### Teaching Scheme and Syllabi of B.E. (Chemical)-MBA [2020-2025]

**First Year**

#### 1st SEMESTER

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
<th>Total contact hours</th>
<th>Mid Term</th>
<th>End Term</th>
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<th>Credits</th>
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<tr>
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<td>BS101</td>
<td>Mathematics –I</td>
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1. **Mid-Term**
   a. One best of two minor tests (50% of Mid-term marks)
   b. Assignments (20% of Mid-term marks)
   c. Class Surprise Tests/ Quizzes/Presentations/Term paper (20% of Mid-term marks)
   d. Attendance (10% of Mid-term marks)

2. **End -Term**
### 2nd Semester

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<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
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<th>Mid Term</th>
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2. End-Term
# Teaching Scheme and Syllabi of B.E. (Chemical Engineering)-MBA (2020-2025)

## 2nd Year

### 3rd Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
<th>Total contact hours</th>
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<th>End Term</th>
<th>Total Marks</th>
<th>Credit</th>
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<td>T</td>
<td>P</td>
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<td>2.</td>
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<td>-</td>
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<td><strong>480</strong></td>
<td><strong>405</strong></td>
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2. End-Term
Teaching Scheme and Syllabi of B.E. (Chemical Engineering)-MBA (2020-2025)

2nd Year

4th SEMESTER

<table>
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<th>S. No.</th>
<th>Course code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
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<th>Mid Term</th>
<th>End Term</th>
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<td>PCC-CS 104</td>
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Total 18 3 9 450 375 270 645 25.5

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2. End-Term
## Teaching Scheme and Syllabi of B.E. (Chemical Engineering)-MBA (2020-2025)

### 3rd Year

#### 5th Semester

<table>
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<th>S. No.</th>
<th>Course code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
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<th>Mid Term</th>
<th>End Term</th>
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<th>Credits</th>
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<td>T</td>
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</table>

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2. **End-Term**
# Teaching Scheme and Syllabi of B.E. (Chemical Engineering)-MBA
## (2020-2025)

### 3rd Year

#### 6th Semester

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<th>Courses</th>
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<th>Mid Term</th>
<th>End Term</th>
<th>Total Marks</th>
<th>Credits</th>
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<td>45 40 -</td>
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<td>10.</td>
<td>ESC-GES158</td>
<td>Chemical Engineering Computation lab</td>
<td>- - 3</td>
<td>45 40 -</td>
<td>40</td>
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<tr>
<td>10.</td>
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<td>Industrial training#</td>
<td>- - -</td>
<td>- - -</td>
<td>- -</td>
<td>-</td>
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<tr>
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</tr>
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<td>15 4 15</td>
<td>510 435</td>
<td>240 675</td>
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</tbody>
</table>

**Note:**
- NSS/NCC/Sports proficiency/Community services/Professional society activities/Technical activities related to the field of Engineering (1st to 3rd year, 2 credits to be earned in 7th semester)
- Discipline (1st to 4th year, 1 credit to be earned in 8th semester)

L: Lectures/Week, T: Tutorials/Week, P: Practical Hours/Week

Assessment will consist of the following components

1. **Mid-Term**
   - a. One best of two minor tests (50% of Mid-term marks)
   - b. Assignments (20% of Mid-term marks)
   - c. Class Surprise Tests/ Quizzes/Presentations/Term paper (20% of Mid-term marks)
   - d. Attendance (10% of Mid-term marks)

2. **End-Term**

# There will be 6-8 weeks’ compulsory industrial training after 6th semester theory examination during summer vacation. Every student will submit the Industrial Training report within one month from the start of teaching of the 7th Semester. After that it will be evaluated by the team of Training & Placement Officers. The credits for the industrial training will be awarded in the seventh semester.
### 4th Year

#### 7th Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
<th>Total contact hours</th>
<th>Mid Term</th>
<th>End Term</th>
<th>Total Marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1.</td>
<td>PCC-CS110</td>
<td>Chemical Reaction Engineering-II</td>
<td>3 1 -</td>
<td>60 50 50</td>
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</tr>
<tr>
<td>2.</td>
<td>PCC-CS112</td>
<td>Process Dynamics &amp; Control</td>
<td>3 1 -</td>
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<td>OEC-OL155</td>
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<tr>
<td>7.</td>
<td>Proj.</td>
<td>Project work**</td>
<td>- - 3</td>
<td>45</td>
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<td>15 5 12</td>
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</table>

**Note:**
- NSS/NCC/Sports proficiency/Community services/Professional society activities/Technical activities related to the field of Engineering (1st to 3rd year, 2 credits to be earned in 7th semester)
- Discipline (1st to 4th year, 1 credit to be earned in 8th semester)

L: Lectures/Week, T: Tutorials/Week, P: Practical Hours/Week

Assessment will consist of the following components

1. Mid-Term
   - e. One best of two minor tests (50% of Mid-term marks)
   - f. Assignments (20% of Mid-term marks)
   - g. Class Surprise Tests/Quizzes/Presentations/Term paper (20% of Mid-term marks)
   - h. Attendance (10% of Mid-term marks)
2. End-Term

**Marks and Credits for the Project Work (Proj.) will be awarded in 8th Semester.**
Teaching Scheme and Syllabi of B.E. (Chemical Engineering)-MBA (2020-2025)

4th Year

8th SEMESTER

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
<th>Total contact hours</th>
<th>Mid Term</th>
<th>End Term</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>OCE-OL103</td>
<td>Open Elective - II</td>
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<tr>
<td>3.</td>
<td>MBA 109</td>
<td>Business Environment</td>
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<td>100</td>
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<td>4.</td>
<td>MBA 110</td>
<td>Project Management &amp; Entrepreneurship</td>
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<td>5.</td>
<td>MBA 111</td>
<td>Financial Accounting</td>
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<td>8.</td>
<td>Proj.</td>
<td>Project work**</td>
<td>-</td>
<td>45</td>
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<td>-</td>
<td>50</td>
<td>2</td>
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<tr>
<td>9.</td>
<td>MBA 152</td>
<td>Industrial Training (Management)-II##</td>
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<td>410</td>
<td>330</td>
<td>765</td>
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</table>

Note:

- Discipline (1st to 4th year, 1 credit to be earned in 8th semester)

L: Lectures/Week, T: Tutorials/Week, P: Practical Hours/Week

Assessment will consist of the following components

1. Mid-Term
   i. One best of two minor tests (50% of Mid-term marks)
   j. Assignments (20% of Mid-term marks)
   k. Class Surprise Tests/Quizzes/Presentations/Term paper (20% of Mid-term marks)
   l. Attendance (10% of Mid-term marks)

2. End-Term

** Marks and Credits for the Project Work (Proj.) to be awarded for 7th and 8th Semester.

## There will be 6-8 weeks’ compulsory industrial training after 8th semester theory examination during summer vacation. Every student will submit the Industrial Training report within one month from the start of teaching of the 9th Semester. After that it will be evaluated by the team of Training & Placement Officers. The credits for the industrial training will be awarded in the ninth semester.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>List of Departmental Electives</th>
<th>S.No.</th>
<th>List of Open Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Petroleum Processing Engineering</td>
<td>1.</td>
<td>Fuel Cell Technology</td>
</tr>
<tr>
<td>2</td>
<td>Industrial Safety and Hazards</td>
<td>2.</td>
<td>Nanotechnology</td>
</tr>
<tr>
<td>3</td>
<td>Plant Utilities</td>
<td>3.</td>
<td>Polymer Science and Engineering</td>
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<td>4</td>
<td>Petrochemical Technology</td>
<td>4.</td>
<td>Mathematical and Statistical Methods</td>
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<tr>
<td>5</td>
<td>Biochemical Engineering</td>
<td>5.</td>
<td>Paper Technology</td>
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<tr>
<td>6</td>
<td>Food Processing</td>
<td>6.</td>
<td>Fertilizers</td>
</tr>
</tbody>
</table>

**Note:**

1. Midterm evaluation shall be as per the format already approved by the competent authority (as indicated in the scheme already approved for the first year).
2. Departmental electives (I, II and III) shall be offered amongst the list indicated above depending on the available resources.
3. Open electives (I, II and III) shall be offered amongst the list indicated above depending on the available resources.
4. List of electives (open and departmental) is subject to change and as approval of the competent authority from time to time.
### Teaching Scheme and Syllabi of B.E. (Chemical Engineering)-MBA (2020-2025)

#### 5th Year

**SEMESTER-9th**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
<th>Total contact hours</th>
<th>Mid Term</th>
<th>End Term</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1.</td>
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<td>2.</td>
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<td>6.</td>
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<td>- - 4</td>
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<td>7.</td>
<td>MBA 154</td>
<td>Workshop on Multivariate Statistical Techniques</td>
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<td>8.</td>
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<td>25</td>
<td>-</td>
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<td>9.</td>
<td>MBA 152</td>
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<td>- - -</td>
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<td>-</td>
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<td><strong>Total</strong></td>
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<td><strong>450</strong></td>
<td><strong>250</strong></td>
<td><strong>700</strong></td>
<td><strong>28</strong></td>
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</table>

**Group-A (Functional Subject-1&2)**

1. Market Research and Product Management
2. Supply Chain and Logistics Management
3. Sales and Distribution Management
4. International Human Resource Management
5. Enterprise Resource Planning

**Group-B (Functional Subject-3&4)**

1. Services Operations Management
2. Technology Management
3. Purchase and Materials Management
4. Advertising and Consumer Behaviour
5. Manufacturing Systems Management

**Note:** Students in the ninth semester will have to opt for four functional subjects, selecting TWO each from Group A&B.

***Marks and Credits for the Research Project (Management) (MBA 153) will be awarded in 9th Semester.***
# Teaching Scheme and Syllabi of B.E. (Chemical Engineering)-MBA (2020-2025)

## 5th Year

### SEMESTER-10th

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course code</th>
<th>Courses</th>
<th>Contact hrs per week</th>
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<th>Mid Term</th>
<th>End Term</th>
<th>Total Marks</th>
<th>Credits</th>
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<tr>
<td>1.</td>
<td>MBA 117</td>
<td>Strategic Management</td>
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<td>2.</td>
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<td>Legal Aspects of Business</td>
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<td>3.</td>
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<td>6.</td>
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<td>Research Project (management)</td>
<td>- L - T 4 P</td>
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<td>-</td>
<td>100</td>
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<tr>
<td>7.</td>
<td>MBA 153</td>
<td>Seminar on Corporate Governance</td>
<td>- L - T 2 P</td>
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<td>25</td>
<td>-</td>
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<td>8.</td>
<td>MBA 157</td>
<td>Workshop on Management Information Systems</td>
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<td>30</td>
<td>25</td>
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</table>

| Total  | 18 L 6 T 8 P | 480 | 450 | 300 | 750 | 30 |

**Group-C (Functional Subject-5&6)**

1. Strategic Cost Management
2. Industrial and Rural Marketing
3. Product Innovation in Technology Business
4. Performance Management
5. International Business Management

**Group-D (Functional Subject-7&8)**

1. Management of Financial Services
2. Human Values and Ethics
3. Facilities and Location Management
4. Industrial Relations and Labour Laws
5. International Financial Management

**Note:**

Students in the tenth semester will have to opt for four functional subjects, selecting TWO each from Group C&D.

