9. Noise & Vibration Control - Leo N. Beraneck


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## MACHINE DESIGN AND DRAWING - I

**M 705** **2+0+2**

**Module 1**

Definitions - Design principles – common engineering materials – selection and their properties – general steps in design – design criteria – types of failures - types of cyclic loading.

Stresses in Machine parts – tension, compression and shear –elastic constants-working stress-factor of safety-bending and torsion-combined stresses-stress concentration-fatigue-endurance limit-fatigue diagram-fatigue factors-theories of failure-Goodman and Soderberg lines

Detachable joints-socket and spigot cotter joint, knuckle joint – pins, keys, splines -set screws, threaded fasteners and power screws – Shaft coupling – sleeve

coupling – split muff coupling – flange coupling – protected type flange coupling – thick and thin cylinders

Riveted joints: Lap joint – Butt joint – failures of riveted joint – strength of riveted joint – efficiency of riveted joint – design of longitudinal butt joint for boiler – design of circumferential lap joint for boiler – joints of uniform strength – Lozange joint – eccentrically loaded riveted joint.

**Module 2**

Springs – Classification and uses of springs – design of helical springs – effect of end turns – energy absorbed – deflection – design for fluctuating loads – vibration in springs – buckling of spring materials

Shafts – Torsion and bending of shafts – hollow shafts – design of shafts for strength an deflection – effect of keyways – transverse vibration and critical speed of shafts

Design of IC engine parts – connecting rod – piston – flywheel –

Welded joints: Lap joint – Butt joint – weld symbols parallel and transverse fillet welds – strength of welded joints – axially loaded welded joints – eccentrically loaded welded joints.

**References**


1. Mechanical Engg. Design – Joseph Shigley
2. Machine Design – Mubeen
3. Machine Design – Black
4. Machine Design – R. K. Jain
5. Machine Design an integral approach – Norton, Pearson
6. Machine Design data hand book – Lingayah Vol I.
7. Elements of Machine Design – Pandya & Shah


**Note**

For the University Examination 100% choice may be given. i.e. two questions from each module with full choice.

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## OPTIMIZATION TECHNIQUES (ELECTIVE - I)

**CMELRTA 706-1** **3+1+0**

**Module 1: Classical optimization techniques**

Single variable optimization – Multivariable optimization with no constraints – Hessian matrix – Multivariable saddle point – Optimization with equality constraints – Lagrange multiplier method - Multivariable optimization with inequality constraints – Kuhn-Tucker conditions.

**Module 2: One-dimensional unconstrained minimization**

Elimination methods – unrestricted search method – Fibonacci method – Interpolation methods – Quadratic interpolation and cubic interpolation methods.

**Module 3: Unconstrained minimization**

Gradient of a function – Steepest descent method – Newton's method – Powells method – Hooke and Jeeve's method.

**Module 4: Integer – Linear programming problem**

Gomory's cutting plane method – Gomory's method for all integer programming problems, mixed integer programming problems.

**Module 5: Network Techniques**

Shortest path model – Dijkstra`s Algorithm – Floyd`s Algorithm – minimum spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm.

**References**


1. Optimization theory and application - S.S. Rao, New Age International P. Ltd.
2. Optimization Concepts and applications in Engineering - A.D.Belegundu, T.R. Chandrupatla, Pearson Education Asia.
3. Principles of Operations Researc for Management - F. S. Budnick, D. McLeavey, R. Mojena, Richard D. Irwin, INC.
4. Operation Research an introduction - H. A. Taha, Eastern Economy Edition.
5. Operations Research - R. Panneerselvam, PHI


## PLANT ENGINEERING AND MAINTENANCE (ELECTIVE-I)

**M 706-2** **3+1+0**

**Module 1**

Wear and Lubrication: -wear-classification-theories of wear-analytical treatment of wear- stages of wear-effect of moisture, gas and liquid on wear-effects of temperature-corrosive wear- fretting-fatigue-calculation of working life-design considerations.

**Module 2**

Lubricants: -solid, fluid and semifluid-synthetic lubricant-general properties and uses-tests and classification-aniline point-cloud, pour and flash point-carbon residue-flash and fire points- sulphur content-lubricant additives-lubricant systems-lubrication equipments and components.

**Module 3**

Maintenance: -Breakdown and preventive maintenance-deterioration and failure analysis- planning, scheduling, and controlling of maintenance work-organisation for maintenance.

Replacement: - causes of deterioration and obsolescence-sudden and gradual obsolescence and deterioration-economic analysis-MAPI method. Evolution of maintenance management-SWOT analysis-subjective methods of evaluation-objective criteria of evaluation.

**Module 4**

Reliability: -concept and definition-chance of failure-wear and failure application of stochastic model for reliability studies-reliability of series, parallel and stand by systems-estimation of parameters of failure distribution-maintainability and availability-problems.

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**Module 5**

Non destructive testing and diagnostic instruments: - inventory control of spare parts-simple problems.

Safety management: - accident prevention program-designing of safe operation-fire protection –legal provisions for safety in industry.

**References**


1. Standard Handbook of Plant Engineering - Robert C.Rosder
2. Reliability&Maintainability Management - Balbir S.Shillon
3. Industrial Maintainence Management - Sushilkumar, Srivasthava
4. Handbook of Tribology - Bharat Bhooshan, B.K.Guptha
5. Inspection, Quality control and Reliability - S.C.Sharma
6. Maintenance and Spare parts management - P.Gopalakrishnan, A.K.Banergy.


## WELDING TECHNOLOGY (ELECTIVE - I)

**M 706-3** **3+1+0**

**Module 1**

Introduction: - Welding as a fabrication process- advantages and limitations – principal types of welding process and their characteristics.

Soldering & Brazing: -Soldering – principles of soldering, Tin-Lead binary diagram- different types of solders – need of fluxes for soldering and different fluxes used – method of soldering – silver soldering and aluminium soldering – advantages and limitations.

Brazing: - Principle of Brazing – brazing alloys & fluxes- methods of brazing – aluminium brazing – advantages & limitations.

Pressure Welding Process: - Forge welding- spot welding – seam welding – projection welding- butt welding – flash butt welding – welding of tubes & percussion welding.

