UNIVERSITY OF KERALA

B.Tech Degree Course – 2008 Scheme

REGULATIONS

1. Conditions for Admission

Candidates for admission to the B.Tech degree course shall be required to have passed the Higher Secondary Examination, Kerala or 12th Standard V.H.S.E., C.B.S.E., I.C.S.E. or any examination accepted by the university as equivalent thereto obtaining not less than 50% in Mathematics and 50% in Mathematics, Physics and Chemistry/ Bio-technology/ Computer Science/ Biology put together, or a diploma in Engineering awarded by the Board of Technical Education, Kerala or an examination recognized as equivalent thereto after undergoing an institutional course of at least three years securing a minimum of 50% marks in the final diploma examination subject to the usual concessions allowed for backward classes and other communities as specified from time to time.

2. Duration of the course

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

ii) Each semester shall ordinarily comprise of not less than 400 working periods each of 60 minutes duration

iii) A candidate who could not complete the programme and pass all examinations within Ten (10) years since his first admission to the B.Tech programme will not be allowed to continue and he has to quit the Programme. However he can be readmitted to the first year of the programme if he/she satisfies the eligibility norms applicable to the regular candidates prevailing at the time of readmission.

3. Eligibility for the Degree

Candidates for admission to the degree of bachelor of technology shall be required to have undergone the prescribed course of study in an institution maintained by or affiliated to the University of Kerala for a period of not less than four academic years and to have passed all the examinations specified in the scheme of study

4. Subjects of Study

The subjects of study shall be in accordance with the scheme and syllabi prescribed

5. Evaluation

Candidates in each semester will be evaluated both by continuous assessment and end semester University examination. The individual maximum marks allotted for continuous assessment and University examination for each subject is as prescribed by the scheme of study.
5.1 Continuous Assessment (C.A.)
The marks awarded for the continuous assessment will be on the basis of the day-to-day work, periodic tests (minimum two in a semester) and assignments (minimum of three – one each from each module). The faculty member concerned will do the continuous assessment for each semester. The C.A. marks for the individual subjects shall be computed by giving weightage to the following parameters.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Attendance</th>
<th>Tests</th>
<th>Assignments/Class Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory Subjects</td>
<td>20%</td>
<td>50%</td>
<td>30%</td>
</tr>
<tr>
<td>Drawing</td>
<td>20%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Practical</td>
<td>20%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Project Work</td>
<td>Work Assessed by Guide – 50%</td>
<td>Assessed by a three member committee out of which one member is the guide – 50%</td>
<td></td>
</tr>
</tbody>
</table>

The C.A. marks for the attendance (20%) for each theory, practical and drawing shall be awarded in full only if the candidate has secured 90% attendance or above in the subject. Proportionate reduction shall be made in the case of subjects in which he/she gets below 90% of the attendance for a subject. The C.A marks obtained by the student for all subjects in a semester is to be published at least 5 days before the commencement of the University examinations. Anomalies if any may be scrutinized by the department committee and the final C.A marks are forwarded to the university within the stipulated time.

5.2. End Semester University Examinations

i) There will 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 under the respective scheme of examinations. Semester classes shall be completed at least 10 working days before the commencement of the University examination.

ii) The examination will be held twice in a year – April/May session (for even semester) and October/November session (for odd semester). The combined 1st and 2nd semester is reckoned as equivalent to an even semester for the purpose of conduct of examination and the University examination will be held during April/May. However VII and VIII Semester examination will be conducted in both the sessions. This schedule will not be changed.

iii) A student will be permitted to appear for the university examination only if he/she satisfies the following requirements:

a. He/she must secure not less than 75% attendance in the total number of working periods during the first year and in each semester thereafter and shall be physically present for a minimum of 60% of the total working periods. In addition, he/she also shall be physically present in at least 50% of total working periods for each subject.

b. He must earn a progress certificate from the head of the institution of having satisfactorily completed the course of study in the semester as prescribed by these regulations.
c. It shall be open to the Vice-Chancellor to grant condonation of shortage of attendance on the recommendation of the head of the institution in accordance with the following norms

d. The attendance shall not be less than 60% of the total working periods

e. He/she shall be physically present for a minimum of 50% of the total working periods

f. The shortage shall not be condoned more than twice during the entire course

g. The condonation shall be granted subject to the rules and procedures prescribed by the university from time to time.

h. The condonation for combined 1st and 2nd semesters will be reckoned as a single condonation for attendance purposes.

iv) A student who is not permitted to appear for the University examinations for a particular semester due to the shortage of attendance and not permitted by the authorities for condonation of shortage of attendance shall repeat the semester when it is offered again. This provision is allowed only once for a semester.

v) The university will conduct examinations for all subjects (Theory, Drawing & Practical)

vi) The scheme of valuation will be decided by the chief examiner for theory / drawing subjects

vii) For practical examinations, the examiners together will decide the marks to be awarded. The student shall produce the certified record of the work done in the laboratory during the examination. The evaluation of the candidate should be as per the guidelines given in the syllabus for the practical subject.

6. Letter Grades

For each subject in a semester, based on the total marks obtained by the student in the University examination and Continuous assessment put together a letter grade (S, A+, A, B+, B, C+, C, D, E and F) will be awarded. All letter grades except ‘F’ will be awarded if the marks for the University examination is 40% or above and the total mark (C.A marks + University Exam mark) is 50% or above. No absolute mark will be indicated in the grade card. Letter grade corresponding to total marks (C.A marks + University Exam mark) and the corresponding grade point in a ten-point scale is described below.

<table>
<thead>
<tr>
<th>% of Total marks (C.A marks + University Exam mark)</th>
<th>Letter Grade</th>
<th>Grade (G.P)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 % and above</td>
<td>S</td>
<td>10</td>
<td>Excellent</td>
</tr>
<tr>
<td>85 % and above but less than 90%</td>
<td>A+</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>80 % and above but less than 85%</td>
<td>A</td>
<td>8.5</td>
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</tr>
<tr>
<td>75 % and above but less than 80%</td>
<td>B+</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>70 % and above but less than 75%</td>
<td>B</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>65 % and above but less than 70%</td>
<td>C+</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>60 % and above but less than 65%</td>
<td>C</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>55 % and above but less than 60%</td>
<td>D</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>50 % and above but less than 55%</td>
<td>E</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>Below 50% (C.A + U.E) or below 40 % for U.E only</td>
<td>F</td>
<td>0</td>
<td>Failed</td>
</tr>
</tbody>
</table>
7. **Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)**

Grade point average is the semester wise average points obtained by each student in a 10-point scale. GPA for a particular semester is calculated as per the calculation shown below:

\[
GPA = \frac{\sum \text{Credit} \times GP \text{ obtained for the subject}}{\sum \text{credit for subject}}
\]

Cumulative Grade point Average (CGPA) is the average grade points obtained by the students till the end of any particular semester. CGPA is calculated in a 10-point scale as shown below.

\[
CGPA = \frac{\sum \text{Credits for semester} \times \text{GPA obtained for the semester}}{\sum \text{credits for the semester}}
\]

GPA and CGPA shall be rounded to two decimal points. The Grade card issued to the students shall contain subject number and subject name, credits for the subject, letter grades obtained, GPA for the semester and CGPA up to that particular semester. However, on specific request from a candidate and after remitting the prescribed fees, the University shall issue detailed mark to the individual candidate.

8. **Minimum for a pass**

a) A candidate shall be declared to have passed a semester examination in full in the first appearance if he/she secures not less than 5.5 GPA with a minimum of ‘E’ grade for the all individual subject in that semester.

b) A candidate shall be declared to have passed in an individual subject of a semester examination if he/she secures grade ‘E’ or above.

c) A candidate who does not secure a full pass in a semester examination as per clause (a) above will have to pass in all the subjects of the semester examination as per clause (b) above before he is declared to have passed in that semester examination in full.

9. **Improvement of Grades**

i) A candidate shall be allowed to re-appear for a maximum of two subjects of a semester examination in order to improve the marks and hence the grades already obtained subject to the following conditions:

a) The candidate shall be permitted to improve the examination only along with next available chance.

b) The candidate shall not be allowed to appear for an improvement examination for the subjects of the VII & VIII semesters.

c) The grades obtained by the candidate for each subject in the improvement chance he has appeared for or the already existing grades – whichever is better will be reckoned as the grades secured.

d) First & Second semester will be counted as a single chance and they can improve a maximum of three subjects.
ii) A candidate shall be allowed to repeat the course work in one or more semesters in order to better the C.A. marks already obtained, subject to the following conditions:
   a) He/she shall repeat the course work in a particular semester only once and that too at the earliest opportunity offered to him/her.
   b) He/she shall not combine this course work with his/her regular course work.
   c) He/she shall not be allowed to repeat the course work of any semester if he has already passed that semester examination in full.
   d) The C.A. marks obtained by the repetition of the course work will be considered for all purposes.

iii) A candidate shall be allowed to withdraw from the whole examination of a semester in accordance with the rules for cancellation of examination of the University of Kerala.

10. Classification of Successful candidates

i) A candidate who qualifies for the degree passing all the subjects of the eight semesters within five academic years (ten consecutive semesters after the commencement of his/her course of study) and secures not less than 8 CGPA up to and including eighth semester (overall CGPA) shall be declared to have passed the B.Tech degree examination in FIRST CLASS WITH DISTINCTION.

ii) A candidate who qualifies for the degree passing all the subjects of the eight semesters within five academic years (ten consecutive semesters after the commencement of his/her course of study) and secures less than 8 CGPA but not less than 6.5 CGPA up to and including eighth semester shall be declared to have passed the B.Tech degree examination in FIRST CLASS.

iii) All other successful candidates shall be declared to have passed the B.Tech Degree examination in SECOND CLASS.

iv) Successful candidates who complete the examination in four academic years (eight consecutive semesters after the commencement of the course of study shall be ranked branch-wise on the basis of the CGPA in all eight semesters put together. In the case of a tie in the CGPA the total marks of the students who have got same CGPA shall be considered for finalizing the rank. Students who pass the examination in supplementary examination are also covered under this clause.

11. Educational Tour

a) The students may undertake one educational tour during the course and submit a tour report.

b) The tour may be conducted during the vacation/holidays taking not more than 5 working days, combined with the vacation/holidays if required. Total number ofTour days shall not exceed 15 days.

c) The tour period shall be considered as part of the working periods of a semester.

12. Revision of Regulations

The university may from time to time revise, amend or change the regulations, curriculum, scheme of examinations and syllabi. These changes unless specified otherwise, will have effect from the beginning of the academic year/semester following the notification of the University.
UNIVERSITY OF KERALA

B. TECH DEGREE COURSE – 2008 SCHEME

INDUSTRIAL ENGINEERING

I - VIII SEMESTER SYLLABUS (2008 SCHEME)

RECOMMENDED TO BE PLACED BEFORE

BOARD OF STUDIES IN ENGINEERING

& FACULTY OF ENGINEERING FOR APPROVAL
University of Kerala

Scheme of study for the B.Tech, Combined I and II Semesters, 2008 scheme
(Common for all branches)

<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Weekly load, hours</th>
<th>Max sessional marks</th>
<th>Exam Dur Hrs</th>
<th>Exam max marks</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>08.101</td>
<td>Engineering Mathematics</td>
<td>2 1 0</td>
<td>50</td>
<td>3</td>
<td>100</td>
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<td>08.102</td>
<td>Engineering Physics</td>
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<td>3</td>
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<tr>
<td>08.103</td>
<td>Engineering Chemistry</td>
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<tr>
<td>08.104</td>
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<td>3</td>
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<tr>
<td>08.105</td>
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<td>08.106</td>
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<td>08.107</td>
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<tr>
<td>08.108</td>
<td>Basic Electrical and Electronics</td>
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<tr>
<td>08.109</td>
<td>Basic Communication and Information</td>
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<td>50</td>
<td>3</td>
<td>100</td>
<td>6</td>
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<td>08.110</td>
<td>Engineering Workshops</td>
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<td>500</td>
<td></td>
<td>1000</td>
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The subject 08.108 will be handled by the Department of Electrical and Electronics Engineering and the subject 08.109 will be handled by the Department of Electronics and Communication Engineering.
### Semester III

<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Weekly load, hours</th>
<th>Max. Sessional marks</th>
<th>Exam Dur Hrs</th>
<th>Exam max marks</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>08.301</td>
<td>Engineering Mathematics- II (CMPUNERFHBTA)</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>4</td>
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<tr>
<td>08.302</td>
<td>Mechanics of Machines</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>4</td>
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<tr>
<td>08.303</td>
<td>Metallurgy and Material Science</td>
<td>3 0 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
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<tr>
<td>08.304</td>
<td>Mechanics of Structures</td>
<td>3 0 -</td>
<td>50</td>
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<tr>
<td>08.305</td>
<td>Electrical Machines</td>
<td>3 0 2</td>
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<td>08.307</td>
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<tr>
<td></td>
<td>a. Machine Drawing</td>
<td></td>
<td></td>
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<td>b. Building Drawing</td>
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<td></td>
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<tr>
<td>08.308</td>
<td>Machine Dynamics and Material Testing Lab</td>
<td>0 0 3</td>
<td>50</td>
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<td>100</td>
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<td></td>
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<td><strong>Total</strong></td>
<td><strong>18 3 8</strong></td>
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<td><strong>800</strong></td>
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### Semester IV

<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Weekly load, hours</th>
<th>Max. Sessional marks</th>
<th>Exam Dur Hrs</th>
<th>Exam max marks</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>08.401</td>
<td>Engineering Mathematics – III (CMPUNERFHB)</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
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<tr>
<td>08.402</td>
<td>Computer programming and Numerical Methods(MNPU)</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>4</td>
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<tr>
<td>08.403</td>
<td>Fluid Mechanics and Hydraulic Machines</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>4</td>
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<tr>
<td>08.404</td>
<td>Manufacturing Processes(MN)</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>4</td>
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<tr>
<td>08.405</td>
<td>Operations Management</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
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<tr>
<td>08.406</td>
<td>Introduction to Industrial Engineering</td>
<td>3 0 0</td>
<td>50</td>
<td>3</td>
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<tr>
<td>08.407</td>
<td>Fluid Mechanics &amp; Machines Lab(MN)</td>
<td>0 0 3</td>
<td>50</td>
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<tr>
<td>08.408</td>
<td>Thermal Engg. Lab.</td>
<td>0 0 3</td>
<td>50</td>
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Semester V