***Marks and Credits for the Research Project (Management) (MBA 153) to be awarded in 9th & 10th Semester.
SYLLABUS OF B.E. (Chemical)-MBA 2020-2025  
FIRST YEAR

1st SEMESTER

<table>
<thead>
<tr>
<th>Title</th>
<th>MATHEMATICS-I</th>
<th>Credits</th>
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<tr>
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<td>Mid term- 50</td>
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</tr>
<tr>
<td>Pre requisites</td>
<td></td>
<td>Contact</td>
<td>Hours</td>
</tr>
</tbody>
</table>

Objectives  
1. Understand the behaviour of infinite series and their use.  
2. Learn the concepts related to functions of several variables and their applications.  
3. Understand the concept of Vectors and its applications.  
4. Learn the methods of evaluating multiple integrals and their applications to various problems.  
5. Learn the methods to formulate and solve linear differential equations and apply them to solve engineering problems.

Note for the Examiner  
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting atleast two questions from each Section. The duration of End Term exam will be 3 hrs.

SECTION- A

Infinite Series:  
Infinite series and convergence, alternating series, power series and convergence. Taylor’s and Maclaurin’s Series.

Multivariable Functions:  
Limit, Continuity and Partial Derivatives; Euler’s Theorem for Homogeneous functions; Differentiability, Linearization and Differentials; Chain rule; Extreme values and Saddle Points; Lagrange multipliers; Taylor’s Formula.

Vector Differential Calculus and Integral Theorems:  
Gradient, Divergence, Curl, Statement of Green’s, Gauss and Stoke’s Theorem and their simple applications.

SECTION- B

Solid Geometry:  
Cylinders and Cones, Cylindrical and Spherical Polar Coordinates

Integral Calculus:  
Area between plane curves; Volumes of solids of revolution; Lengths of plane curves; Areas of surfaces of revolution. Double integrals in rectangular and Polar form, Triple integrals in Rectangular, Cylindrical and Spherical coordinates, Substitutions in Multiple Integrals.

Ordinary Differential Equations:  
First order exact differential equations, Integrating factor, Orthogonal trajectories, Second and Higher order Linear Differential Equations with constant coefficients, Differential Operators, Methods of Variation of Parameters and Undetermined Coefficients, Euler Cauchy Equation, Wronskian.

Text books:  

Reference Books:  
3. Differential Equations, Frank Ayers, TMH
Assessment will consist of the following components:

- Mid-Term
- One best of two minor tests (50% of Mid-term marks)
- Assignments (20% of Mid-term marks)
- Class Surprise Tests/Quizzes/Presentations/Term paper (20% of Mid-term marks)
- Attendance (10% of Mid-term marks)
- End-Term

The students are able to:

1. Test the behaviour of infinite series.
2. Analyze functions of several variables and their applications.
3. Operate vectors and convert line integral to surface integral to volume integral.
4. Evaluate multiple integrals and apply them to practical problems.
5. Solve linear differential equations.

### Course Outcomes

- Reactivity of organic molecules: Shapes and Molecular orbital structures of compounds containing C, N and O. Conformations of cyclic and acyclic systems, structures of dienes, pyridine, pyrrole, aromatic compounds. Factors affecting acidity, basicity and nucleophilicity of molecules (Kinetic as well as thermodynamic aspects) 08 hrs
- Delocalisation: Concept of aromaticity, stability of cycloalkanes, resonance concept, inductive and mesomeric effects, directive effects, activating and deactivating groups. 06 hrs
- Stereochemistry: Enantiomers, Diastereomers, Meso-and Racemic compounds, Resolution of racemic mixture. Asymmetric synthesis, Walden Inversion, Configuration (D and L nomenclature), Absolute configuration (R, S, E and Z nomenclature) 08 hrs

### SECTION A

Organic Reagents and Reaction Intermediates: Free radicals, carbonium and carbanions and the mechanism of important substitution, elimination as well as important rearrangement reactions—: House synthesis, halogenation of alkanes, free radical mechanism, orientation, reactivity and selectivity; catalytic hydrogenation, dehydoration of alcohols, dehydrohalogenation, Saytzeff rule, electrophilic addition reactions, peroxide effect, mechanism of allylic substitution, acidity of 1-alkynes, conjugated dienes, 1,2-and 1,4- additions, free radical and ionic mechanisms of addition polymerisation reactions, ringopening reactions of cyclopropane and cyclobutane, chemistry of benzene and alkylbenzenes, aromatic electrophilic substitution reactions, nucleophilic substitution Friedel-Crafts reactions, Anisole nucleophilic addition, Aldol condensation 18 hrs

Synthetic utility of diazonium salts, synthetic utility of Grignard reagents and alkyllithiums, basicity of amines, multistep synthesis. 05 hrs

### Books Recommended:

5. Mukherji & Singh: Reaction mechanism in organic chemistry, Macmillan India Ltd.
<table>
<thead>
<tr>
<th>Title</th>
<th>ELECTRICAL AND ELECTRONICS ENGINEERING</th>
<th>Credits</th>
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<tr>
<td>Code</td>
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<tr>
<td>Semester</td>
<td>1st</td>
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<tr>
<td>Max. marks</td>
<td>End term- 50</td>
<td>Mid term- 50</td>
<td>Elective</td>
</tr>
<tr>
<td>Pre-requisites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact hours</td>
<td></td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To provide students about basic knowledge of A.C and D.C circuits, theorems, laws.</td>
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<tr>
<td></td>
<td>Introduce to the students about difference between single phase and three phase system.</td>
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<tr>
<td></td>
<td>To teach the students basic principle of operation of transformers and other electrical machines.</td>
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<tr>
<td></td>
<td>To make them aware of the difference between analog and digital system and study diodes, rectifiers, digital circuits.</td>
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</tr>
<tr>
<td>Note for examiner</td>
<td>The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section. The duration of End Term exam will be 3 hrs.</td>
<td></td>
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</tr>
</tbody>
</table>

**SECTION A**

**DC Circuits and Single Phase A.C. Fundamentals**
General introduction to Electrical Engineering, Kirchoff’s Laws, Mesh and Node analysis, Superposition theorem, Thevenin Theorem, Norton Theorem, Maximum power transfer theorem.
Generation of alternating voltages and currents, Equations for AC quantities, cycle, time period, frequency, amplitude, calculation of R.M.S values, Average values for different waveforms, solution and phasor diagram of single phase AC circuit with sinusoidal source of excitation, series and parallel combination of R-L-C circuits.

**Three Phase AC Fundamentals**
Disadvantages of single phase system, star and delta connection in three phase circuits, relation between line and phasor quantities, power in three phase system, solution of three phase balanced circuits, power and power factor measurement by two wattmeter method.

**Electrical Machines**

**SECTION B**

**Semiconductor Diodes and Transistors**
General introduction to Electronics. Concept of stiff Voltage and Current Source. PN Junction, Depletion layer, Barrier Potential, Forward and Reverse Bias, Breakdown voltage, V-I characteristics, Half wave and full wave rectifiers, Zener diode. Introduction to junction transistors, Transistor amplifying action, CB, CE, CC-configuration characteristics.

**Digital Electronics**
Binary and Hexadecimal number system, conversion of numbers from one system to other, OR, Relations: Commutative, Associative and Distributive Laws. Concept of flip-flops, RSJK flip flops, shift register.

**Text Books**
<table>
<thead>
<tr>
<th>Reference Books</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Course Assessment Methods</th>
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<tbody>
<tr>
<td>Assessment will consist of the following components</td>
</tr>
<tr>
<td>1. Mid-Term</td>
</tr>
<tr>
<td>a. One best of two minor tests (50% of Mid-term marks)</td>
</tr>
<tr>
<td>b. Assignments (20% of Mid-term marks)</td>
</tr>
<tr>
<td>c. Class Surprise Tests/ Quizzes/Presentations/Term paper (20% of Mid-term marks)</td>
</tr>
<tr>
<td>d. Attendance. (10% of Mid-term marks)</td>
</tr>
<tr>
<td>2. End-Term</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The student will understand how various loads are connected in circuits and difference between single and three phase system.</td>
</tr>
<tr>
<td>2. The students will know the principles and working of different types of electrical machines used in industry</td>
</tr>
<tr>
<td>3. The students will have the basic knowledge of digitalization and conversion of physical quantity to digital quantity.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>MATERIAL AND ENERGY BALANCE</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Code</td>
<td>PCC-CS101</td>
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<tr>
<td>Max.Marks</td>
<td>End term- 50</td>
<td>Mid term- 50</td>
</tr>
<tr>
<td>Pre requisites</td>
<td></td>
<td>Contact Hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note for examiner</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION-A
Review: Stoichiometric and composition relationship gas laws; Gaseous mixtures, vapor pressure, humidity, etc.
Material Balances for Non-reaction systems including balances involving recycle and by-pass streams.

SECTION-B
Material Balances for Reacting systems including balances involving recycle and purge streams.
Combustion Calculations.
Energy balances on nonreactive and reactive systems.