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**Module 2**

Fusion Welding: Oxy-acetylene welding – chemistry of oxy-acetylene welding flame – type of flames & adjustments – welding set up & arrangements – preparation & storing of acetylene as well as oxygen gases- rightward & leftward welding techniques – filler metals & fluxes used for gas welding – weld movements – welding of: cast iron, stainless steel, aluminium, copper, nickel & magnesium- safety rules in oxy-acetylene welding.

**Module 3**

Electric arc welding: Electric properties of the arc – arc column theories: ion theory & electron theory- heat distribution in an electric arc – arc welding power sources – their specific characteristics advantages & limitations – arrangements for straight & reverse polarities – striking of an arc – types of weld movements – welding positions – welding symbols – Electrodes – needs & types of electrodes covering – classification of arc welding electrodes.

Arc welding Processes: Carbon arc welding – single & twin carbon arcs – flux shielded metal arc welding – submerged arc welding – TIG & MIG welding and atomic hydrogen welding.

**Module 4**

Special or Unique welding processes: Various welding processes – their specific applications – neat sketches- advantages & limitations: Electroslag welding – Plasma arc welding – Ultrasonic welding – Electron beam welding – Laser beam welding – friction welding – explosive welding & cold welding processes.

**Module 5**

Basic metallurgy of welding: Three prominent zones: weld metal zone – heat affected zone & the unaffected zone.

Welding Stresses: causes of development of residual stresses – methods of relieving or controlling of residual stresses in weldments.

Defects: commonly found defects in welded joints.

Inspection & testing of weldments: - Needs of inspection & testing of weldments – the various testing methods – destructive tests such as tensile, bend, impact, neck break & hardness tests – Non destructive tests such as Magnetic particle, Ultrasonic, Dye-penetratant, radiographic & eddy current methods.

**References**


1. Welding Engineering -Rossi
2. Welding & welding Technology -Little.
3. Metallurgy of welding -Bruckner
4. The Electric Welder -Tse Golsky
5. Welding Engineer's Hand Book Vol 1,2 & 3 (ASME)
6. Welding for Engineers -Udin & Funk
7. A text book of Welding Technology -O.P Khanna
8. Welding Engineering -R.L Agarwal
9. Welding engineering & Technology -R. S. Parmer
10. Welding (10th Edition) -A. C. Davis, Cambridge University Press.


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## FOUNDRY TECHNOLOGY (ELECTIVE - I)

**M 706-4** **3+1+0**

**Module 1**

Patterns: Different types of patterns – colour codes of patterns.

Moulding sands: Natural and synthetic sand- ingredients of moulding sands- special sand additives sand mixing- general properties of moulding sand – testing of moulding sand - effect of ingredients and Additives on properties of moulding sand- reusability of moulding sands- sand conditioning.

Core and core making: Purpose of cores - core prints – types of cores – core sand ingredients – requirements of core sand- core sand mixing – binding materials – core boxes, core making, baking, coating, reinforcing and venting.

**Module 2**

Gating and risering: Mechanism of solidification – nucleation and growth – rate of solidification – progressive and directional solidification.

Gates and gating system – functions and types of gates – design of gating system – gating ratios for ferrous and nonferrous castings – risering- functions and requirements of riser – types of risers - theoretical considerations – Chvorinov s

rule – riser shape and directional solidification – use of chills, insulators and exothermic compounds

**Module 3**

Ferrous foundry metallurgy: Gray cast iron – composition – effect of composition in properties – types of graphite in gray cast iron – foundry characteristics of grey cast iron – effect of inoculation and inoculants – low alloy and high alloy cast iron –malleable iron – white heart and black heart malleable iron – malleablisation – S.G. iron – compositon and properties

**Module 4**

Non-ferrous foundry metallurgy: Foundry characteristics of copper and aluminium base alloys – degassing and melt treatment.

Melting and pouring: Types of furnaces used for C.I., steel and non-ferrous metals – details and charge calculation in cupola charging

**Module 5**

Cleaning and inspection: Knock out and fettling – destructive and non-destructive testing- salvaging.

Mechanisation in foundry: Elementary ideas of mechanisation in sand conditioning and supply, moulding, core making, knock out and fettling.

**References**


1. Principles of Metal Casting - Hine and Rosenthal
2. Foundry Technology - P.R.Beeley
3. Manufacturing Science - Amitabha Ghosh and Ashok Kumar Mallick
4. Manufacturing Engineering and Technology - Kalapakjian and Schmid


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## ADVANCED OPERATIONS RESEARCH (ELECTIVE - I)

**M 706-5** **3-1-0**

**Goals:** The course is designed to develop an understanding of operation research with particular attention to linear programming, dynamic programming, and integer programming.

**Module 1**

- **Linear Programming**
  1. Problem Formulation
  2. Graphical Solution
  3. Simplex Method
  4. Revised Simplex Method
  5. Duality Theory
  6. Sensitivity Analysis

**Module 2**

- **Transportation Model**
  1. North-west corner method

2. Least cost method
3. VAM
4. Test of optimality

**Module 3**

- **Integer Programming**

1. Introduction, basic concepts and simple problems
2. Gomory's all integral cutting plane method

- **Goal Programming**

1. Application of goal programming
2. Introduction basic concepts and simple problems

**Module 4**

- **Dynamic Programming**

1. Shortest path models
2. Characteristic of Dynamic Programming
3. Discrete Dynamic Programming models

**Module 5**

- **Simulation**

1. Basic Concepts
1.1 Binomial distribution
1.2 Poisson distribution
1.3 Normal distribution
2. Monti-cralo simulation
3. Generation of random numbers
4. Simulation software

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**Course Outcomes**

1. Students will have a working knowledge of operation research techniques such as linear programming, Integer Programming, Goal Programming and Dynamic Programming.
2. Students will have the ability to analyze and perform sensitivity analysis on different optimum solutions generated.
3. Students will have the ability to tackle real life optimization problems.

**References**

1. Hamda & Taha, Operations Research - 7th edn; Pearson
2. Ravindran and Philips Operations Research – Principles and Practice.
3. Ronald L.Rardin, Optimisation in Operation Research, Pearson Education
4. Verma A.P., Operation Research, S.K.Katharia & Sons

## MARKETING AND SALES MANAGEMENT (ELECTIVE - I)

**M 706-6** **3+1+0**

**Module 1**

**Marketing**: Definition- Marketing concepts- Market segmentation- Market demand- Product- Value and satisfaction- Exchange and transactions- Marketing channels- Competition- Marketing environment- Marketing mix.