<table>
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<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Weekly load, hours</th>
<th>Max sessional marks</th>
<th>Exam Dur Hrs</th>
<th>Exam max marks</th>
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<tbody>
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<td>08.501</td>
<td>Introduction to Stochastic Models(N)</td>
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<td>50</td>
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<td>08.502</td>
<td>Operations Research(N)</td>
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<td>08.503</td>
<td>Methods and Systems Design(N)</td>
<td>3 1 D/P</td>
<td>50</td>
<td>3</td>
<td>100</td>
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<tr>
<td>08.504</td>
<td>Precision Engineering(N)</td>
<td>2 1 D/P</td>
<td>50</td>
<td>3</td>
<td>100</td>
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<td>08.505</td>
<td>Machine Tools(MN)</td>
<td>3 1 D/P</td>
<td>50</td>
<td>3</td>
<td>100</td>
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<tr>
<td>08.506</td>
<td>Elective I (N)</td>
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<td>08.507</td>
<td>Machine Tools Lab(N)</td>
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<td>50</td>
<td>3</td>
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<tr>
<td>08.508</td>
<td>Methods and Systems Design Lab(N)</td>
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<td>50</td>
<td>3</td>
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<td><strong>Total</strong></td>
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Semester VI

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<tr>
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<th>Name of subject</th>
<th>Weekly load, hours</th>
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<th>Exam Dur Hrs</th>
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<td>08.601</td>
<td>Data Analysis for Management (N)</td>
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<td>08.602</td>
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<td>08.603</td>
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<td>100</td>
<td>3</td>
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<tr>
<td>08.604</td>
<td>Machine Design(N)</td>
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<td>50</td>
<td>3</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>08.605</td>
<td>System Modeling &amp; Simulation (N)</td>
<td>3 1 -</td>
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### Semester VII

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### Semester VIII

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### List of Electives (B. Tech – 2008 scheme)

#### 08.506 Elective I
- 08.506.1 Communicative English and Technical Report writing
- 08.506.2 Human Aspects of Management (N)
- 08.506.3 Advanced Mechanics of Solids (N)
- 08.506.4 Computer Aided Design (N)
- 08.506.5 Energy Management (N)
- 08.506.6 Management of projects (N)

#### 08.606 Elective II
- 08.606.1 Decision Support System and Expert Systems (N)
- 08.606.2 Finite Element Applications in Manufacturing (N)
- 08.606.3 Fire Science & Industrial Safety (N)
- 08.606.4 Value Engineering (N)
- 08.606.5 Design for Manufacturing (N)
- 08.606.6 Design of Jigs and Fixtures (N)

#### 08.706 Elective III
- 08.706.1 Total Quality Management (N)
- 08.706.2 Total Productive Maintenance (N)
- 08.706.3 Maintenance Management (N)
- 08.706.4 Customer Relationship Management (N)
- 08.706.5 Marketing Management (N)

#### 08.805 Elective IV
- 08.805.1 Advanced Numerical Methods (N)
- 08.805.2 Advanced Optimization Techniques (N)
- 08.805.3 Design and Analysis of Algorithms (N)
- 08.805.4 Managerial Economics (N)
- 08.805.5 Multi-criteria Decision Making (N)

#### 08.806 Elective V
- 08.806.1 Flexible Manufacturing Systems (N)
- 08.806.2 Agile and Lean Manufacturing (N)
- 08.806.3 Enterprise Resource Planning (N)
- 08.806.4 Business Process Reengineering (N)
- 08.806.5 Human Factors in Engineering (N)
- 08.806.6 Econometrics (N)
Applications of differentiation:-- Definition of Hyperbolic functions and their derivatives-- Successive differentiation- Leibnitz' Theorem(without proof)- Curvature- Radius of curvature- centre of curvature- Evolute (Cartesian, polar and parametric forms)
Vector differentiation and applications:-- Scalar and vector functions- differentiation of vector functions-Velocity and acceleration- Scalar and vector fields- Operator $\nabla$ - Gradient- Physical interpretation of gradient- Directional derivative- Divergence- Curl- Identities involving $\nabla$ (no proof) - Irrotational and solenoidal fields- Scalar potential.

MODULE-II

Laplace transforms:-- Transforms of elementary functions - shifting property- Inverse transforms- Transforms of derivatives and integrals- Transform functions multiplied by $t$ and divided by $t$ - Convolution theorem(without proof)-Transforms of unit step function, unit impulse function and periodic functions-second shifting theorem- Solution of ordinary differential equations with constant coefficients using Laplace transforms.
Differential Equations and Applications:-- Linear differential equations with constant coefficients- Method of variation of parameters - Cauchy and Legendre equations -- Simultaneous linear equations with constant coefficients- Application to orthogonal trajectories (Cartesian form only).

MODULE-III

Matrices:-Rank of a matrix- Elementary transformations- Equivalent matrices- Inverse of a matrix by gauss-Jordan method- Echelon form and normal form- Linear dependence and independence of vectors- Consistency- Solution of a system linear equations-Non homogeneous and homogeneous equations- Eigen values and eigen vectors - Properties of eigen values and eigen vectors- Cayley Hamilton theorem(no proof)- Diagonalisation- Quadratic forms- Reduction to canonical forms-Nature of quadratic forms-Definiteness, rank, signature and index.

REFERENCES
Oscillations and Waves

Electromagnetic Theory
Del operator – grad, div, curl and their physical significance. Concept of displacement current. Deduction of Maxwell’s equations. Prediction of electromagnetic waves. Transverse nature of electromagnetic waves. E and H are at right angles. Poynting’s theorem (qualitative only)

Physics of Solids

MODULE-II

Interference of Light

Diffraction of Light

Polarization of Light

Special Theory of Relativity

MODULE – III

Quantum Mechanics

Statistical Mechanics

Laser

REFERENCE:
1. University Physics. XI Edn., Sears & Zemansky; Pearson
2. Introduction to Optics. III Edn., Frank & Leno, Pearson
4. Introduction to Electrodynamics, III Edn, David J Griffiths, Pearson
7. Modern Physics for Scientists and Engineers. II Edn, John R Taylor, Chris D Zafiratos & Michael A Dubson, Prentice Hall of India
8. Optics. IV Edn, Eugene Hecht, Pearson
9. Introduction to Special Relativity. Robert Resnick, John Willey and Sons
10. Introduction to Quantum Mechanics. IV Edn, Richard L Liboff, Pearson
12. Nanotechnology. Mark Ratner & Daniel Ratner

LIST OF DEMONSTRATION EXPERIMENTS

2. Air Wedge – Diameter of a thin wire
5. Laser – Diffraction at a narrow slit.
6. Laser – Diffraction at a straight wire or circular aperture.
11. Computer stimulation – study of E & H. (Gauss’ law & Ampere’s law)

Pattern of Question Paper

University examination is for a maximum of 100 marks, in 3 hour duration. The syllabus is spread in 3 modules. The question paper will consist of two parts (A and B).

Part A contains short answer questions for 40 marks. This part contains 10 questions without any choice, each of 4 marks (uniformly taken from all modules).

Part B contains long answer questions for 60 marks. From each module, this part contains 3 questions out of which 2 are to be answered, each of 10 marks. Long answer questions from all the 3 modules will form 60 marks.

* * * * * * * *
MODULE-1


(12hrs) Corrosion and its control-

Theories of corrosion (chemical corrosion and electrochemical corrosion)- Galvanic series-

Types of corrosion (Concentration cell corrosion, Stress corrosion, Galvanic corrosion) - Factors affecting corrosion (nature of metal and nature of environment) and different methods of corrosion control (corrosion inhibitors, cathodic protection).

(5hrs)

Protective coatings- Metallic coatings- Chemical conversion coatings- paint


(4hrs)

MODULE-2

Water treatment- Types of hardness- Degree of hardness- Related problems- Estimation of hardness- by EDTA method- Sludge and scales in boilers- Priming and foaming- Boiler corrosion-Water softening methods, Lime-soda process, Ion exchange methods-Internal treatments (colloidal, carbonate, phosphate and calgon conditioning)- Domestic water treatment- Methods of disinfection of water-Desalination process (Reverse osmosis, electrodialysis- Distillation).

(12hrs)


(3hrs)

Thermal methods of analysis-Basic principles involved in Thermo gravimetry, Differential thermal analysis and applications.

(2hrs)

Spectroscopy- Molecular energy levels-Types of molecular spectra- Electronic spectra (Classification of electronic transitions- Beer Lambert law, Vibrational spectra (mechanism of interaction and application), Rotational spectra (Determination of bond length and application), NMR spectra (Basic principle, chemical shift, spin-spin splitting) (6hrs)

Chromatography- General principles- High performance liquid chromatography- Gas chromatography.

(2hrs)
MODULE-3

Polymers- Classifications- Mechanism of polymerisation (Addition, free radical, cationic, anionic and coordination polymerisation)- Thermoplastics and thermosetting plastics- Compounding of plastics-Moulding techniques of plastics (Compression, Injection, Transfer and Extrusion moulding)-Preparation, properties and uses of PVC, PVA, PMMA, Nylon, PET, Bakelite, Urea formaldehyde resin- Silicon polymers- Biodegradable plastics. Elastomers- structure of natural rubber- vulcanisation- synthetic rubbers (Buna-S, Butyl rubber and Neoprene) (12hrs)

Organic electronic compounds- Super conducting and conducting organic materials like Polyaniline, polyacetylene and polypyrrole and its applications. (2hrs)

Fuels- Calorific value- HCV and LCV-Experimental determination of calorific value-Theoretical calculation of calorific value by Dulong's formula - Bio fuels- Bio hydrogen and Bio-diesel (5hrs)

Lubricants- Introduction-Mechanism of lubrication- solid and liquid lubricant- Properties of lubricants-Viscosity index- flash and fire point- cloud and pour point- aniline value. (4hrs)

Cement- Manufacture of Portland cement- Theory of setting and hardening of cement (2hrs)

LAB-EXPERIMENTS

1. Estimation of total hardness in water using EDTA.
2. Estimation of chloride ions in domestic water.
3. Estimation of dissolved oxygen.
4. Estimation of COD in sewage water.
5. Estimation of available chlorine in bleaching powder.
8. Determination of flash and fire point of a lubricating oil by Pensky Martens' apparatus.
12. Determinations of PH using glass electrode and quinhydrone electrode.

REFERENCES

14. Chemistry of Engineering and Technology volume I & II: J.C. Kuriakose and
15. J. Rajaram.
INTRODUCTION: Introduction to technical drawing and its language. Lines, lettering, dimensioning, scaling of figures, symbols and drawing instruments. (1 sheet practice)

MODULE I

PLAIN CURVES: Conic sections by eccentricity method. Construction of ellipse: (i) Arc of circles method (ii) Rectangle method (iii) Concentric circles method. Construction of parabola (i) Rectangle method (ii) Tangent method. Construction of hyperbola (i) Arc of circles method (ii) given ordinate, abscissa and the transverse axis (iii) given the asymptotes and a point on the curve. Construction of Tangent and Normal at any point on these curves

MISCELLANEOUS CURVES: Construction of Cycloid, Epicycloid and Hypocycloid, Involute of a circle. Archimedian spiral, Logarithmic spiral and Helix. Construction of Tangent and Normal at any point on these curves

PROJECTION OF POINTS AND LINES: Types of projections, Principles of Orthographic projection. Projections of points and lines. Determination of true length, inclination with planes of projection and traces of lines.

MODULE II

PROJECTION OF SOLIDS: Projection of simple solids such as prisms, pyramids, cone, cylinder, tetrahedron, octahedron, sphere and their auxiliary projections.

SECTIONS OF SOLIDS: Types of cutting planes, section of simple solids cut by parallel, perpendicular and inclined cutting planes. Their projections and true shape of cut sections.

DEVELOPMENT OF SURFACES: Development of surfaces of (i) simple solids like prisms, pyramids, cylinder and cone (ii) Cut regular solids.

MODULE III

ISOMETRIC PROJECTION: Isometric scale, Isometric view and projections of simple solids like prisms, pyramids, cylinder, cone sphere, frustum of solids and also their combinations.

INTERSECTION OF SURFACES: Intersection of surfaces of two solids as given below.

(i) Cylinder and cylinder
(ii) Prism and prism.
(iii) Cone and Cylinder

(Only cases where the axes are perpendicular to each other and intersecting with or without offset.)

CAD: Introduction to CAD systems, Benefits of CAD, Various Soft wares for CAD, Demonstration of any one CAD software.

General Note:
(i) First angle projection to be followed.

(ii) Question paper shall contain 3 questions from each module, except from CAD. Students are required to answer any two questions from each module.

(iii) Distribution of marks

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REFERENCES
1. Fundamentals of Engineering Drawing Luzadder and Duff
2. Engineering Drawing N. D. Bhatt
3. Engineering Drawing and Graphics K. Venugopal
4. Engineering Graphics P.S. Gill
5. Engineering Graphics P.I. Varghese
6. Engineering Drawing K.R. Gopalakrishnan
7. Engineering Drawing Thamaraselvi
MODULE I (20 HRS)
Idealizations of Mechanics- Elements of vector algebra
Statics of rigid bodies-Classification of force systems- principle of transmissibility of a force-
composition and resolution- Resultant and Equilibrant of coplanar concurrent force systems-
various analytical methods- - Lami’s theorem, method of resolution- Conditions of equilibrium-
Moment of a force, couple, properties of couple- Varignon’s theorem- Resultant and equilibrant
of coplanar non-concurrent force systems- Conditions of equilibrium. Equilibrium of rigid
bodies-free body diagrams.(simple problems)
Types of supports - types of beams - types of loading- Support reactions of simply supported and
overhanging beams under different types of loading.
Forces in space, equations of equilibrium, Vector approach.

MODULE II (20 HRS)
Properties of surfaces- centroid of composite areas- Theorems of Pappus-Guldinus- Moment of
inertia of areas, Parallel and perpendicular axes theorems- Radius of Gyration- moment of inertia
of composite areas.
Dynamics: Kinematics-Combined motion of translation and rotation-instantaneous centre, motion of
link, motion of connecting rod and piston, wheel rolling without slipping.
Relative velocity - basic concepts-analysis of different types of problems
Kinetics- Newton’s laws of translatory motion- D’Alembert’s principle- Motion of lift- Motion of
connected bodies.