Books Recommended:
<table>
<thead>
<tr>
<th>Title</th>
<th>COMPUTER PROGRAMMING FOR PROBLEM SOLVING</th>
<th>Credits</th>
<th>2</th>
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<tbody>
<tr>
<td>Code</td>
<td>ESC-GES 104</td>
<td>Semester:</td>
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<td>T</td>
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<tr>
<td>Max. Marks</td>
<td>End term- 25</td>
<td>Mid term- 25</td>
<td>Elective</td>
</tr>
<tr>
<td>Pre requisites</td>
<td>Contact Hours</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>1. To develop logical skills so that students should be able to solve basic computing problems.</td>
<td>2. To learn the syntax and usage of C++ programming constructs.</td>
<td></td>
</tr>
<tr>
<td>Note for the Examiner</td>
<td>The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting atleast two questions from each Section. The duration of End Term exam will be 3 hrs.</td>
<td></td>
<td></td>
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</tbody>
</table>

**SECTION- A**

<table>
<thead>
<tr>
<th>Introduction To Programming:</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic introduction to computers, block diagram of computer. Evolution of languages: Machine languages, Assembly languages, High-level languages. Software requirements for programming: System softwares like operating system, compiler, linker, loader. Application programs like editor. Overview of Algorithm and Flowcharts.</td>
<td>04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programming In C++ :</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data types in C++, Formatted input-output for printing integer, floating point numbers, characters and strings.</td>
<td>04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operators And Expression:</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressions in C++ and their evaluation. Precedence and associativity rules. Operators: arithmetic operators, relational operators, logical operators, miscellaneous operators.</td>
<td>04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statements:</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision making structures: if, if-else, nested if and if-else, switch-Case. Loop control structures: for, while, do-while. Role of statements like break, continue, go to.</td>
<td>03</td>
</tr>
</tbody>
</table>

**SECTION- B**

<table>
<thead>
<tr>
<th>Arrays:</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept and use of arrays, declaration and usage of 1-dimensional arrays and 2-dimensional arrays.</td>
<td>04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functions:</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantage of modularizing C++ program into functions, function definition and function invocation. Methods of passing parameters to a function: call-by-value, call-by-reference; Passing arrays to functions, Recursion, Library functions.</td>
<td>04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Introduction To User-Defined Data Types:</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structures- definition, declaration, use. Unions: definition, declaration, use, introduction to classes and Properties of object oriented programming.</td>
<td>04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Introduction to Numerical Methods And Spreadsheet Calculations:</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing programs to solve engineering computation problems and working with spreadsheets.</td>
<td>03</td>
</tr>
</tbody>
</table>


| Course Assessment Methods | Assessment will consist of the following components 1.Mid-Term | a. One best of two minor tests (50% of Mid-term marks) |
b. Assignments (20% of Mid-term marks)
c. Class Surprise Tests/Quizzes/Presentations/Term paper (20% of Mid-term marks)
d. Attendance. (10% of Mid-term marks)

2. End-Term

Course Outcomes

1. The student will demonstrate proficiency in C++ programming language.
2. The student will be able to solve basic engineering computation problems using C++

<table>
<thead>
<tr>
<th>Title</th>
<th>MANAGEMENT &amp; ORGANIZATIONAL BEHAVIOUR</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>MBA101</td>
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<tr>
<td>Semester</td>
<td>1st</td>
<td>L T P</td>
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<td>Max. Marks</td>
<td>End term- 50</td>
<td>Mid term- 50</td>
</tr>
<tr>
<td>Pre requisites</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Note for the Examiner</td>
<td>The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting atleast two questions from each Section. The duration of End Term exam will be 3 hrs.</td>
<td></td>
</tr>
<tr>
<td>Contact Hours</td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

SECTION A

Unit-I: Concept, Nature and Evolution of Management Thought: Early contributors, Scientific, process, human behaviour and social system school; Decision theory school; Quantitative and system school; Contingency theory of management; Social and Ethical issues in management, Challenges of managing 21st century corporations/organization

Unit-II: Managerial Functions: Planning -concept, significance, types; Organizing -concept, principles, theories, types of organizations, authority, responsibility, power, delegation. Decentralization; Staffing; Directing; Coordinating; Control -nature, process, and techniques.

Unit-III: Organizational Behaviour: Organisational behaviour -concept and significance; Relationship between management and organisational behaviour; organizational culture, Attitudes; Perception; Learning; Personality and values; emotions and moods. Motivation: Process of motivation; Theories of motivation - need hierarchy theory, theory X and theory Y, two factor theory, Alderfer's ERG theory, McCleland's learned need theory, Victor Vroom's expectancy theory, Stacy Adams equity theory.

SECTION B

Unit-IV: Concept; Leadership styles; Theories -trait theory, behavioral theory, Fielder's contingency theory; Harsy and Blanchard's situational theory; Managerial grid; Likert's four systems of leadership, contemporary issues in leadership Group Dynamics and Team Development: Group dynamics - definition and importance, types of groups, group formation, group development, group composition, group performance factors; Principle-centred approach to team development.

Unit-V: Organizational Conflict and Negotiations: Dynamics and management; Sources, patterns, levels, and types of conflict; Traditional and modern approaches to conflict; Functional and
dysfunctional organizational conflicts; Resolution of conflict. Organizational Development: Concept; Need for change, resistance to change; Theories of planned change; organization change and stress management, Organizational diagnosis.

Text Books:

Reference Books:

<table>
<thead>
<tr>
<th>Title</th>
<th>ELECTRICAL AND ELECTRONICS ENGINEERING LAB.</th>
<th>Credits</th>
<th>1.5</th>
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<tbody>
<tr>
<td>Code</td>
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<td>Max. Marks</td>
<td>Practical- 40</td>
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<tr>
<td>Pre requisites</td>
<td></td>
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</table>

| Objectives | Students will be able
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• to design electric circuits.</td>
</tr>
<tr>
<td></td>
<td>• To use voltmeter, ammeter and wattmeter</td>
</tr>
<tr>
<td></td>
<td>• Perform open circuit test and short circuit test on a single phase transformer and draw equivalent circuit</td>
</tr>
<tr>
<td></td>
<td>• To identify diode characteristics and transistor characteristics and perform experiments related to rectifiers(half-wave and full-wave)</td>
</tr>
<tr>
<td></td>
<td>• To verify various logical gates and networking theorems through experiments.</td>
</tr>
</tbody>
</table>

1. Overview of the equipments, instruments and procedure to be used, safety precautions and report writing.
2. To study resonance in R-L-C series and parallel circuit.
3. Measurement of power and power factor by three voltmeter method.
4. Measurement of power and power factor by three ammeter method.
5. To measure power and power factor using a single wattmeter in a single phase circuit.
6. Measurement of power and power factor of three phase balanced load by two wattmeter method.
7. To perform open circuit test and short circuit test on a single phase transformer and draw equivalent circuit.
8. To obtain magnetization characteristics of DC Machine
9. Study the forward and reverse biased diode characteristics.
10. Study the CB, CE, CC transistor characteristics.
11. To obtain the waveforms of half wave rectifier circuit on CRO.
12. To obtain the waveforms of full wave rectifier circuit on CRO.
13. Verification of basic and universal gates.
14. To verify the thevenin theorem, nortan theorem, Maximum power transfer theorem

Course Outcomes
Students will
- have hands on knowledge about the design, purpose and working of R-L-C and parallel circuits
- become confident in taking accurate readings of voltmeter, ammeter and wattmeter
- have in depth knowledge about transformers, transistors, diodes and rectifiers and will be able to understand their applications in industry.
- have knowledge about networking theorems and their utility in industry.

Title | CHEMISTRY (ORGANIC) LAB. | Credits |
---|---|---|
Code | BS155 | 1.5 |
Semester | -1<sup>st</sup> | - |
L T P | - | - | 3 |
Max. Marks | Practicals- 40 | Elective N |
Pre requisites | | Contact Hours 45 |

2. Identification of unknown organic compounds through group detection, physical constants and preparation of derivatives – Hydrocarbons, Phenols, Aldehydes, Ketones, Carboxylic acids, Amides and Amines.

Course outcomes :
List steps for identifying simple organic compounds
Use different analytical procedures

Title | COMPUTER LAB. | Credits |
---|---|---|
Code | ESC-GES 154 | 1 |
Semester | -1<sup>st</sup> | - |
L T P | - | - | 2 |
Max. Marks | Practicals- 25 | Elective N |
Pre requisites | | Contact Hours 30 |

Objectives
1. To develop programs using C++
2. To make the students design programs by using logic and become confident in handling numerical problems.
3. Programs based on input & output in C++
4. Programs using Decision Statements if-else, CASE
5. Programs using while statements, do- while and for Loops
6. Array based programs
<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Course Assessment Methods</th>
</tr>
</thead>
</table>
| 1. The students will be able to demonstrate proficiency in C++
2. The student will become confident in solving any computation problem using his programming skills. | The students will be assessed based upon the practical assignments and viva voce |
2nd SEMESTER

<table>
<thead>
<tr>
<th>Title</th>
<th>PHYSICS</th>
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<tr>
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<tr>
<td>L T P</td>
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<tr>
<td>Max. Marks</td>
<td>End term- 50</td>
<td>Mid term- 50</td>
</tr>
<tr>
<td>Pre requisite</td>
<td>Elective</td>
<td>N</td>
</tr>
<tr>
<td>Contact Hours</td>
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</tr>
</tbody>
</table>

Objectives: Basic concepts of optics and its applications, electromagnetism and magnetism properties, and Structural characterizations.

Note for the Examiner

SECTION A

1. Optics and Fibre Optics (12L + 4T)
   - Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications.
   - Polarisation: Introduction, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity.
   - Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres.

2. Structural Characterization: (16 hours+5T)
   - Crystal Lattice, points groups, Bravais lattices, crystal systems, X ray diffraction Symmetry
   - X-ray generation, Bragg Law, factors influencing intensity, Techniques, Indexing, precise lattice parameter determination, residual stress measurement

SECTION B

3. Electromagnetism and Magnetic Properties of Materials (17L + 6T)
   - Dielectric Materials: Review of basic formulas, dielectric constant and polarizability, sources of polarizability, classical treatment of dipolar, ionic and electronic polarizability, piezoelectricity, ferroelectricity. (4)
   - Magnetic Materials: Review of basic formulas, magnetic susceptibility, classification of materials, Langevin diamagnetism, paramagnetism (only classical treatment), magnetism in metals, ferromagnetism in insulators, anti-ferromagnetism and ferrimagnetism, ferromagnetism in metals, ferromagnetic domains, hysteresis (8)
   - Superconductivity: Zero resistance, occurrence of superconductivity, Meissner effect, critical field, thermodynamics of superconducting transitions, electrodynamics of superconductors, qualitative idea of BCS theory. (3)
   - Nanotechnology: Nanomaterials and its applications, chemical and physical synthesis techniques of nano-powder and thin films. (2)

Text Books

1. Introduction to Solid State Physics: Charles Kittel 8th Ed.

Reference Books


**Course Assessment Methods**

Assessment will consist of the following components

1. Mid-Term
   a. One best of two minor tests (50% of Mid-term marks)
   b. Assignments (20% of Mid-term marks)
   c. Class Surprise Tests/ Quizzes/Presentations/Term paper (20% of Mid-term marks)
   d. Attendance. (10% of Mid-term marks)

2. End –Term

**Course outcomes**

Students will be familiar with

- Bragg’s Law and introduced to the principles of lasers, types of lasers and applications
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic knowledge of structural properties, crystal structure as well as magnetic and dielectric properties of materials