**Marketing Management**: Functions-Sales forecasting-Pricing-Distribution-Advertising- Sales promotion- Marketing research.

**Module 2**

**Strategic Planning**: Strategic business unit (SBU)- Business strategic planning-SWOT analysis. Marketing decision support system.

**Module 3**

**Product life cycle:** Marketing strategies in the different stages of product life cycle.

**New product development**: Idea generation- Concept development and testing-conjoint analysis.

Introduction to Relationship marketing, International marketing and on line marketing.

**Module 4**

**Consumer behaviour**: Major factors affecting consumer buying behaviour-Consumer decision making process.

**Organisational buying behaviour**: Buying situations- the buying center-Purchasing process.

**Module 5**

**Sales management**: Evolution of Sales management- Objectives of Sales management- Personal selling situations- Theories of selling- Basic selling styles-Recruitment, selection and training of sales personnel-Sales territory-Sales quotas.

**References**


1. Marketing Management - Philip Khotler
2. Sales Management - Richard, Edward & Norman
3. Industrial Engg & Management - O.P.Khanna
4. Industrial Organisation & Management - Banga & Sarma
5. Organisational Behaviour - Fred Luthans
6. Consumer Behaviour - Schifman & Kanuk
7. Basic marketing - Gundiff
8. Marketing Management for small units - Jain
9. Sales Engg - Lester
10. Salesmanship concept - Thomson


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## COMPUTATIONAL FLUID DYNAMICS (ELECTIVE - I)

**M 706 -7** **3+1+0**

**Module 1**

Basic concepts: -conservation principles-mass, momentum energy-conservation of scalar quantities-dimensionless form of equations-simple mathematical models for incompressible, inviscid, potential and creeping flows-approximations of hyperbolic, parabolic, elliptic, and mixed flows- introduction to numerical methods, advantages and limitations-components of numerical solution methods and properties.

**Module 2**

Finite difference methods: - concept-approximation of first derivative, second derivative and mixed derivative-boundary conditions, errors, spectral methods, examples-finite volume method, approximation of surface and volume integrals, boundary conditions-examples.

**Module 3**

Solutions of Linear Equations: - direct methods-Gauss elimination method-LV decomposition- tridiagonal system-cyclic reduction-iterative methods-conyergence-conjugate gradient- multigrid methods-non linear equations-deferred correction approaches, methods for unsteady problems, two level Runge Kutta predictor corrector methods-explicit, implicit methods.

**Module 4**

Solutions of Navier Stokes equations: -choice of variable arrangement on grid-calculation of pressure-other methods-solution methods for Navier Stokes equations.

**Module 5**

Turbulent flows: - direct numerical solution-large eddy simulation, RANS models, Reynolds stress models- compressible flows (introduction only)-pressure correction models-simple examples.

**References**


1. Computational methods for Fluid Dynamics -Joel H.Ferziger & Miloven Peric. (Springer Werlag Publishers)
2. Computational Fluid Dynamics (The basics with applications) -John D.Anderson (Mc Graw ..l Pub.)
3. Numerica .nethods for Scientific& Engineering Computations - M.K.Jain & R.K.Iyen.ar (WileyEastern)
4. Introduction to Numerical Analysis - F.B.Hilderbrand. (Tata Mc GrawHill)


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## MECHANICAL ENGINEERING LABORTAORY

**M 707** **0+0+4**

Tests on reciprocating air compressor
Tests on blowers and rotary compressors
Vibration of springs – free and forced vibrations.
Whirling of shafts.
Balancing of reciprocating and revolving masses – balancing machines.
Tests on universal governor apparatus.
Tests on gyroscope.
Friction in hydrodynamic bearings – bearing testing machines.
Metallurgical analysis of specimens using metallurgical microscope.
Testing of foundry sands for strength, moisture content, permeability etc.
Determination of minimum fluidizing velocity in a conventional fluidized bed.

## HEAT TRANSFER LABORTAORY

**M 708** **0+0+4**

Tests on refrigeration equipment.
Tests on air conditioning units.
Determination of thermal conductivity of conducting and insulating materials.
Determination of emissivity of surfaces
Heat flow through lagged pipes.
Heat flow through composite walls.
Determination of overall heat transfer co-efficient of a heat exchanger.
Free and forced convection.

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# EIGHTH SEMESTER

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## PRODUCTION ENGINEERING

**M 801** **2+1+ 0**

**Module 1**

**Theory of metal cutting:** Historical back ground –Classification of manufacturing process – Deformation of metals (review only) – Performance & process parameters - Oblique & orthogonal cutting – Mechanism of chip formation, types, chip curl, chip control – Tool geometry: American, British, DIN, ISO systems – Mechanism of orthogonal cutting: Thin zone model, Merchant's analysis, Oxley thin shear zone analysis – Thick zone models, Palmer & Oxley analysis – shear angle relationship, Lee & Shaffer`s; relation ship etc. – Friction process in metal cutting: nature of sliding friction, effect of increasing normal load on apparent to real area of contact , columb`s law, yield stress at asperities, adhesion theory, ploughing, sublayer flow – Effect of rake angle,cutting angle, nose radius etc. on cutting force and surface finish – Empirical determination of force component.

**Module 2**

**Thermal aspects of machining**: Source of heat; temperature distribution in chip, shear plane & work piece; effect of speed, feed & depth of cut – Tool materials: carbon steel, HSS, coated HSS, ceramics, diamond etc.- Cutting fluids: effect of specific heat, etc on selection of liquids; effectiveness at tool chip interface; classification of fluids – Tool wear: flank & crater [KT] wear – Tool wear mechanisms: adhesion, abrasion, diffusion & fatigue; Taylor's equation, application at shop floor; speed, tool material & micro structure on tool life; allowable wear land [VB] ; rapid, steady & catatospheric wear on rough & finishing operations – Economics of machining – Machineability index.

**Module 3**

**Power metallurgy**: Preparation metal powers – Power characteristics: properties of fine power, size, size distribution, shape, compressibility, purity etc.- Mixing – Compaction techniques – Mechanism of sintering of single & multi phase materials - Sintering atmosphere – Finishing operations: heat treatment, surface treatment, impregnation treatment etc. – Impregnated bearings – Sintered oil-retaining bearing – Economics of p/m.