MODULE III (20 HRS)
Collision of elastic bodies-Law of conservation of momentum-Direct and oblique impact
between elastic bodies and impact with fixed plane.
Curvilinear motion- D’Alembert’s principle in curvilinear motion- Mass moment of inertia of
rings, solid discs and solid spheres (no derivations required)Angular momentum-Angular
impulse.
Kinetics of rigid bodies under combined translatory and rotational motion – work – energy
principle for rigid bodies.
Centrifugal and centripetal forces – motion of vehicles on curved paths in horizontal and vertical
planes – super elevation – stability of vehicles moving in curved paths (qualitative ideas only).
Simple harmonic motion – vibration of mechanical systems - basic elements of a vibrating
system – spring mass model – undamped free vibrations – angular free vibration – simple
pendulum.

REFERENCES:

Note

Question For University Examination:- Part A – 8 compulsory questions covering entire syllabus, 5 marks each. (2 x 8 = 40) Part B – Three questions of 10 marks from each module, out of which two should be answered (10 x 2 x 3 = 60).
08.106 BASIC CIVIL ENGINEERING

L-T-P: 2-1-0

Credits

MODULE I

Surveying: Object and Principles of Surveying.
Linear Measurements: Direct measurements - Tape & chain only - Ranging out survey lines.
Taking measurements of sloping ground - Errors - Tape correction (problems).
Levelling: Levelling instruments - Level (Dumpy Level, Tilting Level) Levelling Staff
Measurements in levelling - Temporary adjustments of a level, holding the staff, reading the
staff - Principles of levelling - recording measurements in the field book - reduction of level
height of collimation method only (simple examples).
Contour maps (Brief description only). Computation of areas - Mid ordinate rule, average
ordinate rule, Trapezoidal rule, Simpson’s rule (examples) - Introduction to Distomat, Total
Station & GPS (Brief description only).

MODULE II

Building construction: Selection of site for buildings - types of buildings - Components of
buildings.
Foundation: Different types - Spread footing, Isolated footing, Combined footing, Mat
foundation, Pile foundation (description only).
Safe Bearing Capacity of Soil: Importance of determination of the Safe Bearing Capacity of
Soil (brief description only).
Super structure: Masonry - stone masonry, brick masonry - Types - desirable qualities of
stone and brick.
Partition: Materials used for making partition - plywood, particle boards & glass.
Doors, windows & ventilators: Types - materials used for the construction of doors and
windows - wood, steel & Aluminium.
Plastering: Mortar - properties - Preparation of Cement mortar
Painting: Preparation of surfaces for painting - plastered, wood and steel surfaces - Types of
paint - enamel, emulsion & distemper. Flooring: Types - mosaic tiles, ceramic tiles, marble,
granite and synthetic materials. Roofing: Selection of type of roof - flat roof, sloping roof -
Concrete roof, tiled roof. Selection of roof covering materials. GI Sheet, AC Sheet, PVC
Sheet

MODULE III

Concrete: Ingredients - cement, aggregate, and water. Qualities of ingredients (brief
description only).
Tests on Cement - consistency, initial and final setting times. Compressive strength
Specifications.
Aggregates - desirable qualities of fine and coarse aggregates
Steel - common types used in construction - Mild Steel, HYSD Steel and their properties.
Reinforced Cement Concrete (RCC): advantages of RCC over Plain Cement Concrete.
Elementary ideas on pre-cast and pre-stressed concrete constructions.
Building services - vertical transportation - stairs - types, escalators and elevators, ramp
(brief description only). Plumbing services - brief description of water supply and sewage
disposal arrangements for residential buildings.
REFERENCE:
2. B.C. Punmia, "Surveying & Leveling" Vol. – I, Laxmi publications(P) Ltd., N. Delhi, 2004
8. distributor., 1957
11. Santha Minu, “Basic Civil Engineering” Karunya Publications, Trivandrum

Note: The question paper will consist of two parts. Part I and Part II.
Part I is Compulsory covering the entire syllabus, for 40 marks. It contains 8 questions of 5 marks each.
Part II is to cover 3 modules. There will be two questions (20 marks each) from each module, out of which one from each module is to be answered. (20 X 3 = 60)
MODULE I
Thermodynamics: Basic concepts and definitions of Zeroth law, First law, Second law of thermodynamics-concept of reversibility and entropy. p-v and T-s diagrams
Air cycles: Carnot, Otto and Diesel cycles-Air standard efficiency (simple problems)
IC Engines: Working and comparison of two stroke and four stroke petrol and diesel engines-general description of various systems using block diagrams—air system, fuel system, ignition system and governing system. A brief description of CRDI, MPFI, GDI and Hybrid Vehicles
Steam boilers: Classification – Coehran boiler, Baboock and Wilcox boiler, Benson boiler-fluidized bed combustion,

MODULE II
Principles and fields of application of compressors - reciprocating and centrifugal, blower, pumps- reciprocating, centrifugal and jet pumps, steam and hydraulic turbines- impulse and reaction, gas turbine cycles-open and closed
Elementary ideas of hydro electric, thermal and nuclear power plants
Refrigeration & Air Conditioning: Refrigerants, CFC free refrigerants. Vapor compression refrigeration system, Comfort and Industrial air conditioning—typical window air conditioning unit (general description only).

MODULE III
Mechanical Power transmission systems: Belt, rope and gear drives-types, comparison and fields of application-velocity ratio-slip (simple problems) friction disc, single plate clutch, gear trains (no derivations).
Manufacturing processes: Elementary ideas of casting, forging, rolling, welding, soldering and brazing
Machining processes- turning, taper turning, thread cutting, shaping, drilling, grinding, milling (simple sketches and short notes).
Non conventional machining - Electro discharge machining (EDM) and Electro chemical machining (ECM)
Principle, application and advantages of C N C machine

REFERENCES
1. Spalding and Cole, "Engineering Thermodynamics"
2. Gill, Smith and Zuriys, “Fundamentals of IC Engines”
3. Amstued, Ostwald and Begeman, “Manufacturing processes”
5. R K Bensul, “Fluid mechanics and machines”
7. Roy and Choudhary, “Elements of Mechanical Engineering”
8. Hajra Choudhary, “Workshop Technology”

Note: Lectures are to be supplemented by demonstration in laboratories.

Note: The question paper will consist of two parts. Part I is to be compulsory for 40 marks. This may contain 10 questions of 4 marks each. Part II is to cover 3 modules. There can be 3 questions from each module (10 marks each) out of which 2 are to be answered.
MODULE - I


Alternating current fundamentals - generation of alternating currents - waveforms - frequency - period - average and rms values - form factor. Phasor representation of alternating quantities - rectangular polar and exponential forms.

Analysis of simple ac circuits - concept of impedance and admittance - phasor representation - j notation - power and power factor in ac circuits - active and reactive components. Solution of RL, RC and RLC series circuits.

Three phase systems - generation of three phase voltage - star and delta connection - relation between phase and line values of voltage and current - phasor representation - three wire and four wire systems.

Measurement of power in three phase circuits (two wattmeter method). Measurement of energy - working of 1-phase energy meter.

MODULE - II

Transformers - Principle of operation - EMF equation - constructional details of single phase and three phase transformers

Methods of bulk generation of electric power. Block schematic of layout of generating stations - hydroelectric, thermal and nuclear power plants. Renewable energy sources - solar, wind, tidal, wave and geothermal energy.

Bulk transmission of electric power - typical electrical power transmission scheme - need for high transmission voltage - substations - substation equipments. Primary and secondary transmission and distribution systems

Different methods of wiring for LT installations. Schematic layout of LT switchboards. Earthing of installations - necessity of earthing - plate and pipe earthing. Protective fuses, MCBs, ELCBs and switches.

Working of incandescent lamps, fluorescent lamps, energy efficient lamps

MODULE - III

Diodes - PN junction diodes, V-I characteristics, dynamic & static resistance, principle of working and V-I characteristics of Zener diode, principle of Photo diode, Solar cell, & LED.

Rectifiers & power supplies - block diagram description of a dc power supply. Circuit diagram & working of half-wave & full wave rectifier, final equations of Vrms, Vdc, ripple factor and peak inverse voltage in each case, principle of working of series inductor and shunt capacitor filters. Working of simple zener voltage regulator.
Power devices – V-I characteristics and applications of SCR and Triac  Working principle of
UPS and SMPS
Transducers – Resistance strain guage, thermistor, LVDT

REFERENCES
Hall of India, 2000.
3. B.L. Thereja, “A Text Book of Electrical Technology”, Volume I, S Chand & Co, New Delhi,
4. Francis M Fernandez, “A Basic Course in Electrical Engineering”, Rajath Publishers,
Emakulam.
5. TP Imthias Ahmed, B. Premlet, “Introduction to Electrical Engineering”, Phaser Books,
Kollam.
Engineering”, Dhanpath Rai & Sons, New Delhi 1997, N.N. Bhargava, “Basic Electronics and
Linear Circuits”, T.M.H.
education, Asia 2003.

Note: The question paper will consist of two parts. Part – A is to be compulsory for 40 marks
(10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice- One out
of two or two out of four from each module).
MODULE 1 (Qualitative Treatment)
(a) Bipolar junction transistors: NPN & PNP transistors, structure, typical doping, working of NPN transistor, concepts of common base, common emitter & common collector configurations, current gain of each, input & output characteristics of common emitter configuration, comparison of three configurations with reference to voltage & current gain, input & output resistances and applications. (6 hrs)
(b) Field effect Transistors: basic principles of JFET, MESFET and MOSFET, comparison with BJT. (3 hrs)
(c) Amplifiers & Oscillators: circuit diagram & working of common emitter amplifier, function of each component in the circuit, need of proper biasing, frequency response, voltage gain and 3dB bandwidth, concepts of class A, B, AB and Class C power amplifiers, circuit diagram & working of push pull amplifiers, concepts of feedback, working principles of oscillators, circuit diagram & working of RC phase shift oscillator. (7 hrs)
(d) Integrated circuits: advantages of ICs, analog and digital ICs, functional block diagram of operational amplifier, ideal operational amplifier, use as inverting amplifier, non inverting amplifier, summing amplifier, integrator and comparator. (4 hrs)
(e) Digital ICs: logic gates, realization of logic functions, principle of combinational and sequential logic circuits, flip flop (JK), logic families: TTL and CMOS Logic (No internal diagram), examples of digital ICs-functional diagram of (7400, 7402, 7473, CD4011). (4 hrs)
(f) IC fabrication: purification of silicon, crystal growth, wafer preparation, unit process: oxidation, diffusion, ion implantation, epitaxy, deposition, photolithography. (4 hrs)

MODULE 2 (Qualitative Treatment)
(a) Measurements: principle and block diagram of analog and digital multimeter, working principle of CRT, block diagram of CRO, measurements using CRO, principle of digital storage oscilloscope, principle and block diagram of function generator. (5 hrs)
(c) Color television: TV Standards, interlaced scanning, block diagram of PAL TV transmitter & receiver, basic principles of cable TV, CCTV system, basic principles of HDTV, basic principles of LCD & Plasma displays. (5 hrs)
(d) Radar and navigation: principle of radar and radar equation, block schematics of pulsed radar, factors affecting range, applications of radar in measurements and navigation. (4 hrs)
(e) Satellite communication: microwave frequency bands, concept of geo-stationary satellite, frequency bands used, satellite transponder, block diagram of earth station transmitter & receiver, advantages of satellite communication, principle of Global Positioning System (GPS). (3 hrs)
(f) Optical communication: block diagram of the optical communication system, principle of
A. Carpentry:

B. Fitting:
   Study of tools, Practice in filing, cutting, drilling and tapping. Male and female joints, Stepped joints.

C. Sheet Metal Work:
   Study of tools. Selection of different gauge GI sheets for jobs. Practice on riveted joints. Preparing tube joints, frustums, trays and containers.

D. Plumbing:
   Study of tools. Details of plumbing work in domestic and industrial applications. Study of pipe joints, cutting, threading and laying of pipes with different fittings using PVC pipes. Use of special tools in plumbing work.

E. Foundry:
   Study of tools. Preparation of sand, moulding practice and demonstration of casting.

F. Welding:
   Study of welding machines. Straight line practices, Making of Butt joint, T joint and Lap joint.

G. Smithy:
   Study of tools. Demonstration on forging of square prism, hexagonal bolt, T bolt and Eye bolt.

H. Machine Tools:
   Study and demonstration on working of machine tools. Lathe and Drilling machine.

NOTE: For the university examination the student shall be examined in sections A, B, C, D and E only.
Syllabus

III Semester Industrial Engineering (2008 Admissions)

<table>
<thead>
<tr>
<th>08.301 ENGINEERING MATHEMATICS II (CMPUNERFHBTA)</th>
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<tbody>
<tr>
<td>L-T-P/D: 3-1-0</td>
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<tr>
<td>4Credits</td>
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</tbody>
</table>

Module I


Module II

Fourier series: Fourier series of periodic functions of period $2\pi$ and $2l$. Dirichlet’s condition for convergence. Odd and even functions. Half range expansions.

Fourier Transforms: Fourier integral theorem (no proof)- Fourier transforms- Fourier sine and cosine transforms, inverse Fourier transforms, properties

Module III


Application of PDE: Derivation of one dimensional Wave and Heat equations. solution by seperation of variables. Boundary value problems in one dimensional Wave and Heat equations.

References


Examination Duration: 3 hours

Note: The question paper shall consists of two parts. Part A (40 marks) Ten compulsory questions of 4 marks each. Part B (60 marks) Student must answer one out of two questions from each module. Each question carries 20 marks.
Module I


Friction: laws of friction: pivot and collar friction. – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

Brakes -analysis of internal expanding shoe brakes – applied to rear wheels only, applied to front wheels and applied to all four wheels.-self energizing and self-locking in braking-heat generation in braking. Dynamometers- transmission and absorption types.

Module II

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque - Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

Governors, types of governors-simple watt governor, porter, proell, and hartnell governors - sprig controlled governors - effect, power, isochronisms, hunting, sensitivity and stability.

Gyrooscope-gyroscopic stability -gyroscopic effect on two wheeled vehicles and automobiles Gyroscopic stabilization of ships, aeroplanes and rockets.