<table>
<thead>
<tr>
<th>Title</th>
<th>CHEMISTRY (INORGANIC)</th>
<th>Credits</th>
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<tr>
<td>Code</td>
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<td>03</td>
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<tr>
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<table>
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<tr>
<th>Max.Marks</th>
<th>Semester:-2nd</th>
<th>L T P</th>
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<tbody>
<tr>
<td>End term- 40</td>
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<td>3 - -</td>
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<tr>
<td>Mid term- 35</td>
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<table>
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<th>Pre requisites</th>
<th>Elective</th>
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<td></td>
<td>Contact</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Hours</td>
<td></td>
</tr>
</tbody>
</table>

**Objectives**

**Note for the Examiner**

**Section A**

*Introduction to quantum theory for chemical systems*: Quantum theory and atomic structure: Introduction to wave mechanics, the Schrodinger equation, as applied to hydrogen atom, the origin of quantum numbers and shapes of orbitals from the Schroedinger equation. 06 hrs

*Chemical Bonding and structure Part I*: Molecular orbital and valence bond theories of bond formation and application of molecular orbital theory to the formation of homonuclear and heteronuclear diatomic molecules. Bonding in Coordination Compounds: Theories of bonding i.e, Werner’s theory, effective atomic number, valence bond theory, crystal field theory, crystal fields splitting in tetrahedral, octahedral and distorted octahedral (square planar) crystal fields. Kinetic and Thermodynamic aspects of coordination compounds (crystal field stabilization energies of octahedral and tetrahedral complexes, spectrochemical series). Electronic spectra and magnetic properties of complexes. 10 hrs

*Homogeneous catalysis/mechanism of industrially important reactions*: Organometallic Compounds: Nomenclature, types of ligands and bonding in organometallic compounds, The catalytic properties of the organometallic compounds and the mechanism of homogeneous catalysis for important industrial processes like hydrogenation, polymerisation and hydroformylation etc. 06 hrs

**SECTION B**

*Chemical Bonding and structure Part II*: Ligand Substitution reactions in complexes with coordination numbers 4 and 6 and their mechanism. Kinetic aspects of substitution in coordination compounds; Magnetic behaviour of complexes – Para magnetism, diamagnetism, ferromagnetism and antiferromagnetism and measurement of magnetic susceptibility of complexes by Guoy’s method. 09 hrs

*Inorganic polymers*: Types of inorganic polymers, polyphosphazenes, polysiloxanes –their structures and properties. 05 hrs

*Bio-inorganic Chemistry of Iron and cobalt*: Heme proteins, Non-Heme iron proteins, Iron Sulphur proteins and coenzyme B12; 05 hrs
**Metal Toxicology**: Toxic effects of heavy metals with special reference to Cd, Pb, Hg and As. 04hrs

**Recommended Books:**

<table>
<thead>
<tr>
<th>Title</th>
<th>MATHEMATICS-II</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Code</td>
<td>BS104</td>
<td>4</td>
</tr>
<tr>
<td>Semester:</td>
<td>2nd</td>
<td>L T P</td>
</tr>
<tr>
<td>Max marks</td>
<td>End term- 50</td>
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<td></td>
<td>Mid term- 50</td>
<td></td>
</tr>
<tr>
<td>Pre-requisites</td>
<td>Contact hours</td>
<td>60</td>
</tr>
</tbody>
</table>

**Objectives**
To students shall
- Learn to expand various functions in terms of Fourier series.
- Learn the methods to formulate and solve partial differential equations.
- Be taught to apply the method of separation of variables to solve partial differential equations of engineering interest.
- Learn to find Laplace transforms and inverse transforms and apply these to solve differential equations.
- Understand the concept of Complex functions and their applications to various problems.

**Note for examiner**
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section. The duration of End Term exam will be 3 hrs.

**SECTION A**

**Fourier Series**
Euler’s Formulae, Dirchilet’s Conditions for Expansion, Change of interval, Odd and Even Functions, Expansion of Odd and Even Periodic Functions, Introduction to Harmonic Analysis.

**Partial Differential Equations (Pde’s)**
Formation and classification of partial differential equations, first order linear equations, standard forms of non linear equations, Charpit’s method, homogeneous linear equations with constant coefficients.

**Engineering Applications Of Pde’s**
Method of separation of variables, Solution of partial differential equations of engineering interest by the method of separation of variables.

**SECTION B**

**Laplace Transforms**
Definition, Transforms of Elementary functions, Properties of Transforms, Inverse Transforms,
Transforms of Derivatives, Unit Step Function, Dirac’s Delta Function & Unit Impulse function. Periodic Functions, Application of Transform to the solution of ordinary Differential equations

**Calculus Of Complex Functions**
Functions of complex variables, analytic functions, Cauchy-Riemann equations, Cauchy’s theorem, Cauchy’s integral formula, introduction to Tayler’s series and Laurent’s series, Residues, Residue theorem and its simple applications.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3. Differential Equations, Frank Ayers, TMH</td>
</tr>
</tbody>
</table>

**Course Assessment Methods**
Assessment will consist of the following components
1. Mid-Term
   a. One best of two minor tests (50% of Mid-term marks)
   b. Assignments (20% of Mid-term marks)
   c. Class Surprise Tests/Quizzes/Presentations/Term paper (20% of Mid-term marks)
   d. Attendance. (10% of Mid-term marks)
2. End –Term

**Course Outcomes**
The students are able to:
- expand functions in terms of Fourier series.
- formulate and solve partial differential equations.
- solve partial differential equations of engineering interest.
- find Laplace transforms, inverse transforms and apply these to solve various differential equations.
- evaluate complex integrals and apply these to various problems.

<table>
<thead>
<tr>
<th>Title</th>
<th>COMMUNICATION SKILLS</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>HSMC-HASS 101</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Semester:- 2nd</td>
<td>L T P 1 - -</td>
</tr>
<tr>
<td>Max. marks</td>
<td>End term- 15</td>
<td>Mid term- 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elective N</td>
</tr>
<tr>
<td>Pre-requisites</td>
<td>Contact hours 30</td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>1. To inculcate effective communication skills in students for better performance in professional as well as personal life</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. To improve personality of students with advanced techniques in verbal, non verbal and para verbal communication.</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION A**
Advanced Communication Skills

Speaking Skills
Interpersonal Communication, Presentation Skills, Voice Modulation, Persuasion, Negotiation and Linguistic Programming, Public Speaking, Group Discussions, Interviews and Case Studies, Conducting Meetings and Conferences

Personality Development
Body Language and importance of Non Verbal communication, Social and Professional etiquettes.

**SECTION B**
Communication and Media
Social and Political Context of Communication, Recent Developments in Media
### Advanced Techniques in Speaking Skills
Importance of Listening/Responding to native and global accents, Telephonic Interviews and Video Conferencing

### Advanced Techniques in Technical Writing
Job Application, CV Writing, Business Letters, Memos, Minutes, Reports and Report Writing Strategies, E-mail Etiquette, Blog Writing, Instruction Manuals and Technical Proposals


| Course Assessment Methods | Assessment will consist of the following components 
1. Mid-Term  
   a. One best of two minor tests (50% of Mid-term marks)  
   b. Assignments (20% of Mid-term marks)  
   c. Class Surprise Tests/ Quizzes/Presentations/Term paper (20% of Mid-term marks)  
   d. Attendance. (10% of Mid-term marks)  
2. End –Term |

| Course Outcomes | 1. Gain proficiency in English language as medium for communication in both professional and personal life  
2. Increase in employment prospective of students by developing technical aspects of communication.  
3. Personality development of students by thorough knowledge of effective and enhanced communication skills |

| Title | MANAGERIAL ECONOMICS | Credits | 4 |
| Code | MBA 102 | Semester:-2nd | L T P | 3 1 - |
| Max.Marks | End term 50 | Mid term 50 | Elective | N |
| Pre requisites | - | Contact Hours | 60 |

**THEORY**

**Note for the Examiner**
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section. The duration of End Term exam will be 3 hrs.

**SECTION- A**

**Introduction to Managerial Economics**: Nature Scope and Importance of Managerial Economics. opportunity costs , incremental principle, time perspective, discounts and equi marginal principles.  
**Demand Concepts and Analysis**: Individual Demand, Market Demand, Kinds of Demand,
Determinants of Demand, Demand Functions, Functions, Demand Schedule and Law of Demand.  
**Theory of Consumer Behavior:** Cardinal Utility Approach and Ordinal Utility (Indifference Curves) Approach;  
**Elasticity of Demand:** Concept, Types, Measurement and importance.  
**Demand Forecasting:** Sources of Data-Expert Opinions, Surveys and Market Experiments;  
**Time Series Analysis:** Trend Projection; Barometric Forecasting-Leading Indicators, Composite and diffusion Indices.  

**SECTION- B**  
**Production Function:** Concept and types, Returns to Factor and Returns to Scale, Law of Variable Proportions.  
**Cost concepts and Analysis:** Concept of Cost, Short run and Long-run Cost Curves, Relationships among various costs, Break-even Analysis.  
**Revenue Curves:** Concept and Types.  
**Perfect Competition:** Characteristics, Equilibrium Price, Profit Maximizing output in Short Run and Long Run;  
**Monopoly:** Characteristics, Equilibrium Price, Profit Maximizing output in Short Run and Long Run; Price Discrimination;  
**Imperfect Competition:** Monopolistic Competition, oligopoly and Barriers to Entry.  

**Recommended Books**  

<table>
<thead>
<tr>
<th>Title</th>
<th>ENGINEERING GRAPHICS (PRACTICAL)</th>
<th>Credits</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>ESC-GES 151</td>
<td>Semester: 2nd</td>
<td>L T P - - 3</td>
</tr>
<tr>
<td>Max. Marks</td>
<td>Practical- 40</td>
<td>Elective</td>
<td>N</td>
</tr>
<tr>
<td>Pre requisites</td>
<td></td>
<td>Contact Hours</td>
<td>45</td>
</tr>
</tbody>
</table>

**Objectives**  
Objectives of the Engineering Drawing course is  
1. To introduce the students to visual science in the form of technical graphics.  
2. To give general instructions related to Theory of Orthographic Projection of points, lines, planes and solids as per the BIS codes prevalent to drawing practices.  
3. To upgrade the basic understanding and visualization of geometric objects and machine parts by introducing the students to section of solids, intersection and development of surfaces, isometric projection and orthographic projection of simple solids/blocks.  
4. To introduce the students to Computer graphics to enhance understanding of the subject. 

1. Introduction to engineering drawing, instruments, symbols and conventions in drawing practice.
2. Types of lines and BIS codes for lines, dimensioning
3. Introduction to methods of projections: Orthographic projection, Isometric projection
4. Projection of points, lines, planes and solids on principal and auxiliary planes.
5. Sectioning of solids, Intersection of solids
6. Development of surfaces
7. Drawing of threaded fasteners and assembly drawing
8. Introduction to CAD software.