*Advanced materials*: Super alloys - Titanium & titanium alloys – shape memory alloys –smart materials – microstructure, properties, applications.

**Module 4**

**Polymers**: Polymerization – Structural features: Linear & net work molecular structure – Molecular wt, degree of polymerization, branching, cross linking – co polymers & ter polymers – Molecular architecture – effect of crystallinity – Glass transition temp: - Thrmo polymers – Thermoset polymers – Additives – Polymer matrix composites: properties & applications. - *Elastamers*: Kinked structure - Mechanical, physical & chemical properties – Vulcanization of rubber – conductive polymers, applications. – *Ceramics*: Structure – Mechanical, physical properties & applications. – *Glasses*: Types, glass ceramics – Types, properties and application of MMC and CMC – Honey comb structure.

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**Module 5**

**Advanced production methods**: Rapid prototyping: background & definitions – Process methods: Stereolithography, selective laser sintering, fused deposition modeling, laminated object manufacturing, laser engineered net shaping, 3D welding – Information processing – Indirect fabrication of metals & ceramics. – *Non traditional machining*: EDM, ECM, USM – principle, types, process parameters, control, MRR, surface finish, application etc. – Electro chemical grinding, lapping, honing; process principle & Ra only, applications – EBM, LBM, IBM, AJM, Abrasive water jet machining, LIGA process.

**References**


1. Armarego & Brown, The Machining of Metals, Prentice - Hall
2. Beaman, Barlow & Bourell, Solid Free Foam Fabrication: A new direction in mafg., Kluwer Academic Publishers
3. Brophy, Rose & Wulf, The Structure & Properties of Metals Vol.2, Wiley Eastern
4. Dixon & Clayton, Powder Metallurgy for Engineers, Machinery publishing co. London
5. HMT, Production Technology, Tata McGraw Hill
6. Kalpakjian, Manufacturing Engineering & Technology, Addison – Wesley, 4nd edn.
7. Lal G.K., Introduction to Machining Science, New Age publishers
8. Metcut research, Machinablity Data Center Vol.1 & 2, Metcut research associates, Cincinnati
9. Paul. H. Black, Theory of Metal Cutting, McGraw Hill


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## AUTOMOBILE ENGINEERING

**M 802** **3+1+0**

**Module 1**

**Engines**: Types of engines in automobiles-classifications-engine components-working of various systems-CNGengines-R&D works-present and future vehicles-frame, body and engine construction-structure and mechanism forming components- carburetors, diesel fuel pumps, injector, single point and multi point fuel injection-combustion chambers-lubricating oil pumps-cooling systems-Vehicle performance-resistance to the motion of vehicle-air, rolling, and radiant resistance-power requirement-acceleration and gradeability-selection of gear ratios.

**Module 2**

**Transmission:** prime movers-clutch-principle-friction-helical spring and conical spring clutches –centrifugal clutches and fluid couplings-Gear box-principle and necessity of manual gear box- constant mesh, sliding mesh and synchromesh gear boxes-epicyclic gearbox-overdrives-hydraulic torque converters-semi and automatic transmission-Final drive-front wheel, rear wheel and four wheel drives-transfer case-Hotchkiss and torque tube drives-universal joints-constant velocity universal joint-differential-non-slip differential-rear axles-types of rear axles.

**Module 3**

**Steering and Suspension**: Different steering mechanisms-steering gear boxes-power steering –types-suspension systems-front axle, rigid axle and independent suspensions-anti-roll bar-coil spring and leaf spring-torsion bar-Macpherson strut-sliding pillar-wish bone-trailing arm suspensions-front axle types-front wheel geometry-castor, camber, king pin inclination, toe-in toe-out. Shock absorbers-hydraulic and gas charged shock absorbers-air suspensions.

**Module 4**

**Chassis and Body**: Types of chassis and body constructions-crumble zones, air bags and impact beams-automotive air conditioning-braking mechanism and convectional brakes- booster, hydraulic and power brakes, components and attachments-mechanical, hydraulic and pneumatic brakes-anti-lock braking systems-Wheels and Tyres:tube-less tyres-ply ratings- radial tyres-hybrid vehicles-vintage cars-racing cars-automated roads-coach works-materials- safety provisions- motor vehicle act.

**Module 5**

**Electrical systems** Battery, charging and ignition systems-electronic ignition-dynamos and alternators-voltage regulators-light and horn relays-circuit diagrams-starting motor-bendix and follow through drives-power windows-electronic engine control unit for fuel injection- automotive lighting, accessories and dashboard instruments-Preventive and breakdown maintenance-engine testing, servicing-overhaul- engine tuning- wheel balancing-trouble shooting-garage tools and equipments-noise, vibration, and performance tests.

**References**


1. Automobile Engineering (Vol. 1 & 2) - K.M.Guptha
2. Automotive Mechanics - Joseph Heitner
3. Automobile Engineering - Harbans Singh Reyd
4. Automotive Mechanics - William H. Course


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## PRODUCTION PLANNING AND CONTROL

**M 803** **2+1+0**

**Module 1**

**Introduction to PPC**: need for PPC, effect, advantages, functions and problems of PPC.

**Forecasting:** methods of sales forecasting-forecasting for new products-forecasting for established products-time series analysis for sale forecasting – long term forecasting – methods of estimating Sales trend- problems- correlation analysis.

**Module 2**

Production planning: objectives-characteristics-process planning. Capacity planning- factors affecting-Master production scheduling-material requirement planning – BOM and product structure.

**Production control**: objectives- production control systems- principle and procedure of production Control.
**Routing**: objectives- procedure – route sheets.

**Module 3**

**Sequencing assumptions**: solution of sequencing problems-processing n jobs through two machines
Processing n jobs through three machines – processing n jobs through m machines – processing two
Jobs through m machines-problems

**Module 4**

**Materials management:** Components of integrated material management Purchasing management- stores management. Supply chain management – ERP- Role of I.T.

**Module 5**

**Loading and scheduling**: aim- reasons for scheduling- master scheduling or aggregate scheduling
Estimating shop loads- short term scheduling – mathematical loading and scheduling- problems-
Scheduling through PERT / CPM problems.
Despatching- duties- procedure- rules.
Follow up and reporting- types-report preparation and presentation.