Module III

Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method

References


Note: The question paper shall consists of two parts. Part A (40 marks) Ten compulsory questions of 4 marks each. Part B (60 marks) Student must answer one out of two questions from each module. Each question carries 20 marks.
Module I

Module II

Module III

References:
1. L.W.Van Wlanck, Elements of Materials Science.
7. Dieter, Mechanical Metallurgy.
8. Serope Kalpakjian et al., Manufacturing Engg and Technology.
Note: The question paper shall consists of two parts. Part A (40 marks) Ten compulsory questions of 4 marks each. Part B (60 marks) Student must answer one out of two from each module. Each question carries 20 marks.

08.304 MECHANICS OF STRUCTURES

L-T-P/D: 3-0-0  Credits: 3

Module I

Concept of stress and strain – normal stress and shear stress, concept of strain, normal strain and shear strain, constitutive relation, Saint-Venant’s Principle and stress concentration, lateral strain, Poisson’s ratio, Hooke’s law, modulus of elasticity, modulus of rigidity, volumetric strain, bulk modulus of elasticity, relationship between elastic constants, deformation of axially loaded bars, members with varying cross section, principle of superposition, composite bars, thermal stress.

Concept of stress and strain tensor, generalised Hooke’s law, definition of plane stress, plane strain and examples. Stress transformation (2D only) principal stress and Mohr’s circle, Strain energy due to axial loads- gradually and suddenly applied impact loads.

Module II

Shear force and bending moment diagrams– cantilever, simply supported and over hanging beams-concentrated and UD loads, Theory of simple bending-bending stress and shear stress distribution-rectangular, circular and I sections.

Slope and deflection of beams, load- deflection differential equation, computation of slope and deflection of simply supported and cantilever beams- Macaulay’s method.

Module III

Torsion of circular shafts-solid and hollow shafts-power transmitted by shafts.

Thin cylinders and shells subjected to internal and external pressures – thick cylinders and spherical shells- Lame’s equation – compound cylinders.

Direct and bending stress – short columns – core of section Crippling load Eulers equation

References:

1. S. B. Junarkar, Mechanics of structures Vol I & II
2. Egor P Popov, Engineering Mechanics of solids PHI
3. Timoshenko, Strength of Materials
Note: The question paper shall consists of two parts. **Part A** (40 marks) Ten compulsory questions of 4 marks each. **Part B** (60 marks) Student must answer one out of two from each module. Each question carries 20 marks.

### 08.305 ELECTRICAL MACHINES

**L-T-P/D:** 3-0-2  
5 Credits

#### Module I


#### Module II


#### Module III

3-Phase induction motors – slip ring and squirrel cage – rotating magnetic field – torque slip characteristics, simple circle diagrams, no load and blocked rotor tests, methods of starting, principles of operation and applications of single phase stepper motor, universal motor.


**Text books:**

1. B.L.Theraja and A.K. Theraja, A Text book of Electrical Technology,
2. Pratab, Art and Utilisation of Electric Energy

**References**

1. Mehta V.K.,Principles of Electrical Engineering and Electronics
2. Gupta, J.B.,A course in Electric Power
Note: The question paper shall consist of two parts. Part A (40 marks) Ten compulsory questions of 4 marks each. Part B (60 marks) Student must answer one out of two from each module. Each question carries 20 marks. There is no university examination for Electrical lab, however 40 percent of the sessional marks should be awarded for the performance in the practical classes as per the syllabus given below:

**Electrical Lab**

Study of DC Motor, DC Generator, Transformer (single phase), Polyphase induction motor, Synchronous machines.

Experiments

1. OCC of DC self Excited shunt Generator
2. Load Characteristic of shunt generator
3. Load test on Series motor
4. Load Characteristics of compound Generator
5. Load characteristics of single phase transformer
6. Load characteristics of slip ring induction motor
7. Starting and Load test of squirrel cage 3-phase induction motor
8. Synchronising of alternator by Dark Lamp Method
9. Load test on Alternator by Direct Loading
10. Starting and Load test of single phase induction motor – determination of characteristics.

**Electrical Workshop**

1. Wiring Practice in PVC conduit system
   i. Two lamps & a plug (independent control)
   ii. Stair case wiring / Tunnel wiring
   iii. Main switch & Energy meter connection (study of Earthing system)
   iv. Fluorescent Lamp & Ceiling Fan connection.

**08.306 THERMAL ENGINEERING**

L-T-P/D: 3-1-0 4 Credits

**Module I**

Introduction to heat transfer: Different Modes of heat transfer, Fourier law, derivation of heat transfer equations for all modes of heat transfer from basic assumptions, heat exchangers and designs.

**Module II**

Fuels and combustion – stoichiometry, calculation of A/F ratio, and equivalence ratios, volumetric and gravimetric analysis, fuel properties.


**Module III**

Compressors: reciprocating compressors – work done and efficiency, volumetric efficiency- effect of clearance, Rotary compressors- roots blowers, vane type compressor, centrifugal and axial type compressors, work done and efficiency, and performance characteristics.


**Reference:**

1. P. L. Ballaney Thermal Engineering
2. VanWylen-An Introduction to Classical Thermodynamics
3. Keralin- Steam turbines
4. J.B.Heywood, I.C.Engines Fundamentals
5. Cohen, Rogers and Saravanamittoo, Gas Turbine Theory
6. Ob, I.C. Engines
7. Gill and Smith, I.C. Engines
8. Rajput, Thermal Engineering

**Note:** The question paper shall consist of two parts. **Part A** (40 marks) Ten compulsory questions of 4 marks each. **Part B** (60 marks) Student must answer one out of two from each module. Each question carries 20 marks.
08.307 COMPUTER AIDED DRAFTING LAB

L-T-P/D: 0-0-3

3 Credits

Use any Computer Aided Drafting software package.

A. Machine Drawing

Preparation of drawings for machine components - bolts, nuts, Joints, Shaft coupling, connecting rod, cam profile, Assembly drawings of Machine components such as piston, cylinder, crossheads, and Safety Valves, etc.

B. Building Drawing

Principles of building drawing, preparation of drawing of buildings such as office building (for 20 staff), residential building (RCC and tiled roof, single storied and two storied), factory building with steel trusses for small scale industries.

Note: University exam duration is 4 hours, question paper contains two parts (Machine drawing and Building drawing) 50 marks each.

08.308 MACHINE DYNAMICS AND MATERIAL TESTING LAB

L-T-P/D: 0-0-3

3 Credits

Machine Dynamics Lab...........( Sessional mark = 25)

Experiments

1. Determination of time period of oscillation of simple and compound pendulum.
2. Determination of radius of gyration of bifilar and trifilar suspension.
3. Determination of frequency of vibration of Helical Spring.
4. Determination of frequency of vibration of spring mass system.
5. Verification of Dunkerley’s method.
6. Characteristic curve of sleeve position against speed of governor.
7. Displacement curve of cam analysis apparatus.

Material Testing Lab...........( Sessional mark = 25)
Study of UTM, Torsion, hardness and Impact testing Machines

Experiments
1. Test on Mild Steel, High carbon Steel and Cast Iron specimens
2. Shear test on MS Rod
3. Torsion test on MS Rod
4. Torsion test using Torsion Pendulum on MS, Aluminum and Brass wire
5. Izod and Charpy Impact tests
6. Hardness test (Rockwell and Brinnel)
7. Spring test (Open and closed)
8. Bending and Compression test on Wood

Note: University exam duration is 3 hours. Maximum Marks 100. The student will be evaluated in one of the labs based on draw of lots.

Syllabus - IV Semester Industrial (2008 Admissions)

08.401 ENGINEERING MATHEMATICS-III (CMPUNERFHB)

L-T-P/D: 3-1-0 4 Credits

Module I

Complex Differentiation: Limits, continuity and differentiation of complex functions. Analytic functions-Cauchy Reimann equations in Cartesian form (proof of necessary part only) properties of analytic functions-harmonic functions. Milne Thomson method

Conformal mapping: The Transformations $w = \frac{1}{z}$, $w = z^2$, $w = z + \frac{1}{z}$, $w = \sin z$, $w = \cos z$, Bilinear transformation

Module II

Complex Integration: Line integral- Cauchy’s integral theorem-Cauchy’s integral formula. Power series-radius of convergence-Taylors and Laurent’s series-zeros and singularities –Residues and residue theorem. Evaluation of real definite integrals- $\int_0^{2\pi} f(\sin \theta, \cos \theta) d\theta$, $\int_{-\infty}^{\infty} f(x) dx$ with no poles of $f(z)$ on the real axis (proof of theorems not required)

Module III

Euler's method, Runge Kutta methods (derivation of formulae not required for the above methods.)

References:

7. S.S.Sastry, Introductory methods of numerical analysis.

Examination Duration: 3 hours

Note: The question paper shall consists of two parts. Part A (40 marks) Ten compulsory questions of 4 marks each. Part B (60 marks) Student must answer one out of two questions from each module. Each question carries 20 marks.

<table>
<thead>
<tr>
<th>08.402 COMPUTER PROGRAMMING AND NUMERICAL METHODS(MNPU)</th>
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<td>L-T-P/D: 3-1-0</td>
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<td>4 Credits</td>
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Module – I

Introduction to Computer programming concept - Algorithm and flow chart, Basics of procedure oriented and object oriented programming.

Introduction to C++: Structure of C++ program; Key words; Identifiers; Data types – integer, real, character, string, boolean, enumeration, array and pointer; Constant and Variables; Escape sequences; Operators – assignment, arithmetic, relational, logical, increment & decrement, conditional, size of, comma and bitwise operators; Statements – simple & compound, declaration statements, Control statements -if, if-else, switch, for loop, while, do-while, break and continue statements, Input and output streams, Arrays – one dimensional & two dimensional; Functions- inline functions, function over loading, Functions with default arguments, recursion, pointers. Simple programs using above features.

Module –II

Introduction to Class and Object-definition, data members, member function, private & public member function, member access, friend declaration, class objects, predefined classes, initialization, constructor and destructor; Operator overloading, Inheritance- base class and derived class; Input/output stream library - ifstream, ofstream, fstream, class files. Simple problems using the above features.

Module-III


References :
1. Ashok M. Kamthane, Object oriented Programming with ANSI & Turbo C++, Pearson Education.
3. Stanley B. Lippman and Josee Lajoie, C++ Primer, Pearson Education.

Note: The question paper shall consists of two parts. Part A ( 40 marks) Ten compulsory questions of 4 marks each. Part B ( 60 marks) Student must answer one out of two from each module .Each question carries 20 marks.

08.403 FLUID MECHANICS AND HYDRAULIC MACHINES

L-T-P/D: 3-1-0  4 Credits

Module I

Properties of fluids-pressure, density, specific gravity, specific weight, viscosity, compressibility, vapor pressure - gas laws - Capillarity and surface tension-various types of manometers and pressure gauges-transmission of fluid pressure-continuity equation for one-dimensional steady flow. Bernoulli's equation for steady, onedimensional incompressible flow- venturimeter-orifice meter -pitot tube-notches-weirs.


Module II

Dimensional analysis: Dimensions and units, the Buckingham n theorem. Discussions on dimensionless parameters - Models and similitude - Application of dimensionless parameters.

Impact of jets on vanes -flat, curved, stationary and moving vanes-radial flow over vanes-hydraulic turbines-classification - Pelton wheel, Francis turbine and Kaplan turbine-work done and
Module III

Positive displacement pumps-reciprocating pumps-inertia pressure-air vessels and their purpose-separation and cavitation-slip and efficiency-multi-cylinder pumps

Rotary motion of liquids-free, forced, spiral, and vortex flow, rotodynamic pumps:-centrifugal pumps – impeller, casing - manometric heads, work, efficiency and losses-priming-specific speed. Performance characteristics-multistage pumps -selection of pumps-pumping devices-

Hydraulic ram, jet pumps, gear pumps, vane pump, lobe pump, rotary pumps.

References

2. Hydraulics and Fluid mechanics: Lewitt
3. Hydraulics and Fluid mechanics: Dr..Jagadish Lal
4. Fluid flow machines: N.S.Govinda Rao
5. Fluid mechanics and machines : Modi and Seth.
7. Introduction to fluid dynamics, Robert W. Fox, John Wiley and sons
8. Theory and applications of fluid mechanics, K. Subrahmanya, (TMH)

Note: The question paper shall consists of two parts. Part A ( 40 marks) Ten compulsory questions of 4 marks each. Part B ( 60 marks) Student must answer one out of two from each module .Each question carries 20 marks.
Module I


Module II


Module III


References:

4. Campbell, Principles of Manufacturing materials and processes – TMH
5. Paul dE Grarmo , J.T.Black and RA.K Kosher, Materials and process in Manufacturing, PHI.
Note: The question paper shall consists of two parts. Part A (40 marks) Ten compulsory questions of 4 marks each. Part B (60 marks) Student must answer one out of two from each module. Each question carries 20 marks.

08.405 OPERATIONS MANAGEMENT

L-T-P/D: 3-1-0 4 Credits

Module I
Demand forecasting:- basic models, Long and Short-term demand forecasting methods, Regression analysis and smoothing methods, Estimation of trend, cycle, and seasonality components, Analysis of forecast error and computer control of forecasting systems, multi item forecasting, slow-moving item forecasting. Basic inventory models:- assumptions, performance measures, multi-item joint replacement model. Inventory systems under risk:- service levels, safety stock, joint determination of Q and R, time-varying demands.

Module II
Aggregate inventory management:- Exchange curves, stock out situations, safety stock policies, distribution inventory systems. Aggregate planning:- definition, value of decision rules, aggregate planning strategies, methods. Master production schedule:- bill of material, structuring BOM, disaggregation techniques, managing and maintenance of MPS. Material Requirements Planning:- MRP and MRP II, MRP concepts and advantages, implementation.

Module III

Text:
1. Krajewski LJ, Operations Management: Strategy and Analysis, Pearson Education

Reference:
2. Narasimhan et al., Production Planning and Inventory Control, PHI.
4. Silver, Pyke & Peterson, Inventory Management and Production Planning and Scheduling, John Willey & Sons
Note: The question paper shall consists of two parts. Part A (40 marks) Ten compulsory questions of 4 marks each. Part B (60 marks) Student must answer one out of two from each module. Each question carries 20 marks.

08.406 INTRODUCTION TO INDUSTRIAL ENGINEERING

L-T-P/D: 3-0-0  

Module I
History, contribution of various pioneers, scope, objectives, application and role of Industrial Engineering in organisations, Industrial Engineering in the modern world, principles of management, schools of management, management functions, management verses Industrial Engineering. Industrial ownership: Introduction, types of ownership, partnership, joint stock company, private limited company, public limited company, public sector and private sector, different scales and levels of industries.