**Recommended Books:**
1. P.S. Gill: Engineering Drawing
4. Sham Tickoo : Understanding AutoCAD 2006, Wiley Publication
5. James D. Bethune : AutoCAD, Pearson Publishers

**Course Assessment Methods:**
The students will be assessed based upon the practical assignments and viva voce.

**Course Outcomes:**
Student will be able to
1. understand the basics of engineering drawing.
2. visualize the different types of geometrical objects and the assembly drawing of machine parts.

<table>
<thead>
<tr>
<th>Title</th>
<th>ENGINEERING WORKSHOP (PRACTICAL)</th>
<th>Credits</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>ESC-GES 152</td>
<td>Semester:- 2nd</td>
<td>L T P</td>
</tr>
<tr>
<td>Max. marks</td>
<td>Practical – 40</td>
<td>Elective</td>
<td>N</td>
</tr>
<tr>
<td>Pre-requisites</td>
<td>Contact hours</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

**PRACTICAL**

**Objectives**
- To make the students understand the need and importance of different manufacturing techniques.
- To introduce the different tools and equipments used in mechanical workshops and develop the skill to use the same.

**Carpentry Shop:** Description and use of carpenter's tools, Wood and timber, defects found in wood, seasoning of wood. Different types of timber in common use, making of lap joint, Bridle joint, dovetail joint and Mitre joint.

**Electric Tools:** Exercise of wiring in link clip and casting and causing wiring of lights with switches in parallels, series and with 2 ways switches, Connecting energy meter, main switch and distribution board, testing a wiring installation for insulation resistance, Relevant Indian Electricity Rules.

**Machine Shop:** Classification of fabrication processes, machine tools and materials, introduction to working of lathe, shapper, milling and drilling machines, power hacksaw, shearing machine and grinding wheel. Simple turning, threading, drilling board and knurling operations on a lathe.

**Welding:** Introduction to electric arc welding, gas welding and their use in making different types of joints e.g. lap joint, butt joint and T joint.

**Recommended Books**

**Course Outcomes**
Students will be able to
- understand the theory of different manufacturing techniques and tools
- do practices by hand
## Physics Lab

<table>
<thead>
<tr>
<th>Title</th>
<th>PHYSICS LAB</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Code</td>
<td>BS152</td>
<td>Semester: 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>L T P</td>
</tr>
<tr>
<td>Max. marks</td>
<td>Practical – 25</td>
<td>Elective</td>
<td>N</td>
</tr>
<tr>
<td>Pre-requisites</td>
<td>Contact hours</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

### Objectives

Physics lab provides students the firsthand experience of verifying various theoretical concepts learnt in theory courses. In a semester at least 10 experiments to illustrate the concepts learnt in Physics (Number of lab. Hrs. 2 per experiment)

1. To find the energy band gap of the given semiconductor by four probe method.
2. To study the Hall Effect of a given semiconductor.
3. To determine the dielectric constant of the given materials.
4. To study the B-H curve of the ferromagnetic materials.
5. To determine the value of e/m for electron by long solenoid (helical) method.
6. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
7. To determine the velocity of ultrasonics waves in a given liquid.
8. To determine the frequency of A.C. mains using a sonometer and an electro-magnet.
9. To find the capacitance of a capacitor using flashing and quenching of a neon lamp.
10. To plot graph between current and frequency in a series LCR circuit and to find the resonant frequency.
11. To find the wavelength of sodium light using Fresnel’s biprism (3).
12. (i) To determine the wavelength of He-Ne laser using transmission grating.
    (ii) To determine the slit width using the diffraction pattern.
13. To determine the wave length of sodium light by Newton’s rings method.
14. To determine the wave length of sodium light using a diffraction grating.
15. To find the specific rotation of sugar solution using a Bi-quartz Polarimeter.
16. To design a hollow prism and used it find the refractive index of a given liquid.
17. To synthesize the nanoparticles by chemical methods and structural characterization through X-ray diffraction.
18. To investigate the optical band gap of nanomaterial using UV-vis spectroscopy.
19. Fabrication of thin films by spray pyrolysis technique.
20. Fabrication of thin films using spin coater technique.

### Text Books

1. Practical Physics by CL Arora, S Chand & Co.
2. Engineering physics by S.K. Srivastva

### Reference Books

A text book of practical physics by William & Watson

### Course Assessment Methods

One *project out of 6 carries 40% marks, 20% for respective viva and 20% for external exams and 10% for attendance.

### Course outcomes

The student will gain
- Proficiency in technical aspects of performing the experiments.
- Proficiency in designing scientific projects

## Chemistry (Inorganic) Lab.

<table>
<thead>
<tr>
<th>Title</th>
<th>CHEMISTRY (INORGANIC) LAB.</th>
<th>Credits</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>BS153</td>
<td>Semester: 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>L T P</td>
</tr>
<tr>
<td>Max. marks</td>
<td>Practical – 40</td>
<td>Elective</td>
<td>N</td>
</tr>
<tr>
<td>Pre-requisites</td>
<td>Contact hours</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

### Practical session wise break-up

No. of sessions
I. Volumetric Analysis :
(i) Redox Titrations :-Titrations involving
   a ) KMnO4 (Estimation of C2O4 -2 ) 02
   b ) K2Cr2O7 (Estimation of Fe+2/Fe+3) 02
   c) Iodine [Iodometry & Iodimetry] (Standardisation with Sodium Thiosulphate, Estimation of Cu+2, AsO3 -3 and Sb+3) 04
(ii) Complexometric Titrations- Determination of Zn+2 by EDTA titration. 02
II  Gravimetric Analysis
   a) Estimation of Ba+2/SO4 -2 as BaSO4
   b) Estimation of Fe+2/Fe+3 as Fe2O3 04

Text Book: Vogel’s Qualitative Inorganic Analysis, 7th Ed. By G. Svehla, Pearson Education.

Course Outcomes
The student will be able to
- apply the concept of normality, molarity and oxidation and reduction and apply redox titrations involving potassium dichromate and Iodine
- Use Complexometric Titrations to determine metal ions by EDTA method.
- Use gravimetric procedures for estimation (Estimate Ba+2/SO4 -2, and Fe+3)

<table>
<thead>
<tr>
<th>Title</th>
<th>COMMUNICATION SKILLS LAB.</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>HSMC- HASS 151</td>
<td></td>
</tr>
<tr>
<td>Semester</td>
<td>2nd</td>
<td>L T P</td>
</tr>
<tr>
<td>Max. marks</td>
<td>Practical – 25</td>
<td>Elective N</td>
</tr>
<tr>
<td>Pre-requisites</td>
<td>Contact hours</td>
<td>30</td>
</tr>
</tbody>
</table>

Objectives
1. To develop better pronunciation and communication skills.
2. To be able to face interviews and participate in conferences or any personal or professionals discussions with confidence.
3. To develop technical writing skills.
4. To be able to articulate ones voice and overcome stage fright.

Organizational Communication
Verbal and Non-Verbal Communication at different levels of organization, Role Play, Interaction with Bosses and Co-employees

Speaking Techniques
Preparation of Interviews, Participation in Group Discussions and Case Studies, Making and Presenting Power Point Lectures.

Advanced Speaking Techniques
Conducting Meetings and Conferences, Exposure to different Accents, Listening and responding in the global scenario, Telephonic Interviews/Conversations, Video Conferencing

Technical Writing
Writing Letters, Memos, Minutes, Notes, CV, Job Applications, Reports and e-mails, Preparing Instruction Manuals and Technical Proposals

Course outcomes
1. English Speaking skills of students will be enhanced.
2. Students will become self confident in handling both professional and personal meetings/discussions.
3. Students will be able to demonstrate improved technical writing skills.
4. Overall personality of students as well as their communication skills will be developed.
SYLLABUS OF B.E. (Chemical)-MBA 2020-2025
SECOND YEAR

3rd SEMESTER

<table>
<thead>
<tr>
<th>Title</th>
<th>FLUID FLOW</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Code</td>
<td>PCC-CS 102</td>
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<td></td>
</tr>
<tr>
<td>Max.Marks</td>
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<td></td>
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<tr>
<td>Pre requisites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>3 Hours</td>
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<tr>
<td>Note for the</td>
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<td></td>
</tr>
<tr>
<td>Examiner</td>
<td></td>
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</tbody>
</table>

**Note for the Examiner:** The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting atleast two questions from each Section.

**SECTION- A**

*Fluid Statics:* Normal forces in fluids, Pressure Measurements, Forces on Submerged bodies, Buoyancy and Stability.


**SECTION- B**

*Dimensional analysis and its Applications to Fluid Flow.*

*Flow of compressible fluids:* Compressible flow and flow through nozzles.

*Flow Measurements:* Pilot tube, Orifice, Venturi, Rotameter and Notches, wet gas metre etc.

*Fluid Machinery:* Classification and Performance of Pumps, Turbines, Compressors, and Blowers, Selection and Specification, Net positive Suction Head.

**Books Recommended:**


<table>
<thead>
<tr>
<th>Title</th>
<th>MECHANICAL OPERATIONS</th>
<th>Credits</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>PCC-CS 106</td>
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<tr>
<td>Max. Marks</td>
<td>End term- 50</td>
<td>Mid term- 50</td>
<td>Practical-</td>
</tr>
<tr>
<td>Pre requisites</td>
<td></td>
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<td></td>
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<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>3 Hours</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Note for the Examiner

The semester question paper of the subject will be of 60 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

### SECTION- A


- Motion of particle through a fluid: Stoke’s Newton’s law. Free and hindered setting.
- Setting tank and double cone classifiers
- Batch and continuous thickeners

Settling chamber, cyclone, filter bag and electrostatic precipitators.

### SECTION- B

**Filtration:** Plate and frame filter press, continuous rotary vacuum filter, filter aids, theory of filtration for non-compressible cakes.

**Centrifugation:** Tubular bowl centrifuge, disk centrifuge and batch basket centrifuge.

**Fluidization:** Conditions for fluidization: Aggregate and particulate fluidization. Ergun’s and Carman-Kozeny equations.

**Mixing and Agitation:** Basic ideas and characteristics of mixing equipment power consumptions scale-up.

**Conveying:** Mechanical and pneumatic conveying systems, storage & handling of materials.

### Books Recommended:


Examiner and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

SECTION- A


SECTION- B

Phase Equilibria:
Partial molar properties, partial molar Gibbs free energy, Chemical potential and its dependence on temperature and pressure Ideal solutions (Lewis-Randel Rule).
Fugacity and its calculations. Dependence of fugacity of temperatures and pressure

Chemical Equilibria:
Equilibrium constant in terms of measurable properties variations of equilibrium constant with temperature and pressure. Adiabatic reactions, Gibbs phase rule, equilibria in heterogeneous reactions.