**References**


1. Modern Production Management - E.S.Buffa
2. Principles of Production Management - J.Apple
3. Production management principles - Mcycss
4. Production Planning and Control - K.C.jani& L.N.Aggarwal
5. Manufacturing Planning &Control - Volfman, Berry, Whybark systems
6. Production and operations management - R.Paneerselvam
7. Modeling the supply chain - Jeremy F Shapiro


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## MACHINE DESIGN AND DRAWING - II

**M 804** **2+0+2**

**Module 1**

**Gears:** Types of gears –spur gear, helical gear, bevel gear, worm and worm wheel- strength of gear teeth – gear forces and their effects – formative number of teeth – lead – lead angle-basic geometry and nomenclature of meshed spur gear set-dynamic load – endurance load-wear loads – AGMA standards – Lewis equation for strength design and Lewis form factor – design for wear – design of gears such as spur gear, helical gear, bevel gear, worm and worm wheel.

**Module 2**

**Bearings:** Bearing materials – introduction to lubrication – minimum film thickness – hydrodynamic theory of lubrication – viscosity of oil – oil seals –

selection of lubricants – viscosity index – measurement of viscosity – effect of temperature on viscosity – clearance ratio – summer feld number – specifications and selection of bearing – anti friction bearing – bearing life – rating life – dynamic load capacity – equivalent dynamic load – design of journal bearing – design of rolling contact bearing such as ball and roller bearing.

**Pumps:** Design of centrifugal pump (Simple problems)

**References**


1. Mechanical Engineering Design – Joseph Shigley
2. Machine Design – Mubeen
3. Machine Design – Black
4. Principles of Lubrication – Cameron A.
5. Mechanical Seals – Mayer E.
6. Design of Machine Elements – Bhandari V. B.
7. Machine Design – Pandya and Shah


**Note**

Question Paper pattern same as Machine Design - I

## ADVANCED MATHEMATICS (ELECTIVE - II)

**CMELRTM 805-1** **3+1+0**

**Module 1 Green's Function**

Heavisides, unit step function – Derivative of unit step function – Dirac delta function – properties of delta function – Derivatives of delta function – testing functions – symbolic function – symbolic derivatives – inverse of differential operator – Green's function – initial value problems – boundary value problems – simple cases only

**Module 2 Integral Equations**

Definition of Volterra and Fredholm Integral equations – conversion of a linear differential equation into an integral equation – conversion of boundary value problem into an integral equation using Green's function – solution of Fredhlom integral equation with separable Kernels – Integral equations of convolution type – Neumann series solution.

**Module 3 Gamma, Beta functions**

Gamma function, Beta function – Relation between them – their transformations – use of them in the evaluation certain integrals – Dirichlet's integral – Liouville's extension of Dirichlet's theorem – Elliptic integral – Error function.

**Module 4 Power Series solution of differential equation**

The power series method – Legendre's Equation – Legendre's polynomial – Rodrigues formula – generating function – Bessel's equation – Bessel's function of the first kind – Orthogonality of Legendre's Polynomials and Bessel's functions.

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**Module 5 Numerical solution of partial differential equations.**

Classification of second order equations- Finite difference approximations to partial derivatives – solution of Laplace and Poisson's equations by finite difference method – solution of one dimensional heat equation by Crank – Nicolson method – solution one dimensional wave equation.

**References**


1. Linear Integral Equation - Ram P.Kanwal, Academic Press, New York
2. A Course on Integral Equations - Allen C.Pipkin, Springer – Verlag
3. Advanced Engg. Mathematics - H.K.Dass, S.Chand
4. Advanced Engg. Mathematics - Michael D.Greenberge, Pearson Edn. Asia
5. Numerical methods in Engg. &Science - B.S.Grewal, Khanna Publishers
6. Generalized functions - R.F. Hoskins, John Wiley and Sons.
7. Principles and Techniques of Applied Mathematics - Bernard Friedman, John Wiley and sons
8. Principles of Applied Mathematics - James P.Keener, Addison Wesley.
9. Numerical methods - P.Kandasamy, K.Thilagavathy, K.Gunavathy, Chand & co


## EXPERT SYSTEMS IN MANUFACTURING (ELECTIVE - II)

**M 805-2** **3+1+0**

**Module 1**

Artificial Intelligence - expert / knowledge based systems - definition - expert system architecture: software components, knowledge base, inference engine, inference sub systems.

**Module 2**

Hard ware requirements - knowledge acquisition, knowledge base, knowledge representation - semantic netwoks, objects, nods; links, attributes, values - semantic net work structures: nodes, object, links, attributes, values.

**Module 3**

Knowledge representation: rule based system - heuristic rules - frame based knowledge representation - inference engine components - inferences strategies; modus ponens, backward & forward chaining, monotonic & non monotonic reasoning, search strategies - expert system building tools: languages, shells.

**Module 4**

Commercial software for manufacturing applications in CAD, CAPP, MRP - 11, adaptive control of devices, robotics, process control, fault diagnosis, failure analysis etc; linking expert systems to other software such as DBMS, MIS, MDB, process control and office automation.

**Module 5**

Case studies and programming of typical applications in process planning, tool selection, Grinding wheel selection, part classification, inventory control, facilities planning etc.

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**References**


1. Peter Jackson - Introduction to Expert systems, 3/e, by; Addison Wesley Longman, 1999.
2. Prentice - hall hand book of expert systems


## AEROSPACE ENGINEERING (ELECTIVE - II)

**M 805-3** **3+1+0**

**Module 1**

The atmosphere: Characteristics of Troposphere, Stratosphere, Mesosphere and Ionosphere - International Standard Atmosphere – Pressure, Temperature and Density variations in the International Standard Atmosphere – Review of basic fluid dynamics – continuity, momentum and energy for incompressible and compressible flows – static, dynamic and stagnation pressures – phenomena in supersonic flows

**Module 2**

Application of dimensional analysis to 2D viscous flow over bodies – Reynolds number – Mach number similarity – Aerofoil characteristics – Pressure distribution – Centre of Pressure and Aerodynamic Center – Horse shoe vortex

**Module 3**

Momentum and Blade Element Theories – Propeller co-efficients and charts – Aircraft engines – Turbo jet, Turbo fan and Ram Jet engines – Bypass and After Burners

**Module 4**

Straight and Level Flight – Stalling Speed – Minimum Drag and Minimum Power conditions – Performance Curves – Gliding – Gliding angle and speed of flattest glide – Climbing – Rate of Climb – Service and Absolute Ceilings – Take off and Landing Performance – Length of Runway Required – Circling Flight – Banked Flight – High Lift Devices – Range and Endurance of Air planes.