Module II
Operation research: Definition and concept, methods and techniques in operations research, applications of operations research. System Engineering: Introduction, applications of system engineering, system concept, system analysis and approach, techniques in system analysis. Creative Problem Solving: Introduction, basic concepts and models, need for creativity, the creative individual, creative thinking, action programs. Decision making – Styles of Decision Making -Contingency approach, Decision making tools.

Module III


References:
2. Philip E. Hicks, Introduction to Industrial engineering and Management Science, McGraw Hill.
6. Bateman and Snell, Management: Competing in the new era, McGraw Hill
7. Double Entry book Keeping – Batliboi

Note: The question paper shall consists of two parts. Part A (40 marks) Ten compulsory questions of 4 marks each. Part B (60 marks) Student must answer one out of two questions from each module. Each question carries 20 marks.

08.407 FLUID MECHANICS AND MACHINES LAB (MN)

L-T-P/D: 0-0-3 3 Credits

Study of meters, gauges and valves - pressure gauge, vacuum gauge, manometers, flow measuring equipments-water meters-venturi meter-orifice meter-current meter, stop valve, gate valve and foot valve


Experiments

1. Determination of Coefficient of discharge and calibration of Notches, Orifice meter, Nozzle and Venturimeter.
2. Determination of Chezy’s constant and Darcy’s coefficient on pipe friction apparatus
3. Determination of Hydraulic coefficients of orifices
4. Determination of Metacentric Height and Radius of gyration of floating bodies.
5. Performance test on Rotodynamic and Positive displacement pumps
6. Performance test on Impulse and Reaction turbines
7. Speed variation test on Impulse turbine
8. Determination of best guide vane opening for Reaction turbine
9. Performance test on variable speed pump and plotting iso-efficiency curves

08.408 THERMAL ENGINEERING LAB

L-T-P/D: 0-0-3 3 Credits

1. Study of I. C engines :-
   a) Diesel engines - all systems and parts
   b) Petrol engines - all systems and parts.

2. Experiment on I C Engines
   a) Performance test on IC Engines (Petrol and Diesel)
   b) Valve timing diagram
   c) Economic speed test
d) Best cooling water Temperature test
e) Retardation test
f) Volumetric efficiency and Air-fuel ratio test
3. Determination of flash and fire points of petroleum products
4. Determination of viscosity of lubricating oil using Redwood Viscometer.
5. Determination of calorific value of solid, liquid and gaseous fuels using Bomb calorimeter and Gas Calorimeter
6. Study of pollution testing equipment and flue gas analyser.
7. Study and Performance Analysis of
   a. Reciprocating compressor
   b. Rotary compressor
   c. Blowers
8. Determination of thermal Conductivity of metals, experiments on convection and radiation heat transfer.

Syllabus - V Semester Industrial (2008 Admissions)

<table>
<thead>
<tr>
<th>08.501 INTRODUCTION TO STOCHASTIC MODELS (N)</th>
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<tr>
<td>L-T-P/D: 3-1-0 4 Credits</td>
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</table>

Module I
Introduction to Probability Theory:- Sample space and Events, Conditional probabilities, Independent events, The Law of Total probability and Bayes’ Theorem.
Random Variables:- Discrete and Continuous random variables, Expectation of a Random variable, Moment Generating Functions, Joint Probability distributions.
Limit Theorems:- Markov’s Inequality, Chebyshev’s Inequality, Strong Law of Large numbers, Central Limit theorem, Stochastic Processes.
Conditional Probability and Continuous Expectation:- Discrete and Continuous cases, Computing Expectation and Variances by Conditioning.

Module II
Continuous Time Markov Chains:- Birth and Death Processes, Computing the Transition probabilities, Limiting probabilities, Time Reversibility, Uniformization.
Module III

Brownian Motion and Stationary Processes:- Brownian motion, Hitting times, Maximum variable, and the Gambler’s Ruin Problem, Variations in Brownian Motion, White Noise, Gaussian Processes, Stationary and Weakly stationary processes.

Introduction to Martingales and Random walks.(Overview only)

References:
1. Introduction to Probability Models – Sheldon M.Ross – Elsevier

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.502 OPERATIONS RESEARCH (N)

L-T-P/D: 3-1-0 4 Credits

Module I

Introduction to Operations research, Applications.

Linear programming – General formulation, Matrix form of LP problem, Graphical solutions, Simplex method, Duality, Dual Simplex method and Sensitivity analysis.
Queuing theory – Pure Birth and Pure Death processes, Relationship between Poisson process and Exponential Distribution, Basic Poisson queues. Priority disciplines – Queuing decision models.

Module II

Transportation problems – Formulation, Balanced and Unbalanced problems -Solution methods to find basic feasible solution and optimal solution, Degeneracy in transportation problem-Unimodularity, Trans-shipment problem, Sensitivity analysis in Transportation problem.

Assignment problems – Formulation, Solution methods-Hungarian algorithm-Auction algorithm.


Module III

Introduction to Dynamic programming - Stage coach problem, reliability problem, manpower planning problem, continuous variables etc.

Decision theory- Types of decision making environment- Decision making under uncertainty and under risk-Decision tree analysis


Case studies illustrating above models in Industries, introduction to software packages for decisions.

References:

1. Operations Research-G.Srinivasan-PHI
3. Introduction to Operations Research-Hillier and Lieberman-TMH
7. Introduction to Management Science – Taylor – Pearson Education

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module I

Introduction, definition and concept, need for work study, objectives, work-study and productivity. Organization of work study department. Method study: Definition, process analysis, process chart, process chart symbols, outline process chart, flow process charts, multiple activity charts, two handed process charts, flow diagram, string diagram and travel chart. Micro motion, and memo motion analysis.

Module II

Work Measurement: Definition and concept of work measurement, work measurement technique, Stop watch time study, , Time study equipments, selecting the job to be timed, selection of workers for time study, for time study, performance Rating, Systems of Rating, Predetermined motion time systems, Methods Time Measurement, work factor systems, work sampling, applications of work measurement techniques.

Module III

Human physiological and psychological capabilities and limitations, principles of motion economy, , work place arrangements, systems and controls for the improvement of human work place. Advances in applied biomechanics and ergonomics, heat stress and heat stress management, energy expenditure and factors affecting oxygen uptake. Fatigue measurement, anthropometry and workstation design. Case studies in Work study and ergonomics.

References:

2. ILO, Introduction to Work Study.

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module I
Definition-Standards of measurement-Errors in measurement-Accuracy, precision etc-calibration of instruments, selection and care of instruments.
Length standard-Line and end standard - Slip gauges, micrometers, verniers, dial gauges-comparators, various types-principle and applications-limits, fits and tolerance-design of gauges-interferometry applications-angular measuring instruments-bevel protector, levels, clinometers-sine bar, angle dekkor-alignment telescope, autocollimator.

Module II
Coordinate measuring machine-LASER micrometer-LASER interferometer-Noncontact and in-process inspection, vision system.

Module III
Processing system of nanometre accuracies-mechanism of material processing-Nano Physical processing of atomic bit-units-Nano-chemical and electrochemical atomic-bit processing. In process or in situ measurement of position of processing point-Post process and on machine measurement of dimensional features and surface-mechanical measuring systems -optical measuring systems-Electron beam measuring systems-pattern recognition and inspection systems.

References
5. CIRP Annals

Note: Question Paper consists of two parts.
Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module – I


Module II


Module III


Reference:

1. Manufacturing Engineering & Technology : Kalpakjian – Addison Wesley
5. R.K.Jain – Production Technology, Khanna Publishers
6. R.K.Gupta - Production Technology, Sathya Prakashan
8. Production Technology , HMT, TMH.

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
08.506 ELECTIVE I (N) 3-1-0  4 Credits

08.507 MACHINE TOOLS LAB (N)

L-T-P/D: 0-0-3  3 Credits

General study of Lathe and Accessories, Tools used for different operations. Exercises involving plane turning, Groove cutting, form turning, taper turning, facing and thread cutting.

Study of shaping and slotting machines, and planning machines, exercises involving production of flat surfaces, grooves and key ways.

Study of Milling Machines and Milling Cutters, Exercise on Milling machines-face milling, end milling – spur and Helical gear cutting – milling of keyways

Study of Grinding machines, surface Grinding and Cylindrical grinding machines – study of Drilling machines, Exercise on Grinding and drilling Machines

08.508 METHODS AND SYSTEMS DESIGN LAB (N)

L-T-P/D: 0-0-3  3 Credits

1. Experiment to explain the principles of motion economy
2. Experiment to determine method improvement
3. Experiment to demonstrate learning effects (learning curve)
4. Experiment to experience and practice of performance rating
5. Experiment to determine standard times of different jobs by stop watch time study
6. Experiment to determine standard time by MTM
7. Experiment to determine standard time by work sampling
8. Experiment to determine location for facilities by gravity method, etc.
9. Experiment to determine physiological work for doing different tasks
10. Experiment to explain micro-motion analysis

08.506 Elective I (N)
Module 1


Module 2

Organizational development, Concepts of QWL-strategies for improved QWL, Organizational change, Resistance to change, Goals of organizational change and organizational development, Concept of organizational climate-health and effectiveness. Organizational culture- nature and characteristics, types, impact of culture in organizational behaviour, Motivation of person across cultures, Managerial leadership across cultures, Case studies.

Module 3


References:

1. Fred Luthans, Organizational Behaviour, McGraw Hill.
2. Stephen P. Robbins, Organizational Behaviour, Pearson Education.

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module I
Analysis of stress; State of stress at a point; Rectangular stress components; stress components on an arbitrary plane; Principal stress and Principal planes; Planes of maximum shear; State of pure shear; Differential equations of equilibrium in rectangular co-ordinates; Analysis of stress in two dimensions; Plane stress and plane strain. Transformation of stresses. Analysis of strain, strain-displacement relations–Principal strains and principal axes. Compatibility conditions. Stress-Strain relations.

Module II
Energy methods; Reciprocal relations; Maxwell-Betti-Rayleigh reciprocal theorem; Castigliano’s I theorem; Fictitious load method; Theorem of virtual work; Castigliano’s II theorem; Engessers theorem.

Bending of beams; Straight beams and asymmetrical bending; shear centre; shear stresses in thin walled open sections; Bending of curved bars (Winkler–Bach formula)

Module III
Torsion -Torsion of General prismatic bars; Torsion of circular, elliptic and equilateral triangular bars; Membrane analogy. Torsion of thin- walled tubes. Torsion of bars with narrow rectangular cross-section. Torsion of thin- walled multiple cell closed sections, Torsion of rolled sections, Center of twist and flexural centre.

References:
1. Advanced Mechanics of Solids-L.S Srinath (T.M.H)
2. Theory of Elasticity –Timoshenko and Goodier (Mc Graw Hill )

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module I

Computer Aided Design – Definition, necessity for CAD Design process – Application of computers in Design- Geometric modeling, Engineering analysis, design review and evaluation, Automated drafting. Benefits of CAD.

Hardware in CAD- components, Design workstation, computer graphics terminal, types of display devices, CRT tubes, directed beam refresh, DVST and raster scan displays, LCD and plasma discharge displays. User interaction devices.

Module II

Computer graphics software, functions of CG packages.


3D modeling, types of models- wire frame - surface and solid models

Module III


Reference:

1. Daryl Logan, A First course in Finite Element Method, Thomson Learning
2. Groover, CAD/CAM Prentice Hall
3. Roger and Adams, Mathematical Elements of CAD Prentice Hall.
5. Sait, CAD/ CAM,
6. Thirupathi Rao and Belagundu, Introduction to Finite Element Analysis

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module I


Module II


Module III


References


Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module 1

Project identification and formulation, different types of needs leading to different types of projects, BMRED (Balancing, Modernization, Replacement, Expansion, and Diversification) projects, Macro parameters in project selection, SPACE approach, PRI, different considerations for project under private, public and joint sectors. Project formulation, project report and detailed project report. Project appraisal-different types of appraisal—Technical, Economic, Marketing, Commercial and Financial. Financial techniques for project appraisal and feasibility, discounted cash flow and non-discounted cash flow methods, SCBA.

Module 2


Module 3

Project administration- progress payments, expenditure planning, Project implementation Planning: scheduling and network planning, use of Critical Path Method (CPM), PERT, GERT, MOST. Schedule of payments and physical progress, Resource leveling and resource allocation. Crashing and time-cost trade off, Post project evaluation. Multiple projects and constraints; Options and Flexibility, Performance Evaluation; Abandonment Analysis; Principles of Project Contracts; Dynamics of Project Costs.

References:

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
08.601 DATA ANALYSIS FOR MANAGEMENT (N)

L-T-P/D: 3-1-0  4 Credits

Module I

Introduction and Descriptive Statistics:- Samples and Populations, Data and Data collection, Percentiles and Quartiles, Measures of Central Tendency, Measures of variability, Grouped data and the histogram, Skewness and Kurtosis, Chebyshev’s Theorem, The Empirical Rule, Methods of Displaying Data, Exploratory Data Analysis.

Module II

Measurement design:- Primary types of Measurement Scales-Nominal, Ordinal, Interval and Ratio scales.

Sampling and Sampling distributions:- Introduction, Sampling process, Non-probability and Probability sampling- different types, Determination of sample size, Introduction to sampling distributions, Central Limit Theorem, Estimators and their properties, Confidence Intervals.

Hypothesis Testing:- One sample and Two sample tests, z-test, t-test, Chi-square test.

Analysis of Variance:- Theory and computations of ANOVA, ANOVA table, Two-way ANOVA, Blocking designs, Design of Experiments.

Module III

Simple Regression and Correlation:- Introduction, Estimation using the regression line, Correlation Analysis.
Multiple Regression:- The k-variable multiple regression model, The F-test of a Multiple Regression model.


Time Series Analysis and Index numbers:- Trend Analysis, Seasonality and Cyclic behaviour, The Ratio-to-Moving average method, Exponential smoothing methods, Index numbers.