Books Recommended:


Title ENGINEERING MATERIALS Credits 4
Code ESC-GES 106 Semester: 3rd L T P 3 1 -
Max. Marks End term- 50 Mid term- 50 Practical- - Elective N
Pre requisites Contact Hours 60

THEORY Time 3 Hours
**Note for the Examiner**  The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

**SECTION-A**

*Atomic Structure*: Review of bonding in solids, Bonding forces and energies, Primary and Secondary bonds, structure – property – processing relationships

*Crystal Structure*: Space lattice, crystal systems, close packed morphology (Hexagonal and cubic close packing), interstitial spaces, Miller indices, linear and planar densities in crystals, single and polycrystalline structures, structure of ceramics (NaCl, Zinc blende, CsCl, silica and silicates, diamond crystal), effect of radius ratio on co-ordination

*Imperfections in atomic arrangement*: various defects in atomic arrangement, diffusion phenomenon in solids, Fick’s first and second law of diffusion, solid solution, slip systems, various methods of strengthening materials (grain size reduction, solid-solution strengthening, strain hardening), Schmid’s law.

**SECTION-B**

*Phase diagrams and phase transformation: binary phase diagrams* – Fe-Fe₃C, Cu-Ni, Pb-Sn. microstructure development, TTT diagrams, heat treatment processes-hot and cold working, hardening and softening processes.

*Materials*: Standards and specifications, unified alloy numbering system, ferrous metals and alloys, nonferrous metals and alloys; overview of ceramic, polymeric and composite materials;

*Mechanical tests*: standard test procedures for mechanical property determination-strength, toughness, fatigue, hardness, impact, fatigue, creep etc.

*Corrosion*: Types and mechanism of corrosion, factors influencing corrosion, combating corrosion, selection of materials of construction for handling different chemicals.

**Books Recommended:**

4. Raghavan, V. : Material Science & Engineering, Prentice Hall of India

**Title**: BUSINESS STATISTICS  
**Code**: MBA 103  
**Semester**: 3rd  
**Credits**: 4  

<table>
<thead>
<tr>
<th>Max. Marks</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>End term</td>
<td>Mid term</td>
<td>Practical</td>
<td>Elective</td>
<td>Contact Hours</td>
<td>60 (Theory)</td>
<td></td>
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<tr>
<td>50</td>
<td>50</td>
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</tbody>
</table>

**THEORY**

Note for the Examiner The question paper should be divided into Section A and Section B Total of 8 questions.
Examiner 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION- A

Introduction to Statistics & Probability: Definition of statistics-Types. Types of variables – Organising data - Descriptive measures-Construction of frequency distributions and their analysis in the form of measures of central tendency and variations, types of measures, skewness-meaning and coefficient of skewness, Kurtosis. Basic definitions and rules for probability, conditional probability independence of events, Baye’s theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions

Sampling distribution and estimation: Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size.

Testing of hypothesis - parametric tests: Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. ANOVA one and two way.

SECTION- B


Correlation and regression: meaning & types of correlation, Karl Pearson’s coefficient of correlation and spearman’s rank correlation, regression analysis-meaning and two lines of regression, relationship between correlation and regression co-efficient.

Time series analysis and Index Numbers: Time series analysis: Variations in time series, trend analysis, Least Square Method, cyclical variations, seasonal variations and irregular variations, forecasting errors; Definition and Methods of Construction of Index Numbers; Tests of consistency, Base shifting, splicing and Deflation; Problems in construction, importance of index numbers in Managerial decision making

Text books & Reference books:

Text & Reference Books:
4. Kumar, R., Research Methodology- A Step by Step Guide for Beginners., Pearson Education

**Title**: OPERATIONS RESEARCH  
**Code**: MBA 104  
**Credits**: 4  
**Semester**: 3rd  
**Max.Marks**: 50  
**End term**: 50  
**Mid term**: 50  
**Practical**: --  
**Contact Hours**: 60 (Theory)  
**Elective**: N  
**THEORY**

Note for the Examiner: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.
Operations research: Evolution, methodology and role in managerial decision making.

Linear programming: Meaning, assumptions, advantages, scope and limitations, formulation of problem and its solution by graphical and simplex methods, special cases in simplex method, infeasibility, degeneracy, unboundedness and multiple optimal solutions, dualitiesensitivity analysis.

Transportation problems including trans-shipment problems: Special cases in transportation problems, unbalanced problems, degeneracy, maximization objective and multiple optimal solutions, assignment problems including travelling salesman’s problem, special cases in assignment problems: unbalanced problems, maximization objective and multiple optimal solutions.

SECTION- B

Theory of Games: Pure strategy games, principle of dominance; mixed strategy games (Algebraic, Graphical & Linear programming method), 2-person, non-zero- sum games.

Queuing Theory: Introduction, elementary queuing system; single channel queuing model, queuing cost behaviour, multiple channel queuing model, Poisson arrivals and Erlang service distribution; benefits and limitations of queuing theory.

Inventory models, simulation and decision theory - Inventory Models – EOQ and EBQ Models (With and without shortages), Quantity Discount Models. Decision making under risk – Decision trees – Decision making under uncertainty. Application of simulation techniques for decision making.

Text books & Reference books:

Title | WORKSHOP ON BUSINESS RESEARCH | Credits | 2
---|---|---|---
Code | MBA 151 | Semester:-3rd | L T P 0 0 2
Max.Marks | End term - | Mid term 25 | Practical - | Elective N
Pre requisites | - | | | Contact Hours 30 (Practical)

THEORY

Note for the Examiner: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION- A

Introduction to business research: Definition, characteristics, types; research process – an overview, review of literature – its role and significance in the stages of research process, theory building, ethical issues in business research; formulation of the research problem and research proposal; hypothesis - definition, formulation and types

Research Design: Meaning, Characteristics and various concepts relating to research design and classification of research design, Importance.

SECTION- B

Data Collection: Primary/Secondary data – definition, types, sources, evaluation and searches, primary data collection methods - surveys, observation and experiments, direct personal interview, indirect oral interview, information through local agencies, mailed questionnaire method, schedule
sent through enumerators; questionnaire and its designing and characteristics of a good questionnaire; measurement and scaling concepts, measurement scales. sampling design and sampling procedures, sample size estimation, fieldwork, processing of data, data analysis - basic data analysis, hypothesis testing – t test, chi square test, test of proportion, **bivariate analysis** tests of differences and measures of association through use of parametric and non-parametric tests, report writing, use of computers in research.

**Text & Reference Books:**


**Paper Title: FLUID Flow Lab.**

**Paper Code PCC-CS 152**  
**Max. Marks 40**  
**Credits: 1.5**

1. General study of pipe fittings, valves and other equipments in the unit operations laboratory.
2. Pressure drop for flow through pipelines, valves & fittings.
3. Characteristics of pumps.
4. Flow measurement by the use of orifice meter, venturimeter, rotameter & pitot tube.
5. Flow over weirs and notches.
6. Flow measurement of compressible fluids.

**Paper Title: MECHANICAL OPERATIONS Lab.**

**Paper Code PCC-CS 155**  
**Max. Marks 40**  
**Credits: 1.5**

1. Pressure drop and two phase flow characteristics in packed and fluidized beds.
4. Constant pressure filtration.
5. Mixing, crushing, grinding, screening and particle size analysis (Anderson Pipette)
SYLLABUS OF B.E. (Chemical)-MBA 2020-2025
SECOND YEAR

4th SEMESTER

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THEORY Time 3 Hours

Note for the Examiner
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting atleast two questions from each Section.

SECTION- A

Conduction: Steady state conduction in one dimensional system, general conduction equation, effect of variable thermal conductivity, steady state conduction involving internal heat generation, lagging on pipes, the critical thickness of insulation on pipes, extended surfaces of uniform thickness and fin effectiveness, fin efficiency.

Convection: Free and forced convection, concept of heat transfer co-efficient, dimensionless numbers in free and forced convection, Dimensional analysis, Determination of Heat transfer coefficient using heat and momentum transfer analogies, experimental determination of heat transfer coefficient and common working correlations.

Radiation Heat Transfer: Black Body radiation, and grey body radiation, physical mechanism, radiation properties and shape factor, heat exchange between non-black bodies, radiation shields pyrometry and effect of radiation on temperature measurement.

SECTION- B

Condensation and Boiling: Condensation heat transfer phenomenon, film condensation on vertical plates and cylinders as well as on horizontal cylinders. Effects of non-condensable gases and vapor velocity on condensation, pool boiling, forced convection boiling, working correlations for pool boiling.

Evaporation: Types of Evaporators, single and multiple effects, single and multiple effects calculations, evaporator capacity, economy, effect of liquid head and boiling point elevation, methods of feeding.

Heat Exchangers: Various types of heat exchangers, overall heat transfer coefficients, heat exchanger mean temperature differences, heat exchanger effectiveness and the number of transfer units.

Books Recommended:

THEORY Time 3 Hours

Note for the Examiner The semester question paper of the subject will be of 40 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

SECTION A

UNIT-1 Solutions and Colligative Properties: (8 Lectures)
Dilute solutions; lowering of vapour pressure, Raoult’s and Henry’s Laws and their applications. Excess thermodynamic functions. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

UNIT-2: Chemical Kinetics (7 Lectures)
Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws. Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism.

SECTION B

UNIT-3: Catalysis & Surface chemistry (7 Lectures)

UNIT 4 : Electrochemistry (8 Lectures)
Faraday’s laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb2O3 electrodes.

Reference Books
Title  | STRENGTH OF MATERIALS  | Credits  | 03  
Code  | ESC-GES 105  | Semester:-4th  |

| Max. Marks | End term-40 Mid term-35 | Practical- | Elective | N |

Pre requisites  | Contact Hours  | 45  

THEORY  | Time  | 3 Hours  
Note for the Examiner  | The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.  

SECTION- A  

Stresses and Strains: Concept of simple stress and simple strain, mechanical properties of solids, types of load, Tensile stress, compressive stress, shear stress, complementary shear stress, thermal stresses, tensile test, stress strain curve, Hooke’s law, modulus of elasticity, modulus of rigidity, Principle of St. Venant strain, factor of safety, compound bars, Compound Stresses and Compound Strains in two-dimensional stress system, Stresses on oblique plane due to pure shear, principle planes and principle stresses, maximum shear stress, Mohr’s circle of stress, Poisson’s ratio, volumetric strain, elastic constants and relations between them.  

Shearing Force and Bending Moments in Beams: Shearing force, bending moment, types of beams, types of load on beams, types of supports, sign conventions for shearing force and bending moment, point of inflection, relations between bending moment and shearing force shearing force and bending moment diagrams for beam under different loads. Concentrated loads, uniformly distributed loads, numerical problems.  