**Module 5**

Air speed indicators – Calculation of True Air Speed – Altimeters – Rate of Climb meter – Gyro Compass – Principles of Wind Tunnel Testing – Open and Closed type Wind Tunnels – Pressure and Velocity Measurements – Supersonic Wind Tunnels (description only) – Rocket Motors – Solid and Liquid Propellant Rockets – Calculation of Earth Orbiting and Escape Velocities Ignoring Air Resistance and assuming Circular Orbit.

**References**


1. Mechanics of Flight - Kermode A. C.
2. Aerodynamics for Engineering Students - Houghton and Brock
3. Airplane Aerodynamic - Dommasch


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## COMBUSTION (ELECTIVE - II)

**M 805-4** **3+1+0**

**Module 1**

Thermodynamics of reactive mixtures: Bond energy-Heat of formation-Heat of reaction-adiabatic flames temperatures-entropy changes for reacting mixtures-chemical equilibrium – equilibrium criteria –evaluation of equilibrium constant and equilibrium composition –simple numerical solutions.

**Module 2**

Elements of chemical kinetics: law of mass action-order and molecularity of reaction – rate equation- Arrheniuss law – activation energy – collision theory of reaction rates- Transition state theory-collision theory of reaction rates- Transition state theory –General theory of chain reactions- combustion of carbon monoxide and hydrogen.

**Module 3**

Ignition and flammability: methods of ignition –self ignition – thermal theory of ignition – limits of flammability –factors affecting flammability limits- flame quenching- flame propagation- flame velocity- measurement of flame velocity – factors affecting flame speed- premixed and diffusion flames – physical structures and comparison – characteristics of laminar and turbulent flames- theory of laminar flame propagation.

**Module 4**

Flame stabilization: Stability diagrams for open flames- mechanisms of flame stabilization –critical boundary-velocity gradient –stabilization by eddies bluff body stabilization – effects of variables on stability limits.

**Module 5**

Combustion in solid an liquid propellant: Reactant motors – Classification and types of propellants – desirable properties of grain shapes – burning rates and combustion model of solid propellants- injection of liquid propellants-ignition and ignitors. Miscellaneous topics – droplet combustion – fluidized bed combustion - classification of coal – air pollution.

**References**


1. Fuels and combustion – Sharma S.P
2. Some fundamentals of combustion – Spalding D.B
3. Fundamentals of combustion – Strehlow . R.A
4. Elementary reaction Kinetics – Lathan J.L
5. Flames – Gaydan and wolfhard.


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## PROJECT MANAGEMENT (ELECTIVE - II)

**M 805-5** **3+1+0**

**Module 1**

**Project feasibility Analysis-** Marketing, Technical, and financial feasibilities-report preparation-case studies.

**Module 2**

**Project Management-** nature and scope- PERT and CPM techniques, Estimates-time, cost, resources (man, material, tool).

**Module 3**

**Forecasting Methods-**Time series analysis-method pf least square, moving average, curvilinear, correlation analysis.

**Module 4**

**Risk Analysis-**risk in economic analysis-measuring risk in investment; risk profiles, decision trees, formulation of discounted decision trees, simulation.

**Module 5**

**MS Project: (Software Practice)** Creation of task, sequencing of task, assignment of resources, finding critical path, ABC activities (discuss), breaking the activities, colouring techniques, resource balancing, allocating overtime, using different calendars (Like 8 or 12 hours shift, Friday/Sunday holiday, Special public holidays etc), cost estimates, assignment of blank fields, creation of different views on screen.

**Reports:** Daily reports for completed activity, lagging activities, overall progress review, Management high-level reports, individual Departmental reports.

**References**


1. Corter, Mastering MS Project 2000, BPB Publishers.
2. Harvey Maylor, Project Management, Pearson Education.
3. PrasannaChandra, Project Management, Tata McGraw Hill.
4. Prasanna Chandra, Projects, Tata McGraw Hill.


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## PROGRAMMING IN C++ AND VISUAL C++ (ELECTIVE - II)

**M805-6** **3+1+0**

**Module 1**

Introduction to C++ - Object Oriented Approach – I/O instructions – Data types – Type Conversions – Arithmetic Operators – Relational Operators – Loops – Precedence – Conditional Operator – Logical Operators – Structures and its manipulations – Functions – Arrays.

**Module 2**

Classes and Objects – Specifying the Class – The private and public key words – Defining Member Functions – Defining Objects – Calling Member Functions –

Constructors – Destructors – Overloaded Constructors – Objects as Arguments – Returning Objects from Functions – Array of Objects.

**Module 3**

Operator Overloading – Operator Arguments – Operator Return Values – Postfix Notation – Overloading Binary Operators – Arithmetic Assignment Operators – Data Conversion – Inheritance – Derived Class and Base Class – Specifying The Derived Class – Accessing Base Class Members – The protected Members – Derived Class Constructors – Overriding Member Functions – Scope Resolution with Overridden Functions – Public and Private Inheritance – Levels of Inheritance – Multiple Inheritance.

**Module 4**

Pointers – Memory Management – The new and delete Operators – Pointers to Objects – Self Containing Classes – Virtual Functions – Accessing Normal and Virtual Member Functions with Pointers – Pure Virtual Functions – Friend Functions – The 'this' Pointer – Accessing Member Data with 'this'.

**Module 5**

Introduction to Windows Programming – Basic Windows Program Structure – Different Windows Messages like WM_PAINT, WM_TIMER etc. – Introduction to MFC – MFC Hierarchy - Use of Simple Foundation Classes like CTime, CString, CFile etc. – Exception Handling.