Introduction to Factor Analysis, Multi Dimensional Scaling, Cluster Analysis, Discriminant Analysis and Conjoint Analysis.(Overview only)

References:

7. Fundamentals of Quality Control and Improvement – Mitra – Pearson Education
8. Mathematical Statistics – Irwin Miller and M.Miller – Prentice Hall India

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.602 ADVANCED OPERATIONS RESEARCH (N)

L-T-P/D: 3-1-0 4 Credits

Module I


Module II


Module III

Introduction to graph theory-Basic definitions-spanning trees, matching problem,Hamiltonian circuits, Eulerian circuit etc.

Network problems: Minimum spanning tree problem-Prim’s algorithm, Kruskal’s algorithm. Shortest path problems-Dijkstra’s algorithm, Successive Shortest path algorithm, Maximum flow


Reference:

1. Operations Research-G. Srinivasan-PHI
3. Introduction to Operations Research-Hillier and Lieberman-TMH

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module III

Robotics - Robot position and proximity sensing – tactile sensing – sensing touches – sensing slip – Man-Machine interface - AGVs


References:

Mechatronics, Electronic control systems in Mechanical and Electrical Engineering – W. Bolton – Pearson Education

Mechatronics – Electronics in products and Processes – Bradley D A – Chapman and Hall

MECHATRONICS – HMT, Bangalore

Mechatronics – Denny K Min – Springer


Mechatronics: Designing Intelligent Machines – Institution of Mechanical Engineers – MEP (UK) 1990

Mechatronics: The Integrating of Engineering Design – MEP(UK) 1992

Neural Computing, Theory and Practice – Philip D Wasserman – Reinhold, Newyork,

Neural networks using matlab 6.0, Tat McGraw Hills-S N Sivanandam, S Sumathi, S N Deepa

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

<table>
<thead>
<tr>
<th>08.604 MACHINE DESIGN(N)</th>
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<tbody>
<tr>
<td>L-T-P/D: 3-1-0</td>
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</tbody>
</table>

Module I

Design Principles - Common engineering materials and their properties, stress in machine parts, tension, compression, shear, bending and torsional stresses - Variable load- basic concept; Terminology associated with variable loading; Patterns of load or stress variations, Cyclic stressing/straining-and materials response to cyclic loading, The mechanism of fatigue failure; origin and propagation of crack, Stress life relations; S-N curve-fatigue strength and endurance limit, Factors influencing fatigue, Endurance strength modification factors, Effect of stress concentration and fatigue stress concentration definition and its estimation from geometric stress concentration factor, Effect of mean stress- Goodman and Soderberg's relations, Design
approach to fatigue- design for infinite life and finite life, Approach/Methods for design of members under combined (steady and variable) loading conditions

Shafts:- torsion and bending of shafts, Hollow shafts, design of shafts for strength and stiffness- Effect of key ways-Crankshafts, Propeller shafts.

Design of gear tooth- Law of gearing - conjugate action and gear tooth profile-basics Analysis of forces on spur, helical, bevel and worm gears - determination of bearing reaction forces Bending and contact stress in gear tooth-dynamic loading and wear-Lewis and Buckingham equations for design. Design of fixed ratio gear box-general design procedure

Module II


Thin Cylinders - Thick cylinders- Stresses due to internal and external pressures, Design principles for thick cylinders

Design/analysis of Brakes clutches and fly wheels:-Brakes and clutches -need and functioning - dynamic model, Plate clutches- design for uniform pressure and wear, Shoe brakes- short and long shoe analysis, Automotive shoe brake-design/analysis, Fly wheel basic concepts -design requirements, Moment diagram and energy estimations.

Module III

Springs:- classification and uses of springs, spring material- Design of helical, co-axial and leaf spring. Effect of end trusses, stress concentration factor, energy absorbed- deflection-Design for fluctuation loads- vibration in springs- buckling of springs-length of leaf springs.

Design of sliding and journal bearings:- Types of lubrication- hydro dynamic, hydro static and EHD lubrication. Petroff's equation and the bearing characteristic number, Lubrication regimes-boundary and film lubrication, Hydro dynamic bearings- Pressure distribution-eccentricity and minimum film thickness, Reynolds equation and use of bearing design charts, Heat generation and thermal equilibrium, Rolling contact bearings:- ball and roller bearing, types, static and dynamic load capacity, bearing life. Design of ball and roller bearings, and selection of rolling contact bearings using design data handbook.

Design Data hand books


Reference:

1. Mechanical Engg Design – Joseph Edward Shighy
3. Machine Design - Shaum’s Series

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module
(3 x 20=60)

08.605 SYSTEM MODELING AND SIMULATION (N)

L-T-P/D: 3-1-0 4 Credits

Module I

Systems theory, measures of effectiveness, System modeling, system analysis, system approach to problem solving, applications in industrial and business systems. Areas of application of simulation, steps in simulation study, classification of systems, models of systems-different types, system analysis and system postulation. System simulation:- Monte Carlo method, numerical computation technique for continuous and discrete systems, Distributed Lag models, Cobweb models, Comparison of simulation and numerical methods. Continuous system models, feedback systems, Real-time simulation. Use of Monte Carlo method to find area under curves, value of $\pi$, pure pursuit problem, trajectory simulation, etc.

Module II

Discrete and continuous probability functions, uniformly distributed random numbers, properties of random numbers, generation of Pseudo-Random numbers, random number generators, tests for random numbers:- frequency, gap, run, and Poker tests, tests for autocorrelation. Generation of random deviates for Exponential, Uniform, Weibull, Triangular, and discrete distributions; Inverse Transformation method. Direct transformation method for the Normal and Lognormal distributions. Acceptance-rejection technique:- Poisson and Gamma distributions. Input modeling:- data collection, identifying the distribution with the collected data, goodness of fit tests, selecting input models without data.

Module III

References:

2. System Simulation with Digital Computer – Narsingh Deo – PHI
3. Discrete Event System Simulation – J. Banks – Pearson Education
5. Simulation – Sheldon M. Ross – Elsevier

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4 = 40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20 = 60)

08.606 ELECTIVE II (N) 3-1-0 4 Credits

08.607 MANUFACTURING AUTOMATION LAB (N)

<table>
<thead>
<tr>
<th>Experiment</th>
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<tbody>
<tr>
<td>1. Experiments and programming of PLC</td>
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<td>2. Experiments and programming of Motion Controller package</td>
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<td>3. CNC Trainer lathe programming</td>
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<td>4. CNC Trainer milling machine programming</td>
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<tr>
<td>5. Experiments and programming on industrial robot</td>
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<td>7. Experiments on sensors and transducers</td>
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<tr>
<td>8. Programming on CNC production machines (CNC Turning centre, CNC Machining centre, CNC EDM)</td>
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</table>

08.608 DATA ANALYSIS AND OPTIMIZATION LAB (N)

<table>
<thead>
<tr>
<th>Experiment</th>
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<tbody>
<tr>
<td>1. Use of OR packages for solving LPP, Transportation, Assignment, Traveling Salesman, Inventory Control, Queuing problems etc.</td>
</tr>
<tr>
<td>2. Use of Statistical packages for descriptive statistics, curve fitting, correlation testing, regression analysis, design of experiments etc.</td>
</tr>
<tr>
<td>3. Mini project</td>
</tr>
</tbody>
</table>
Module 1


Module 2


Dialog Management: User Interface - Graphics - Multimedia - Visual Interactive Modeling -


Module 3


Tools for machine thinking: Forward chaining, backward chaining, use of probability and fuzzy logic.

Expert system development: Choice of domain, collection of knowledge base, selection of inference mechanism, case studies of expert system development in design and manufacturing.

Industrial application of AI and expert systems: Robotic vision systems, image processing techniques, application to object recognition and inspection, automatic speech recognition.

References:

3. Decision Support System, Marakas, Pearson Education
Note: Question Paper consists of two parts.
Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module
(3 x 20=60)

08.606.2 FINITE ELEMENT APPLICATIONS IN MANUFACTURING(N)

L-T-P/D: 3-1-0

4 Credits

Module 1

Basics of FEM – Initial value and boundary value problems – weighted residual, Galerkin and Raleigh
Ritz methods – Review of variational calculus – Integration by parts – Basic of variational formulation.
Steps in FEA – Discretization, interpolation, derivation of element characteristic matrix, shape function,
assembly and imposition of boundary conditions – Solution and post processing – One dimensional
analysis in solid mechanics and heat transfer.

Module 2

Global and natural co-ordinates – Shape functions for one and two dimensional elements – Three noded
triangular and four noded quadrilateral element – Non linear analysis – Isoparametric elements – Jacobian
matrices and transformations – Basics of two dimensional and axi symmetric analysis.
FE analysis of metal casting – Special considerations, latent heat incorporation, gap element – Time
stepping procedures – Crank-Nicholson algorithm – Prediction of grain structure – Basic concepts of
plasticity – Solid and flow formulation – Small incremental deformation formulation – FE analysis of
metal cutting, chip separation criteria, incorporation of strain rate dependency

Module 3

Pre processing, mesh generation, elements connecting, boundary conditions, input of material and
processing characteristics – Solution and post processing – Overview of application packages such as
ANSYS and DEFORM – Development of code for one dimensional analysis and validation.

REFERENCES

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module
(3 x 20=60)

<table>
<thead>
<tr>
<th>08.606.3 FIRE SCIENCE &amp; INDUSTRIAL SAFETY (N)</th>
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<tr>
<td>L-T-P/D: 3-1-0</td>
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<tr>
<td>4 Credits</td>
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</tbody>
</table>

Module I

Fire, combustion and explosion, flammability characteristics of chemicals and materials: liquids, vapors, gaseous / vapor mixtures, flame propagation.

Flammability diagram, ignition energy, auto ignition and auto oxidation, fire initiation and propagation – severity and duration, effect of enclosure and heat transfer in fire development, stack and pool fires.

Module II

Critical aspects of fire dynamics, diffusion flame and fire plumes, flame spread, production and movement of smoke, computer simulation of fire dynamics.

Fire detection systems. Fire prevention and control, inerting procedures, static electricity. Control techniques- general design methods, flame arrestors – their design, design of sprinkler systems, flare design, fire extinguishment – different methods.

Module III

Importance of safety in design, relief concepts, definitions. Emergency relief system design, determining pressure relief, types of relief devices, design of relief systems, deflagration venting for dust and vapor explosions, venting system design for fires external to process vessels, reliefs for thermal systems, flare design for toxic release from industries.

Reference:

1. An introduction to Fire Dynamics: Dougal Drysdale

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module
(3 x 20=60)
Module 1

Innovation as a built-in feature in nature, need and challenges for survival and excellence, biological, physiological, psychological and social motives, entrepreneurial and business aspects - agricultural industrial and information revolution, innovation in diverse fields of arts and science, major landmarks, contributors in scientific, industrial and social (leadership) spheres.

Innovations in products, processes, services and procedures, product life cycles, favorable and unfavorable aspects in innovation; human attitudes, risks, hardships, examples of failure, case studies of inventors, inventions as intellectual property, patents and patent laws, procedures in India and developed countries, study of patents in different fields and their innovative content, motivating and encouraging innovative attitude in individuals and organizations, entrepreneurial qualities and skills, learning and training.

Module 2

Introduction: History, development and scope of value management, value analysis Vs Value engineering, principles of costing & cost estimation, benefits.

Basic concepts of value engineering: Selection of project, team members, general phase, information phase, creation phase, evaluation phase, investigation and implementation phase, audit.

Module 3

Project work: work sheets, objectives, techniques, guidelines, Checklist, cost worth model, role of creativity.

Value engineering cases: Value Engineering raises production and productivity, Value Engineering is intensive cost search, Value Engineering prevents unnecessary uses of resources.

Methodology, Industrial cases - Product manufacturing, Chemical processing, Automated Production, Semi - Automated production.

References:


Note: Question Paper consists of two parts.
Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

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**08.606.5 DESIGN FOR MANUFACTURING (N)**

**L-T-P/D: 3-1-0**

**Module 1**

Introduction to design for manufacture, DFM principles and rules, Systematic approach to Design engineering systems, Collection of information, Role of Engineering design in production, Flow diagrams for design procedures.

Effect of materials and manufacturing processes on design: Major phases of design. Effect of material properties on design. Effect of manufacturing processes on design. The material selection process – cost per unit property, weighted properties, and limits on properties methods.

**Module 2**

Tolerance analysis: Process capability, mean, variance, skewness, kurtosis, process capability metrics, Cp, Cpk, cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process. Cumulative effect of tolerances – sure fit law, normal law and truncated normal law.

Selective assembly: Interchangeable part manufacture and selective assembly, deciding the number of groups – Model – I: Group tolerances of mating parts equal; Model-II: total and group tolerances of shaft equal. Control of axial play – Introducing secondary machining operations, laminated shims, examples.

Datum systems: Degrees of freedom, grouped datum systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped datum system with spigot and recess pair and tongue – slot pair – computation of translation and rotational accuracy, geometric analysis and applications.

**Module 3**

True position theory: Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, compound assembly, examples.

Form design of castings and weldments: Redesign of castings based on parting line considerations, minimizing core requirements, redesigning cast members using weldments, use of welding symbols.
Tolerance charting technique: Operation sequence for typical shaft type of components. Preparation of process drawings for different operations, tolerance worksheets and centrally analysis, examples, design features to facilitate machining: datum features – functional and manufacturing. Component design – machining considerations, redesign for manufacture, examples.

References:

7. Design for Manufacture - Dieter
8. Introduction to Design - Asimow. M
9. Design Methods - Jones J. C
10. Product design for efficient manufacture workshop - Stoll H.W

Note: Question Paper consists of two parts.
Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.6 DESIGN OF JIGS AND FIXTURES (N)

L-T-P/D: 3-1-0 4 Credits

Module I

Introduction - purpose of work holding devices - principles of jig and fixture design - construction methods and materials used - process planning and typical operation layout product considerations - pre-design analysis - product analysis - operation analysis - machine analysis - operator analysis and cost analysis - examples of pre-design analysis - principles of locating and positioning - definition of location - basic principles - methods of location - pin and button locators - plane, concentric, spherical, radial and V-locators - redundant locators

Module II

Design and mechanics of clamping devices - principles of clamping - standard fixture components - types of clamps - strap, swing, hinge and two-way (multiple) clamps - wedge, pinch and magnetic clamps - latch and self locking clamps - pneumatic, hydraulic and pneumo-hydraulic clamps - design considerations in work holder design and selection - design calculations of lever type clamp - hook type clamp - wedge type clamp - screw clamps - mandrels and collet - chucks - worked examples
Module III

Fixtures - milling fixtures - slot and key-way milling fixtures - fixture for milling flanges - straddle milling fixtures - indexing fixture - face milling fixture with equalizers - profile milling fixtures - universal fixture for profile milling - boring and lather fixtures - fixture design - examples of design and drawing of milling fixtures for machining of simple components - fixtures for inspection testing and assembly - welding fixtures - economics

Drill Jigs - definition - drill guide bushings - jig feet and legs - types of drill jigs - template - vise - leaf box and tumble jigs - indexing jigs - jaw chucks - drive chucks - magnetic chucking devices - mandrels - machine vices - indexing tables and worktables - examples of design and drawing of drill jig for machining of simple components

Reference books
1. Kempster M.H.A., "An Introduction to Jig and Tool Design", ELBS
2. ASTME, Fundamentals of Tool Design
7. Cole B., "Tool Design", Taraporevala

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

Syllabus - VII Semester Industrial (2008 Admissions)

08.701 SYSTEM DYNAMICS (N)

L-T-P/D: 3-1-0 4 Credits

Module I
First order positive and negative feedback systems, second order systems.