Bending Stresses and Shearing Stresses in Beams: Pure bending, graphical determination of moments of inertia, bending stress, composite beams, reinforced concrete beams, General eccentric loading, combined direct and bending stresses, eccentric longitudinal loads, Shear stress distribution in rectangular section and circular section, numerical problems.  

Deflection of Beam: Introduction, Macauly’s integration method, simply supported beam with load at mid span and beam with eccentric load, moment area method, deflection due to shear, numerical problems.  

SECTION-B  

Torsion of Shafts: Torsion of thin circular shaft, composite shaft, combined bending and torsion equivalent torque, equivalent bending moment, numerical problems.  

Struts and Columns: Definition of strut and column, Euler’s Column theory and assumptions made, Strut with both ends pinned, strut with one end fixed and one end free, strut with both ends free,
Slenderness ratio, limitations of Euler theory, Rankine’s Empirical formula, strut with eccentric loading, numerical problems.

**Stresses and Strains in Thin Shells:** Thin cylinder under internal pressure, thin spherical shell under internal pressure, volumetric strain, modifications for built-up shells, numerical problems.

**Stresses and Strains in Springs:** Types of Springs, stresses in Close coiled helical springs, open coiled helical springs, leaf springs, springs in parallel and in series, numerical problems.

**Strain Energy and Theories of Elastic Failure:** Strain energy and resilience, Strain energy in tension and compression due to suddenly applied load and impact loads, strain energy due to shear, strain energy due to bending, strain energy due to torsion, theories of elastic failure and their graphical representation, numerical problems.

**Books Recommended:**


**Title** | **PROCESS EQUIPMENT DESIGN** | **Credits** | **1.5**
---|---|---|---
**Code** | ESS-GES 157 | Semester:-4th | L T P - - 3
**Max. Marks** | End term- | Mid term- | Practical- 40 | Elective | Contact Hours | 45
**Pre requisites** | | | | | |

**PRACTICAL**

**LIST OF PRACTICALS**

1. Study of factors influencing the design of vessels; classification of pressure vessels, applications, method of fabrications, fundamental principles and equations.
2. Study of pressure vessel codes specifications and standards; Review of code and its development, ASME codes, API-ASME code, Section VIII of ASME codes
3. General design considerations for pressure vessels; Design pressure, design temperature, materials, design stress (nominal design strength), corrosion allowance, design loads, minimum practical wall thickness.
4. Design of thin-walled vessels under internal pressure; Cylinders and spherical shells, heads and closures, design of flat ends, design of domes, conical sections and end closures.
5. Design of vessels subject to external pressure; Cylindrical shells, design of stiffening rings, vessels heads.
6. Design of vessels subject to combined loading: Weight loads, wind loads (tall vessels), torque.
7. Design of welded joints and Bolted flanged joints.
8. Design of Foundation and supports.

**Books Recommended:**

1. Battacharyya, B.C.: Introduction to Chemical Equipment Design Mechanical aspects, Chemical Engineering Education Development Centre.
2. Brownell and Young: Process Equipment Design, Willey Publication
ENERGY TECHNOLOGY

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THEORY

Note for the Examiner
The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION- A

Fuels: Types of conventional fuels, their merits and demerits. Non-conventional/renewable energy sources, their importance for sustainable development and environmental protection.


Liquid fuels: Origin of petroleum, refining and distillation of crude oil, uses of petroleum products.

Gaseous fuels: Natural gas, manufacture of water gas and producer gas, gas cleaning methods.

SECTION- B


Furnaces: Classification of furnaces, draught, furnace atmosphere, Portland cement continuous rotary kiln, blast furnace, glass melting furnace

Alternate sources of energy:
- Introduction to solar radiation and evaluation of radiation incident on a solar collector.
- Applications of solar thermal energy such as solar water heater, solar cooker, solar concentrators and solar thermal power generation.
- Types of solar photovoltaic systems and applications.
- Photosynthesis and biomass conversion systems.

Other renewable energy sources such as geothermal, tidal, ocean and wave.

Recommended Books


PRODUCTION AND OPERATION MANAGEMENT

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<td>Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.</td>
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**THEORY**

**SECTION – A**

**Introduction to operations management:** An overview of Operations Management; Operations Management Strategy framework; Understanding similarities and difference among products, goods and services; Historical evolution of operations management-Changes & Challenges

**Product Design & Development:** Product Design and its Characteristics; Product Development Process (Technical); Product Development Techniques.

**Process Selection:** Project, Job, Batch, Mass & Process types of Production Systems; Product-Process Mix; Design of Process Flows

**Facility Location:** importance; location planning process; Factors in Location Analysis; Location Analysis Techniques.

**Facility Layout:** Introduction, Objectives of Layout, Classification of Facilities, Basis for Types of Layouts, Why Layout decisions are important, Nature of layout problems, Redesigning of a layout, Manufacturing facility layouts, Types of Layouts, Layout Planning, Evaluating Plant Layouts, Assembly Line Balancing, Material handling

**Capacity Planning:** Concepts; Factors Affective Capacity; Planning; Capacity Planning Decisions.

**Production Planning & Control (PPC):** Concepts; Objectives; Functions; Introduction, Requirement of Aggregate Plan, Steps in Developing an Aggregate Plan, Advantages of Aggregate Plan, Aggregate Planning Strategies, Planning Options. Selecting the Method in Aggregate Planning, Aggregate Planning in Services

**Work Study:** Productivity; Method Study; Work Measurement.

**SECTION – B**

**Materials Management:** Concepts; Objectives

**Introduction to modern Productivity techniques:** Just in time; Kanban System; Total quality management &six sigma.

**Functions Purchasing Management:** Objectives; Functions; Methods; Procedure

**Stores Management:** Types of Stores; Functions; Coding Methods

**Value Engineering:** Introduction, Value Engineering/Value Analysis, Relevance of VE in Modern Manufacturing, Process of Value Analysis, VE – Approaches and Aim, Providing Value to the Customers, Benefits

**Inventory Management:** Concepts; Classification; Objectives; Factors Affecting Inventory Control Policy; Inventory Costs; Basic EOQ Model; Re-order Level; ABC Analysis.

**Maintenance Management:** Concepts; Objectives; Functions; Types of Maintenance.

**Text books & Reference books:**
1. Nair: Production & Operation Management, Tata McGraw Hill
2. Adam & Ebert: Production & Operation Management, Prentice Hall India
5. SN Chary: Production & Operations Management, Tata McGraw Hill

**Paper Title:** PHYSICAL CHEMISTRY LAB.

**Paper Code BS 156**

Max. Marks 40

Credits : 1.5

1. Surface tension of liquids using Stalagmometer and calculation of Parachor values.
2. Distribution of Iodine between water and carbon tetrachloride.
3. Kinetics of the hydrolysis of methyl acetate in the presence of hydrochloric acid.
4. Adsorption of acetic acid on activated charcoal.
5. Viscosity of liquids and composition of a binary solution.
6. Conductometry
   • Variation of equivalent conductance and specific conductance on dilution.
   • Dissociation constant of acetic acid.
   • Solubility of sparingly soluble salts.
   • Conductometric titrations of HCl vs NaOH and acetic acid vs NaOH.
7. Potentiometric titration of HCl vs NaOH and acetic acid vs NaOH and determination of dissociation constant of acetic acid.
8. Colorimetry
   • Verification of Lambert-Beer Law.
   • Determination of concentration of solution of KMnO$_4$/K$_2$Cr$_2$O$_7$.
   • Determination of composition of Fe-Salicylic Acid Complex by Job’s Method.

Books Recommended:

Paper Title: HEAT TRANSFER Lab.
Paper Code PCC-CS 154 Max. Marks 40 Credits : 1.5
1. Determination of heat transfer coefficient for different types of heat transfer equipment. Wilson plots.
2. Unsteady state heat transfer in jacketed vessels. (Open pan evaporator)
3. Correlation of instantaneous heat transfer coefficients with time study deposition of scale on a heating surface.
4. Determination of heat losses for insulated pipes
5. Study of double pipe heat exchanger and to determine overall heat transfer coefficient
6. Study the performance characteristics of a 1,2 - shell and tube heat exchanger
7. Study and **operation** of long tube, forced circulation and multiple effect evaporators.
8. Duhring plot for solutions involving nonvolatile solutes
### Syllabus of B.E. (Chemical)-MBA 2020-2025
#### Third Year
##### 5th Semester

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### Theory

**Note for the Examiner**
The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

#### Section A

#### Section B

### Recommended Books

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**THEORY**

| Note for the Examiner | The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section. |

**SECTION- A**

Mass transfer operations, classification of mass transfer operations, choice of separation methods, methods of conducting mass transfer operations, design principles.

Introduction to mass transfer and diffusion, molecular diffusion in gases and liquids, diffusion coefficients for gases and liquids, diffusion in solids, types of solid diffusion.

Mass transfer coefficients, types of mass transfer coefficients, mass transfer coefficients in laminar flow, theories of mass transfer.

Interphase mass transfer, concept of overall mass transfer coefficient.

**SECTION- B**

Working principle, construction and industrial applications of various gas liquid contacting equipments like sparged vessels, mechanically agitated vessels, tray towers, packed towers, spray chambers, venturi scrubbers.

Humidification operations, psychometric chart, adiabatic saturation temperatures, wet bulb temperature, adiabatic operations, types of cooling towers.

Principle of drying, batch drying, drying curve, constructional details and working of different dryers

**Recommended Books**


**Title**

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**THEORY**

*Oils & Fats:* Introduction, Extraction of oils from vegetable oils, refining of oils and fats, hydrogenation of oils.

*Soaps and Detergents:* Introduction, Raw materials, Manufacture of soap, Classification of detergents, finishing of detergents.
**Water:** Sources and Constraints, Impurities: dissolved, suspended, colloidal; Hardness of water; Water softening; Lime soda, Ion exchange.

**Desalination:** Classification of processes; Evaporative processes, Multieffect evaporation, multistage flash, vapour compression; Membrane processes, Reverse osmosis, electrodialysis.

**SECTION-B**

**Pulp & paper:** Introduction, Raw Materials, types of pulp, Manufacture of paper.

**Sugar:** Introduction; Sugar extraction, defacation, sulphitation, carbonation, concentration, crystallization, drying, refining; Uses of molasses and bagasse.

**Polymers:** Introduction, Degree of polymerisation, Classification of polymers, Polyethylene, Polyesters

Petroleum Refining: Introduction, composition of crude oil, typical refinery operations like thermal cracking, catalytic cracking

**Books Recommended**


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**Practical**

2. Selection, specification & power requirements of process pumps, fans and blowers.
3. Design of settling equipments like Dor thickeners, dust chambers, cyclone separators and centrifuges.
4. Design of agitated vessels using various types of impellers.
5. Design of Conveyor system for solids.