**References**


1. Object Oriented Programming in Microsoft C++ - Robert Lafore
2. Windows Programming Primer Plus - Jim Conger
3. Programming with ANSI and Turbo C - Kamthane. Pearson


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## SILICATES - STRUCTURE, PARTICLE ANALYSES AND SPRAY COATING (ELECTIVE - II)

**M 805-7** **3+1+0**

**Module 1**

**Silicate Mineralogy in General** - Minerals-Definition, Classification-Silicates and non-silicates. Physical properties of minerals-Colour, lusture, transperancy, cleavage, hardness, fracture, form, specific gravity, fusibility & tenacity.

**Module 2**

**Identification of Silicate Minerals** - Physical properties, chemical composition and uses of the important silicate minerals-1. Quartz, 2. Feldspars, 3.Pyroxenes, 4.Amphiboles, 5.Micas, 6.Aluminium silicates-andalusite, sillimanite & kyanite, 7.Olivine, 8.Garnets, 9.Chlorites 10. Natrolite, 11.Clay minerals, 12.Asbestose, 13.Talc 14.Tourmaline 15. Staurolite

**Module 3**

**Silicate Mineral Structures** - Detailed study of the silicate structures with examples- 1. Nesosilicate, 2.Sorosilicate, 3.Cyclosilicate, 4.Inosilicate, 5.Phyllosilicate & 6. Tectosilicate. Ceramics and silicates.

**Module 4**

**Particle Analyses** – Coarse and powder materials- Coarse material-Size distribution- Grain size parameters, coefficient of angularity, specific surface area (actual and theoretical) by sieve analysis. Powder material-Size and area determination by various methods- Blane's methods, air jet sieve, Bacho dust classifier and BET methods.

**Module 5**

**Spray Coating** – Basic concepts and general discussion of spray coating. Binders- Ethyl orthosilicate (ETS-40), properties and hydrolysis. Slurries – Binder and different ceramic powders, consistency and determination, drying. Heat source – Plasma arc-transferred and non-transferred arcs, arrangement of spray coating.

**References**


1. Rutley's elements of mineralogy, H.H.Read, Thomas Murby&Co, London.
2. A text book of mineralogy, E.S. Dana, Wiley Eastern Ltd, New Delhi.
3. Mineralogy, Dier, Howie & Zussman, CBS Publishers, New Delhi.
4. Materials-Their nature, properties and fabrication, Seghal & Linderburg.
5. Material science and manufacturing process, Dhaunedrakumar, S.K.Jain & A.K.Bhargava, Vikas publishing house, New Delhi.
6. Welding and welding technology, Little, Tata McGraw hill publishing Co., New Delhi.
7. Investment casting, H.T. Bidwell, The machinery publishing Co., Ltd, UK.
8. Non-ferrous foundry metallurgy, A.J. Murphy, Pergamon Press Ltd.
9. Welding engineering and technology, R.S. Parman, Khanna publishers, New Delhi.
10. Manufacturing science, Amitabha Ghosh & Asok kumar Mallik, EWP, East West Press Pvt Ltd, New Delhi.


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## MANAGEMENT INFORMATION SYSTEMS (ELECTIVE - III)

**M 806-1** **3+1+0**

**Goals**

To learn Management Information System (MIS), implementation requirements and process standardisation.

**Module 1**

Elements of a MIS – Levels of Management – Types of Management information – Technical dimensions of Information – System elements – Characteristics of MIS – Case Study.

**Module 2**

Building Business Model – Data Base – Report generation and time sharing – Case study.

**Module 3**

Communication and distributed Data processing.

**Module 4**

Managing and controlling the MIS function. Application Development Cycle.

**Module 5**

Future of MIS – Architecture – reliability – Security – Intelligent Buildings.

**Outcomes**

Student will learn elements of MIS & steps in implementing MIS. Students will also learn hardware and software selection for MIS.

**References**


1. Mudric and Rose - Information System and Management.
2. Jerome Kauter - Management Information Systems, Prentice Hall India.
3. R. S. Daver - The Management Process.
4. Mudric, Rose & Callgget - Information System for Modern Management, Prentice Hall India.
5. James Obrein - Management Information Systems


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## CRYOGENICS (ELECTIVE - III)

**M 806-2** **3+1+0**

**Module 1**

Introduction: Historical development- present areas involving cryogenic engineering. Basic thermodynamics applied to liquefaction and refrigeration process - isothermal, adiabatic and Joule Thomson expansion process - adiabatic demagnetization – efficiency to liquefaction and coefficient of performances irreversibility and losses.

**Module 2**

Low temperature properties of engineering materials: mechanical properties - thermal properties - electrical and magnetic properties. Properties of cryogenic fluids - materials of constructions for cryogenic applications.

**Module 3**

Gas liquefaction systems: production of low temperatures - general liquefaction systems - liquefaction systems for neon, hydrogen, nitrogen and helium.

**Module 4**

Cryogenic refrigeration systems: ideal refrigeration systems- refrigerators using liquids and gases as refrigerants - refrigerators using solids as working media.

**Module 5**

Cryogenic storage and transfer systems - Cryogenic fluid storage vessels cryogenic fluid transfer systems. Application of cryogenics - cryo pumping - superconductivity and super fluidity - cryogenics in space technology - cryogenics in biology and medicine.

**References**


1. Cryogenic Systems - Barron R. F
2. Cryogenic Engineering - Scot R. W.
3. Cryogenic Engineering - Bell J.H.


## NUCLEAR ENGINEERING (ELECTIVE - III)

**M 806-3** **3+1+0**

**Module 1**

Review of elementary Nuclear Physics: Atomic structure – Nuclear energy and nuclear forces – Nuclear fission

Nuclear reactions and radiations: Principle of radioactive decay – Interaction of $\alpha$ and $\beta$ rays with matter – Neutron cross section and reactions – The fission process – Chain reaction – Basic principles of controlled fusion.

**Module 2**

Nuclear reaction principles – Reactor classifications – Critical Size – Basic diffusion theory – Slowing down of neutrons – Neutron flux and power – Four factor formula – Criticality condition – Basic features of reactor control

**Module 3**

Boiling water reactor: Description of reactor system – Main components – control and safety measures Materials of Reactor: Construction – Fuel – Moderator coolant – Structural materials – Cladding – Radiation damage.

**Module 4**

Nuclear fuels: Metallurgy of Uranium – General principles of solvent extraction – Reprocessing of irradicated fuel – Separation process – Fuel enrichment.