Module II
Steps in system dynamics modeling:- problem identification/conceptualization, fixing model aggregates and boundary, principles of simulation modeling, developing model equations, algorithm for Euler integration, hand simulation of system dynamics models. Qualitative Study of model behavior and policy
recommendation. Case presentation on qualitative analysis. Dynamics of growth:- S-Shaped growth, the Bass diffusion model.

Strategy modeling: Approaches and procedures, techniques - a comparative study. Conceptual models, Suitability of System Dynamics for Policy analysis, Qualitative System Dynamics, Physical resources conversion modules

Module III

Introduction to Software packages for System Dynamics modeling and simulation.

References:

2. System Dynamics – Mohapatra – PHI
3. System Dynamics – Ogata – Pearson Education

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
integration, hand simulation of system dynamics models. Qualitative Study of model behavior and policy recommendation. Case presentation on qualitative analysis. Dynamics of growth:- S-Shaped growth, the Bass diffusion model.

Strategy modeling: Approaches and procedures, techniques - a comparative study. Conceptual models, Suitability of System Dynamics for Policy analysis, Qualitative System Dynamics, Physical resources conversion modules

Module III

Introduction to Software packages for System Dynamics modeling and simulation.

References:
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6. System Dynamics – Ogata – Pearson Education

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
CUSUM and Exponentially Weighted Moving Average (EWMA) Control charts.


Acceptance sampling plans – single, double, multiple and sequential - for attributes and variables, minimum inspection per lot, formulation of inspection lots and selection of samples. OC curve. MIL-STD 105E sampling method and its equivalents. Dodge-Romig tables and ABC standards, AOQL and LTPD plans.

Module III

Quality tools–fault tree analysis, event tree analysis, failure mode and effect analysis, Quality Standards-ISO series, Quality Function Deployment, Quality Circles, Quality Audit, Cost of Quality, KAIZEN, 5S, Process Quality Management (PQM)-Online Quality Control.

Six Sigma:: Introduction- definition-methodology- impact of implementation of six sigma-DMAIC method-roles and responsibilities –leaders, champion, black belt, green belts- management role-six sigma tools – sustaining six sigma.

Management of Software Quality, CMM, Taguchi’s Methods, Quality in R&D. Introduction to Total Quality Management and Total Productive maintenance.

Introduction to Software packages for SQC, reliability and their features.

References:

1. Fundamentals of Quality Control and Improvement- Amitava Mithra – Pearson Education
2. Statistical Quality Control –Grant - McGraw Hill
3. Introduction to Statistical Quality Control – Montgomery – John Wiley & Sons
5. Industrial Engineering Handbook – Maynard

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module I

The Basic theory of interest:- Principal and Interest, Present value, Present and Future values of streams, Internal Rate of Return.

Money market:- Zero coupon Bonds, Coupon Bonds, Money market account, Yield, Bond price formula, Duration, Macaulay duration, Duration of a portfolio, Immunization, Convexity.

Term Structure of Interest rates:- Spot rates and its determination, Forward rates, Floating rate bonds, Fisher-Weil duration.

Module II


The Capital Asset Pricing model(CAPM), CAPM as pricing formula, Factor models, CAPM as a factor model, Arbitrage pricing theory, Utility functions and the Mean-Variance criterion, Linear Pricing, Log-optimal pricing, Portfolio choice, Finite state models, Risk-Neutral pricing.

Module III

Derivative Securities:- Forward contracts, Forward prices, Swaps, Futures contracts, Futures prices, Hedging, Minimum-variance hedge, Optimal hedging.

Models of Asset dynamics:- Binomial Lattice model, Additive model, Multiplicative model, Stock price process, Ito’s Lemma.


References:

2. Options, Futures and Other Derivatives – John C.Hull – Prentice Hall
4. Introduction to stochastic calculus applied to Finance – Damien Lamberton and Bernard Lapeyre – Chapman & Hall

Note: Question Paper consists of two parts.
Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.705 HEURISTICS FOR DECISION MAKING (N)

L-T-P/D: 3-1-0

Module 1

Introduction to Non-traditional optimization, Computational Complexity – NP-Hard, NP-Complete.


Module 2

Simulated Annealing: The algorithm, Acceptance probability, Cooling, Neighbourhoods, Cost function. Applications in sequencing and scheduling, Travelling salesman problem etc.

Tabu Search: Basic Tabu search, Neighbourhood, Candidate list, Short term and Long term memory, Application of TS in solving facility location problem, Quadratic Assignment problem etc.

Introduction to Particle Swarm Optimization(PSO), Application of PSO in solving Transportation problem, Portfolio selection, Flow shop scheduling.

Module 3

Ant Colony Optimization: Basic algorithm, Variants, Formalization and properties of ACO, Application of ACO to solve Travelling salesman problem, Vehicle Routing Problem etc.

Lagrangean Relaxation: Basic methodology, Lagrangean heuristic and problem reduction, Lagrangean multipliers, Dual Ascent algorithm, Tree search. Applications of Lagrangean Relaxation in solving facility location problems, Logistics etc.

References

2. Genetic algorithms in Search, optimization and Machine Learning- Goldberg-Addison Wesley.
3. Meta heuristics for Hard Optimization- Dreo, Petrowski, Taillard-Springer
4. Modern heuristic techniques for combinatorial problems- Reeves C-Orient Longman
5. Tabu search- Fred Glover.
6. Ant Colony Optimization- Dorigo M, Thomas Stutzle-MIT press
8. Particle Swarm Optimization- Aleksandar Lazinica- Intechweb.org

**Note:** Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

**08.706 ELECTIVE III(N) 3-1-0 4 Credits**

<table>
<thead>
<tr>
<th>08.707 SIMULATION LAB (N)</th>
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<tr>
<td><strong>L-T-P/D:</strong> 0-0-2</td>
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<tr>
<td>2 Credits</td>
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1. Use of simulation packages for building system models for Continuous and Discrete Event simulations.
2. Mini project

**08.708 QUALITY CONTROL LAB(N)**

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<tr>
<th>L-T-P/D: 0-0-2</th>
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<td>2 Credits</td>
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</table>

1: Experiments to prove central limit theorem.
2: Drawing \( \bar{X} \) and R charts from actual measurements.
3: Drawing P chart and C chart from actual measurements.
4: Experiments and calculations in Acceptance control.
5: Finished products inspection and certification procedure.
6: Experiments in performance testing and life testing.
7: Demonstrating experiments on NDT equipments
   
   (a) NDE by means of eddy current
   (b) NDE utilizing magnetic phenomenon
   (c) NDE by means of acoustic emission
   (d) NDE by means of ultrasonics
   (e) NDE utilizing penetrating phenomenon
08.709 PROJECT AND SEMINAR (N)

L-T-P/D:0-0-2  2 Credits

The Students shall do a project work, which can be the preliminary work of final project, and submit a report at the end of semester.

The students shall present a seminar on a topic which is of high relevance to Industrial Engineering. A report on seminar also shall be submitted at the end of the semester. 25% credit should be given for Project, and 75% credit for Seminar.

08.706 Elective III (N)

08.706.1 TOTAL QUALITY MANAGEMENT (N)

Module I

History of quality, total quality, principles of Total Quality Management (TQM), Quality trilogy, models for TQM, core concepts, characteristics and subjects of TQM. Total Quality and Quality Management systems, quality principles. Total quality control, total waste elimination, total employee involvement. Quality assurance: total quality assurance, management principles in quality assurance, objectives of quality assurance system, hierarchical planning for Quality Assurance, Vendor rating.

Module II

Quality improvement: elements, programmes - KAIZEN. Benchmarking: introduction, why benchmark; Planning: what to benchmark, benchmarking partners, data collection methods; Analysis: determining the current competitive gap, projecting future performance levels; Integration: developing action plan, implementing specific actions & monitoring progress, re-calibration; Maturity: beyond benchmarking. Quality in service systems. Total Quality Culture, system approach to TQC.

Module III

Quality function deployment, QFD concept, overview & QFD process, the voice of customer developing a QFD matrix, reviewing the matrix for priority items, organizing teams & planning QFD projects; Process RE-engineering, BPR philosophy, possibilities & pitfalls, BPR framework, opportunity assessment, planning & BPR project, risk & impact assessment, planning & implementing the transition; Failure mode & effect analysis; FMEA: concepts & applications in TQM; Quality cost, concepts, quality cost definitions, quality cost program implementation use of quality cost, reducing quality cost.

Reference

1. Total Quality Management - Sharma - Sultan Chand & Sons
2. Total Quality Management - R.P. Mohanty & RR Lakhi, Jaico Pub, New Delhi,
Module 1
Overview of TPM implementation: TPM Basic Policy & Objectives, Maximize Equipment Effectiveness through Total Employee Involvement, Improvement, Improve Equipment Reliability, Maintainability & Productivity, Aim for Economical Life cycle costs, Enhance Equipment Expertise & skills, Create a vital, Enthusiastic work environment, Company wide TPM Goals, TPM Promotion Organization & management.


The manager’s role in autonomous maintenance: Three keys to successful TPM circle, Role of Managers & Supervisors, Learning from Breakdowns, Time table of Autonomous Maintenance Activities, Results & Evaluation.

Module 2
Equipment improvement: Equipment Improvement objectives, Promoting Successful Equipment Improvements, Four levels of Equipment Improvement Activity, Effect of Equipment Improvements.

Quality maintenance (QM): Relation between Quality Assurance & QM, conceptual approach QM, preconditions for promoting QM, techniques for developing QM, implementing QM.

Module 3
Education and training : Education & training system, introductory education, studies in general inspection, studies in PM analysis, cultivating in-house maintenance techniques, training in equipment, diagnostic techniques using vibration using vibration measurements, results of TPM education and training.

Overall effects of TPM implementation: Striving for overall equipment effectiveness, defects prevention systems, relationship between TPM and terotechnology.

References:

5. “An Advanced Step in TPM Implementation”, Unio K Shirose, Oshifumi Kimura Y. and Itsugu Kaneda M, Japan Institute of Plant Maintenance

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

Module I


Module II


Module III


REFERENCES

5. “An Advanced Step in TPM Implementation”, Unio K Shirose, Oshifumi Kimura Y. and Itsugu Kaneda M, Japan Institute of Plant Maintenance

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module III


References:

1. Customer Relationship Management at the Speed of Light – Paul Greenberg
2. The Handbook of Key Customer Relationship Management – Bukowitz - Pearson Education
3. The CRM Handbook – Dyche - Pearson Education

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

Module 1

Marketing conceptual framework - Marketing environment -customer oriented organization- Marketing interface with other functional areas-marketing in a globalised environment


Module 2

Understanding Buyer Behavior - Influencing factors -responding buyer behavior - Building customer satisfaction-marketing to organizations and marketing of services.


Module 3
Distribution: distribution Channels – Physical Distribution – channel design and Management - Logistics – Communicating with customers.

Introduction to International Marketing Management: Overview, International economic institutions, foreign markets, export pricing and finance, India’s trade policy.

Web enabled Marketing features - structural requirements – specific characteristics and components of marketing mix under web enabled environment.


References:

1. Marketing Management (Millennium edition), Philip Kotler, PHI (P) Ltd.
2. Marketing, Zikmund d’Amico, South Western, Thomson Learning
3. Essentials of Marketing Research, Aakar, Day and Kumar, John Wiley & Sons.
5. Marketing Management Indian Perspective, R.L. Varshney, S.L. Gupta, Sultan Chand
7. Building an Intelligent E-Business, David Ferris and Larry Whipple, PHI

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

Syllabus - VIII Semester Industrial (2008 Admissions)

08.801 FACILITIES PLANNING AND MANAGEMENT (N)

L-T-P/D: 2-1-0 3 Credits

Module I


Module II

Design of Auxiliary Service Spaces - Receiving and Shipping, Storage, Aisles, Warehousing and Employee services. Office layout techniques and space requirements. Environmental aspects like lighting, Ventilation, dust control, humidity. Different type of Plant services like steam, compressed air etc.
Elements of Industrial safety- Causes and prevention of accidents – Pollution and environmental considerations.

Module III

Material handling system and equipment –Principles, Material handling in Plants , Stores and warehouses, Receiving and dispatching area – Choice of material handling equipment – Cost control in material handling. Automatic Guided Vehicles- Basic concept, Design and operational control of an AGV system- transportation control, operational control, Combinations. Equipment replacement – Repair, replacement based on technical and economical consideration.

Reference:
Plant layout and Material Handling- John A Sehbin
Plant layout and Material Handling - James A Apple
Plant layout and Material Handling - A W Peymberton
Plant layout and Material Handling - Fred Meyers
Material Handling and Layout – S. C. Sharma
Intelligent Manufacturing Systems-Kuiak-Prentice Hall

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module II

Parallel Machine Models:– Parallel Identical processors and Independent jobs, Parallel Identical processors and Dependent jobs.


Module III

Job Shop Scheduling:– Types of schedules, Schedule generation, Branch & Bound Approach, Heuristic procedures, Integer Programming Approach.

Simulation studies of the Dynamic Job shop (Overview only)


Case studies on Scheduling systems.

References:

1. Introduction to Sequencing and Scheduling – Kenneth R.Baker – John Wiley

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module II

Aggregate planning in supply chains; Aggregate planning strategies; Aggregate planning using LP; Network design in supply chains; Production networks and distribution networks; Factors influencing network design; Models for facility location.

Module III

Supply chain inventory management-Deterministic models, Probabilistic models, Discount models, Multi item Models, Lot sizing models; Estimation and management of safety inventory; Different fill rate measures; Forward and reverse bullwhip effect in supply chains; Beer game for bullwhip study in supply-chain management; Introduction to logistics management: modes and styles of transportation, Vehicle Routing problems, Bin packing problems, Fixed charge problems, Knapsack problem; 3PL and 4PL.

References:

1. Supply Chain Management – Sunil Chopra, Peter Meindl-Pearson
2. Logistical Management, Donald J. Bowersox & David J. Closs, TMH.
3. Logistics and supply chain management, Martin Christopher, Financial times management.

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Manufacturing architecture-Product Oriented Plant architecture, Manufacturing Oriented Plant architecture and Turnover Oriented Plant architecture.

**Module 2**


**Module 3**

Flexible manufacturing: FMS architecture, components and working of an FMS, types of FMS, FMS flexibilities, development and installation issues of FMS.


**References**

5. E. M.Goldratt “The Goal”
7. John M. Gross and Kenneth R. McInnis -“Kanban made simple” -Amacom
9. JT Black- “The factory of the future”

**Note:** Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
08.805 ELECTIVE IV (N)
L-T-P/D: 3-1-0  4 Credits

08.806 ELECTIVE V (N)
L-T-P/D: 3-1-0  4 Credits

08.807 INDUSTRIAL SEMINAR(N)
L-T-P/D: 0-0-2  2 Credits
The Student shall present a Seminar based on industrial visits undertaken from V-VII semesters. A minimum of four visits are compulsory. A report on industrial visits shall be submitted.
The institution shall arrange minimum four Seminars on latest topics by experts from Industry.
The student shall be evaluated based on the report on industrial visits, presentation, interaction, performance in the class and general awareness on topics of expert lectures

08.808 PROJECT AND VIVA VOCE  (N)
L-T-P/D: 0-0-5  5 Credits
A project work of good quality should be done under the guidance of project guide(s) and a project report should be submitted.
For internal assessment, 50% weightage to be given to the assessment of the guide and 50% to the project presentation.
For University examination a Viva-voce examination shall be conducted. Marks of Viva voce examination shall be based on the overall performance, Project report, Subject knowledge and general awareness in the developments in Industrial Engineering.

08.805 Elective IV(N)

08.805.1 ADVANCED NUMERICAL METHODS(N)
L-T-P/D: 3-1-0  4 Credits
Module I
Errors and approximations-floating point arithmetic– sources of errors - control of errors –propagation of errors – Condition and stability – Rate of convergence.


Algorithm flow chart and computer programs of Gauss elimination, Gauss Seidel and vector iteration methods.

MODULE II


MODULE III


Partial differential equations- classification- Laplace equation – 1 D wave equation and 1 D heat conduction equation – Finite difference methods – Relaxation methods

Simple computer programs for the RK method and Finite difference methods for the solution of Laplace equation, wave equation and heat equation. Wave equation in two dimensions, computer programs.

REFERENCES

1. Applied Numerical Analysis – Gerald & Wheatley – Addison-Wesley
2. Computer Oriented Numerical Methods – V.Rajaraman
8. Statistics – Murrey R Spicgel
9. Elementary Numerical Analysis – Conte and Carl de Book
11. Numerical methods for Engineers and Scientists- Iqbal H Khan and Q.Hassan

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module
(3 x 20=60)

| Module I |

Optimization:- Introduction, Engineering applications of Optimization, Statement of an Optimization problem, Classification of optimization problems.

Classical Optimization Techniques:- Single Variable optimization, Multivariable optimization with no constraints, Multivariable optimization with equality constraints, Multivariable optimization with Inequality constraints.

One Dimensional Unconstrained Minimization:- Unimodality and Bracketing the minimum, Fibonacci method, Golden Section method, Quadratic interpolation method, Direct root methods.

| Module II |


| Module III |


Introduction to Stochastic Linear and Non-Linear programming(Overview only).
Introduction to Simulated Annealing, Tabu Search, Neural Networks, Genetic Algorithms, Ant Colony Algorithm, Particle Swam Algorithm, Frog Leaping Algorithm and simple applications.(Overview only)

References:

2. Optimization Concepts and Applications in Engineering – Ashok D.Belegundu, T.R. Chandrupatla – Pearson Education Asia
6. Non-Linear Optimization – D.Bertsekas – Athena Scientific Press, USA

Note: Question Paper consists of two parts.
Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.3 DESIGN AND ANALYSIS OF ALGORITHMS(Н)

L-T-P/D: 3-1-0 4 Credits

Module 1

Algorithms, basic steps in development. Basic tools: Top down, Structured programming, networks, data structure. Review of any one of the structured languages.

Module 2
Sub goals, hill climbing and working backward, heuristics, back track programming, Branch and bound recursion process, program testing, documentation, Meta heuristics.

**Module 3**

Development of Algorithms for problems like, Sorting, Searching, Combinatorial problems shortest path, Probabilities algorithms etc.

**REFERENCES**


**Note:** Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

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<tr>
<th>08.805.4 MANAGERIAL ECONOMICS(N)</th>
<th>4 Credits</th>
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**Module I**


Demand Theory and Analysis:- Individual demand, Market demand, Total and Marginal Revenue, Price Elasticity, Income Elasticity and Cross Elasticity, Use of Regression analysis for Demand estimation.

Economic Forecasting:- Sources of data, Time Series Analysis – Trend projection, Exponential Smoothing; Barometric Forecasting, Input / Output analysis.

**Module II**

Production Theory and Analysis:- The Production Function, Production with One variable input, Production with Two variable inputs, Economies of Scale and Scope, Estimating the Production Function.


**Module III**
Market Structure:- Introduction to Market Structure, Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly, Barriers to Entry, Application of Game Theory to Oligopoly, Strategic Behaviour.


Study of Technology change and Location of a Firm in Global economy, Introduction to Excise duty, Taxes on Profit, Taxes on Inputs, Property taxes and Tax preferences.

References:

1. Managerial Economics – H. Craig Petersen and W. Cris Lewis - Pearson
3. Game Theory with Economic Applications – H. Scott Bierman and Luis Fernandez - Pearson

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

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<tr>
<th>L-T-P/D:3-1-0</th>
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<tr>
<td><strong>Module I</strong></td>
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<tr>
<td>Multi criteria decision making- objectives. SMART- categorization, criterion weights and aggregation</td>
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<tr>
<td>Theory of vector optimization: Solution concepts, vector variational inequalities and vector equilibria, multi criteria fractional programming, multicriteria control problems.</td>
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<tr>
<td>Goal programming: Classification of GP, Integration and combination of GP with other techniques- applications.</td>
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| **Module II** | |
| AHP, pairwise comparisons, criterion weights and aggregation, consistency etc. | |
| Evolutionary algorithms and multiple objective optimizations: Definitions, Pareto based and Non-Pareto based techniques- applications. | |
| Data Envelopment Analysis in multi criteria decision making: Basic DEA models, GDEA. | |

| **Module III** |
Scenario analysis, Conflict analysis and negotiations.

Multi objective combinatorial optimization: Properties, Solution methods

Multi criteria scheduling problems: Complexity-Single machines problems, Parallel machines problems, shop problems

REFERENCES

1. Multiple criteria Optimization-Arakawa,Billaut- Kluwer

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806 Elective V(N)

08.806.1 FLEXIBLE MANUFACTURING SYSTEMS(N)

L-T-P/D:3-1-0 4 Credits

Module 1

FMS – An overview: Definition of an FMS – types and configurations concepts – types of flexibility & performance measures. Functions of FMS host computer – FMS host and area controller function distribution.


Automated material handling and storage: Functions – types – analysis of material handling equipments. Design of conveyor & AGV systems.
Module 2


Concepts of distributed numerical control: DNC system – communication between DNC computer & machine control unit – hierarchical processing of data in DNC system – features of DNC systems.

Module 3

Programmable controllers: Control system architecture – elements of programmable controllers: languages, control system flowchart, comparison of programming methods.


References:

1. Flexible Manufacturing-Parrish D J-ButterWorth Heinemann Ltd, Oxford
2. Automation, Production Systems and CIM-Groover M P-PHI
3. Intelligent Manufacturing Systems-Kuiak-Prentice Hall
4. The design and operation of FMS-Ranky P G-IFS Pub., UK

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)
Module 1


Module 2

Manufacturing agile practices: Overview-establishing a manufacturing system design-embedding manufacturing system design in the shop floor-implementing visual methods of control-flow production-agility through group technology-agility through manufacturing cells-agility through set up and changeover reduction-material management strategy for agility-make Vs buy strategy for agility-understanding the value of investing in people-agility Vs perfectionism

Implementing technology to enhance agility: Guidelines for enhancing agility through new technology-checklist for preparing technology implementation-technology applications that enhance agility-decisions making on agility.

Creating the learning factory: Success through learning factory-process of becoming learning factory-road map for becoming a learning factory-learning challenges for learning manufacturing business.

Module 3


References:
1. The transition to agile manufacturing staying flexible for competitive advantage- J.C. Montigomery, L.O. Levine - ASQC Quality press

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.3 ENTERPRISE RESOURCE PLANNING (N)

L-T-P/D: 3-1-0 4 Credits

Module 1


Module 2


ERP System Packages: SAP, People soft, BAAN and Oracle – Comparison – Integration of different ERP applications – ERP as sales force automation – Integration of ERP and Internet – ERP Implementation strategies – Organizational and social issues.

Module 3

Oracle: Overview – Architecture – AIM – applications – Oracle SCM.

SAP: Overview – Architecture – applications -Before and after Y2K – critical issues – Training on various modules of IBCS ERP Package-Oracle ERP and MAXIMO, including ERP on the NET


References:

1. ERP Demystified, Alexis Leon , Tata McGraw – Hill Publishing company limited, New Delhi, 2002
Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40),
Part B-2 questions of 20 marks each, from each module and student has to answer one from each module
(3 x 20=60)

08.806.4 BUSINESS PROCESS REENGINEERING (N)

L-T-P/D:3-1-0 4 Credits

Module 1

Business process reengineering: Introduction – historical outlook – working definition of BPR –
overview on four phases of reengineering process.

Setting the foundation for reengineering :Fallacy of programme change – elements of effective change –
exploration by the Top Management for reengineering – work force preparation for involvement and
change planning for the future : Importance of planning for reengineering – Limitations – key points on
planning for reengineering – creating vision, missing and guiding principles – Developing three-to-five
year strategic plan – scenario approach – critical.

Issues approach: Goal approach – developing yearly operational or breakthrough plans.

Module 2

Designing change: Process definition – constituents of process – types of processes – process
characteristics – processes in service organizations – differences between service and manufacturing
processes.

Reengineering steps: Identification of current business processes – Establishing the scope of the process –
Mapping project – Mapping and analyzing the process.

Module 3

Process creation: Creating the ideal process – Testing the new process – Implementing the new process.

Evaluation: Evaluating the improvement (criteria) of measurements- hurdles foreseen in designing and
implementing meaningful measures – find reengineering steps.
Organization for reengineering: Responsibilities and roles of leader, process owner. Reengineering team, steering committee and reengineering Czar – key points for succeeding at reengineering – case studies.

References:


Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

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<tr>
<th>08.806.5 HUMAN FACTORS IN ENGINEERING (N)</th>
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<td>Module 1</td>
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Concepts of human factors engineering and ergonomics-Man-Machine system and Design Philosophy-

Physical dimensions of the human body as a working machine-Motion size relationships-Static and
dynamic anthropometry-Anthropometric acids-Design principles-Using anthropometric measures for
industrial design-Procedure for anthropometric design

Module 2

Displays and Controls- shapes and sizes of various controls and displays-multiple display and control
situations-design of major controls in automobiles, machine tools etc.- Work place- Seating-design of
office furniture-redesign of instruments- Work process-Duration of rest periods-Hand tool design-Design
of visual displays-Design for shift work

Ergonomics and product design-ergonomics in automated systems-expert systems for ergonomic design.
Anthropometric data and its application in ergonomic design-limitations of anthropometric data-use of
computerized database.

Color and light-colour and the eye-colour consistency-colour terms- reactions to colour and colour
continuation-colour on engineering equipments
 MODULE 3

Temperature-Humidity-Noise-Illumination and contrast-Use of Photometers-Recommended illumination levels-The ageing eye-Use of indirect (Reflected) lighting - Cost efficiency of illumination-Special purpose lighting for illumination and quality control-Measurement of sound-Noise exposure and hearing loss-Hearing protectors-analysis and reduction of noise-Effects of noise performance-annoyance of noise and interface with communication-Sources of vibration discomfort it.

Provision of energy for muscular work-Role of oxygen physical exertion-Measurement of energy expenditure-Respiration-Pulse rate and blood pressure during physical work-Physical work capacity and its evaluation.

References:


Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

5. Ergonomics-Kroemer et al.-Pearson Education

08.806.6 ECONOMETRICS (N)

L-T-P/D: 3-1-0 4 Credits

Module 1

Introduction to econometrics, classical linear regression models assumptions and diagnostic tests: Multicollinearity-Parameter stability tests.

Univariate time series modeling and forecasting: Moving average process, Auto regressive process, ARMA process, forecasting in econometrics.

Module 2

Multivariate models: Exogeneity, Vector autoregressive models(VAR). Stationarity and Unit Root testing- Cointegration.

Modeling volatility and correlation: ARCH, GARCH,GJR, EGARCH models. Forecasing covariances and Correlations, multivariate GARCH model
Module 3

Switching models: Modeling Seasonality, Markov switching model, Threshold auto regressive models.

Panel data: The fixed effects model, the time-fixed effects model, random effects model.

Limited dependant variable model: linear probability model, Logit model, Probit model, Ordered Response dependant variable model - Multinomial linear dependant variable, Censored and Truncated variable.

Dynamic Econometric models- Granger Causality test

References

1. Introductory Econometrics for Finance- Chris Brooks-Cambridge.
2. Basic Econometrics- Gujarati-McGraHill
4. An Introduction to Econometrics - G.S.Maddala - Wiley
5. Introduction to Econometrics - Stock - Pearson
6. Econometric Analysis - Greene - Pearson

Note: Question Paper consists of two parts.

Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40), Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)