**Module 5**

Reaction heat removal: Basic equations of heat transfer as applied to reactor cooling – Reactor heat transfer systems – Heat removal in fast reactors

Radiation Safety: Reactors shielding - Radiation dozes – Standards of radiation protections – Nuclear waste disposal.

**References**


1. Nuclear Engineering - Glasstone & Sesoske
2. Sources book on Atomic Energy - Glasstone S.


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## INDUSTRIAL HYDRAULICS (ELECTIVE - III)

**M 806-4** **3+1+0**

**Module 1**

**Introduction** to hydraulic / pneumatic devices – their application and characteristics – comparison of electric, hydraulic and pneumatic devices.

**Module 2**

**Pumps and motors:** Principle of working – range of displacement and pressures-fixed and variable discharge pumps-gear, screw, vane, piston pumps – axial piston pump-swash pump-bent axis pump. Types of hydraulic motors – their characteristics. Accessories-Hydraulic accumulators – intensifiers-filters-heater-cooler.

**Module 3**

**Hydraulic valves:** Stop valve- non return valve-relief valve-sequence valve-counter balance valve- pressure reducing valve – flow control valve –irection control valves-their principle of operation- and application-JIC symbols of hydraulic- pneumatic components.

**Module 4**

Properties of commonly used hydraulic fluids-Typical hydraulic circuits like those used in machine tools –Rivetter- pneumatic Hammer, hydraulic press, and power steering.

**Module 5**

**Fluidics:** Introduction of fluidics devices –Principles of working of common fluidics devices like wall attachment devices – proportional amplifiers-turbulent amplifiers- fluidic logic devices – examples of applications of fluidics devices like edge control of steel plate in rolling mills tension control.

**References**


1. Daniel Bonteille -Fluid Logic and Industrial automation.
2. John Pippenger & Tyler Hicks - Industrial Hydraulics


## MACHINE VISION AND APPLICATION (ELECTIVE - III)

**M 806-5** **3+1+0**

**Module 1**

Introduction to machine vision – basics of picture processing, Binary and grey scale images.

Preprocessing concepts – Digital image, Geometrical correction, Grey scale modification, Sharpening and smoothing images.

**Module 2**

Edge detection and line finding – Spatial differentiation, extraction of line descriptions.

Types of cameras for Machine vision and their principles.

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**Module 3**

Software for measurement and pattern recognition applications with examples – two and three-dimensional measurements. Fourier transformation for pattern recognition applications.

**Module 4**

Image operation studies, interfacing a robot with a vision system. Basics of hardware for vision system

**Module 5**

Machine vision applications in engineering – dimension measurement, flaw detection, identification, verification, sorting - co ordinate measuring machines, non-contact type – case studies.

**Reference**

1. Sonaka M, Hlavac V & Boyle. R. - Image processing, analysis & machine vision

## FINITE ELEMENT ANALYSIS (ELECTIVE - III)

**M 806-6** **3+1+0**

**Goals:**

This course is designed to acquaint students with the basic principles of the finite element method, to provide experience with its use in engineering analysis and design, and to provide an opportunity to work with finite element programs used in industry. Computer programming may be involved.

**Module 1**

**Introduction:** Structural analysis objectives, static, dynamic and kinematic analysis, skeletal and continuum structures, modeling of infinite d.o.f system into infinite d.o.f system, basic steps in finite element problem formulation, general applicability of the method.

**Element types and characteristics:** Discretization of the domain, basic element shapes, aspect ratio, shape functions, ganeralised co-ordinates and nodal shape functions, 1D spar and beam elements, 2D rectangular and triangular elements, axisymmetric elements.

**Module 2**

**Assembly of elements and matrices**: Concept of element assembly, global and local co-ordinate systems, band width and its effects, banded and skyline assembly, boundary conditions, solution of simultaneous equations, Gaussian elimination and Cholesky decomposition methods, numerical integration, one and 2D applications.

**Module 3**

**High order and isoparametric elements** :One dimensional quadratic and cubic elements, use of natural co-ordinate system, area co-ordinate system, continuity and convergence requirements, 2D rectangular and triangular elements.

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**Module 3**

Software for measurement and pattern recognition applications with examples – two and three-dimensional measurements. Fourier transformation for pattern recognition applications.

**Module 4**

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**Module 4**

Total Quality Control (TQC) – Quality Circles – Poka – Yoke- Just–in-Time (JIT)- KANBAN - '5-5'

**Module 5**

Implementing procedure of TQM - case studies

**Learning Objective**

1. Student will clear principles and practices of TQM
2. Student will learn tools and Techniques used in TQM.
3. Students will learn the procedure of implementation of TQM

**References**


1. Besterfield, Total quality Management, Person Education
2. Besterfield, Quality Control, Prentice - Hall
3. Arora K.C, TQM & 1S0 14000, S K Kataria & Sons
4. Jain & Chitale, Quality assurance and Total quality management, Khanna Publishers.
5. Mitra. Quality control & improvement, Person Education


## MECHANICAL MEASUREMENTS LABORTAORY

**M 807** **0+0+4**

1. Study of use of laser interferometer for calibration of linear measurements
2. Measurement of temperature:
   Calibration of thermometers and pyrometers
   Preparation and calibration of thermocouple and resistance temperature detectors (TTD & RTD)
3. Measurement of pressure:
   Calibration and use of pressure measuring instruments-Pressure Gauge, Micro manometer, Pressure Transducers, Dead weight pressure gauge calibrator
4. Measurement of speed:
   Calibration and use of tachometers & stroboscope
5. Measurement of linear and angular dimensions:
   Micrometer, Vernier caliper, dial gauge feeler gauge, comparator, interferometer, angle gauge, sine bar, plug gauge and wire gauge
6. Measurement of Flow: Rotameter, watermeter, Anemometer; calibration and use
7. Measurement of surface roughness using subtonic tester
8. Measurement of gear and screw thread profiles- gear tooth calipers, screw thread calipers
9. Measurement of strain and force – calibration of strain gauges and load cells
10. Measurement of vibration – use of vibration pick ups, accelerometer and vibration indicator
11. Acoustic measurements-sound level meter – preparation of noise contours
12. Measurement of PH value
13. Measurement of psychometric properties of air

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