**Recommended Books**


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Note for the Examiner: The question paper should be divided into Section A and Section B. Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A


Air Pollution:
- Principal air pollutants and their usual sources.
- Effect of air pollutants on human health, animals, vegetation and materials.
- Atmospheric dispersion of air pollutants, temperature inversions, Estimation of pollutants by Gaussian plume model.
- Process and equipments used for the control of particulate pollutants.

SECTION-B

Water Pollution:
- Types of water pollutants, their sources and effects.
- BOD and COD
- Waste water treatment techniques and equipments, flocculation, skimming, floatation, etc.
- Primary Treatment-through settling.
- Secondary Treatment-Aerobic and anaerobic digestion, activated sludge process, trickle filter and oxidation ponds.

Solid wastes: Control and disposal, sanitary landfill, incineration, pyrolysis gasification and recycling.

Books Recommended:
Examiner  |  Section B  Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION – A


SECTION – B
Service quality Management and cost of Quality: Products and services, classification of services, service quality, measuring service quality, prevention costs, appraisal costs, internal and external failure costs, cost of quality models, India’s quality journey so-far, quality related priorities of Indian Companies

Statistical quality/process control – Meaning and significance of statistical process control, Introduction to Quality control and its benefits, Variation in processes, Process capability – meaning, significance, measurement and its analysis, control charts for variables and attributes, establishing and interpreting control charts, Reliability concepts – Definition, reliability in series and parallel, product life characteristics curve, Total productive maintenance (TPM), Business process improvement principles. Concept of acceptance sampling, sampling by attributes, single and double sampling plans, inspection by samples, AQL, LTDP, consumers and producer’s risk, construction and use of operating characteristic curves, using of standard sampling tables, sampling by variables, continuous sampling plans, vendor ratings.

Six Sigma: meaning, seven magnificent quality tools, introduction to experimental method and Taguchi method, Concept, Process and application of Quality Function deployment (QFD), building House of quality, FMEA analysis-stages, design, process and documentation, benchmarking

Text books & Reference books:
2. Total Quality Management, Subburaj, TMH
4. Probability and Reliability with Statistics, Trivedi, PHI
5. Statistical Quality Control, M. Mahajan
6. TQM in Service Sector, R.P. Mohanty and R.R. Lakhe
7. Total Quality Management, Arora and Kataria

Title | HUMAN MANAGEMENT | RESOURCE | Credits  | 04
---|---|---|---|---
Code | MBA 107 | Semester: 5<sup>th</sup> | L T P | 3 1 0
Max. Marks | End term 50 | Mid term 50 | Practical -- | Elective N
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**Note for the Examiner**

The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

### SECTION- A

**Introduction:** Meaning, scope, objectives and functions of HRM; Importance & Strategic Role of Human Resource Management; HRM & HRD a comparative analysis;

**Environment of HRM:** Role of government, internal and external forces; Human Resource Management practices in India.

**Human Resource Planning:** Definition, objectives, process and importance; Job analysis, description, specification & job evaluation; Recruitment, selection, placement and induction process;

**Human Resource Development:** Concept, Employee training & development; Career Planning & development, Managing Career and Fair Treatment; Promotions, demotions, transfers, separation, absenteeism & turnover;

### SECTION- B

**Job Compensation:** Wage & salary administration, incentive plans & fringe benefits.

**Labour Legislations:** Factories Act, International Labor Organization Labor Management Cooperation/Workers’ Participation in Management, Payment of Wage Legislation Minimum Wage Legislation, Equal Remuneration Legislation

**Performance Management:** Concept & process, performance appraisal, Potential appraisal;

**Quality of work life (QWL):** Meaning, techniques for improving QWL.

**Industrial Relations:** Concept and theories, trade unions; Health, Safety & Employee welfare measures; Employee grievances and discipline, participation & empowerment; Introduction to collective bargaining, Methods of settling Industrial Disputes, Legislations Concerning Settlement of Industrial Disputes

### Text books & Reference books:


---

### Chemical Technology (Organic) Lab.

**PCC-CS 163**

**Marks:** 40  
**Credit:** 1.5

**Practicals**
1. **Oils & Fats**: Determination of Acid value, Iodine value, Saponification value.
2. **Carbohydrates**: Reducing and non-reducing sugars by (i) Fehlings method (ii) Pavy's method.
3. **Soaps**: Determination of free and combined alkali, total fatty matter, moisture and insoluble.

Environmental Engineering Lab.
OEC-OL 154     Marks: 40          Credit: 1.5

To find BOD of water sample.
1. To find COD of waste sample.
2. To find the total dissolved solids (TDS) and its volatile and non-volatile components.
3. To find the total suspended solids (TSS) and its volatile and non-volatile components.
4. To do the chromium separation by different techniques from electroplating wastes.
5. To find the phenol content of water sample and evolution of parameters.
6. To operate the electrodialysis apparatus.
7. To find the biodegradation constant (K) and the effect of timing on it.
8. To use the membrane separation techniques for salt brine and reverse osmosis process for sugar.
9. To use stack monitoring kit to find:
   a. Efficiency of a cyclone.
   b. Dust sampling.

Note: Any six of the above mentioned experiments are to be conducted.
**SYLLABUS OF B.E. (Chemical)-MBA 2020-2025**  
**THIRD YEAR**

**6th SEMESTER**

<table>
<thead>
<tr>
<th>Title</th>
<th>Transport Phenomena</th>
<th>Credits</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td>OEC-OL 102</td>
<td><strong>Semester</strong>: 6th</td>
<td><strong>L T P</strong></td>
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<tr>
<td><strong>Max.Marks</strong></td>
<td><strong>End term</strong> 40</td>
<td><strong>Mid term</strong> 35</td>
<td><strong>Practical</strong></td>
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<tr>
<td>Pre requisites</td>
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</tbody>
</table>

**THEORY**

**Note for the Examiner**  
The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**Section-A**

**Unit-1**

Introduction – mechanisms of momentum transport and their transport properties. Development of mathematical modeling and differential equations through shell momentum balance for solving problems of momentum transport in one dimension and solve these problems by using equation of change-flow of a falling film, flow through circular tube, annulus, couette viscometer.

**Unit-2**

Interphase momentum transport- definition of friction factor for flow in tubes, around spheres.

**Section-B**

**Unit-3**


**Unit-4**


**Unit-5**

Emphasis on the analogy between momentum, heat and mass transfer with respect to transport mechanisms and governing equations.

*Books Recommended:*


<table>
<thead>
<tr>
<th>Title</th>
<th>CHEMICAL REACTION ENGINEERING--I</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
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<td>4</td>
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<td>Contact Hours</td>
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</table>

**THEORY**

Note for the Examiner: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION- A**

Introduction and a brief review of the kinetics of homogeneous reactions.
Interpretation of rate data from constant volume and constant pressure systems.
Single Ideal reactors.
Design for single reactions.

**SECTION- B**

Design for multiple reactions.
Thermal characteristics of reactors: temperature and pressure effects.
Non-ideality in reactors and its effects on chemical conversion. One parameter models to represent the behaviour of chemical reactors.

**Recommended Books**


---

**Title** | CHEMICAL TECHNOLOGY (INORGANIC) | Credits |
<table>
<thead>
<tr>
<th></th>
<th></th>
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<tr>
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</table>

**THEORY**

Note for the Examiner: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.
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<table>
<thead>
<tr>
<th>SECTION-A</th>
</tr>
</thead>
</table>

**Chloralkali industry:** Electrochemistry of brine electrolysis, current efficiency, energy efficiency, diaphragm, mercurcy and dow Cells, caustic soda, chlorine.

Soda Ash: Manufacture of soda ash by Solvay and Modified Solvay process, handling and safety.

**Sulphuric Acid:** Introduction, Manufacture of sulphuric acid by Chamber and Contact process, Material of construction, Storage and handling.

**Cement:** Types of cement, Constituents of cement, Manufacture of Portland cement.

Glass-Introduction, Types of glass, Raw materials, Manufacture of glass.

<table>
<thead>
<tr>
<th>SECTION-B</th>
</tr>
</thead>
</table>

**Industrial gases:** Manufacture and uses of carbon dioxide, oxygen and nitrogen, acetylene.

**Paints:** Introduction, Classification of paints, Manufacture of paints, Requirement of a good Paint.

**Fertilizers:** Nitrogenous fertilizers- Manufacture of Ammonia, Nitric acid, Urea, CAN, Ammonium Sulphate. Phosphatic fertilizers- superphosphate and triple superphosphate. Potassic fertilizers- Potassium Chloride and Potassium Sulphate, Safety aspects.

**Books Recommended:**

<table>
<thead>
<tr>
<th>Title</th>
<th>MASS TRANSFER-II</th>
<th>Credits</th>
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<tr>
<td>Code</td>
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<td>Semester:-6th</td>
<td>L T P 3 1 -</td>
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<td>Mid term 50</td>
<td>Practical : Elective</td>
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<td>Pre requisites</td>
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</table>

**THEORY**

The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION- A**

**Absorption:** Equilibria for absorption systems – use of Raoult’s law, Henry’s law for solubility predictions, Selection of absorbent, limiting liquid gas ratios, absorption factor use in design of plate absorbers. Kremser equation for ideal plates and translation of ideal plates to real plates using various efficiencies. Concept of transfer units for the design of packed absorbers.

**Distillation:** Limitations and applications, prediction of VLE using thermodynamic & experimental techniques. Dew point & bubble point estimations for binary & multicomponent mixtures. Distillation methods – flash distillation, differential distillation for binary systems, steam distillation, optimum reflux ratio. Fractionation of binary mixtures using McCabe – Thiele method and enthalpy

**SECTION- B**

**Liquid-Liquid Extraction**: Ternary Equilibria and its representation on various plots. Selection criteria for solvent, Multistage extraction using partially miscible & immiscible solvents. Stagewise contact for countercurrent and crosscurrent extraction. Constructional details of equipment like mixer-settler, packed columns, pulsed extractor, sieve-tray extractor and centrifugal extractor.

**Leaching**: Preparation of solid, countercurrent and crosscurrent multistage contact Shank’s system. Constructional details of equipment like Rotocel extractor, Hildebrandt extractor, Bollman extractor, Kennedy Extractor & Beet-Sugar Diffusion battery extractor.

**Adsorption**: Types of adsorption, nature of adsorbents, equilibria for adsorption systems. Brief manufacture and commercial applications and characteristics for common adsorbents. Stagewise & continuous contacting of fluid and solid phase. Description of contact filtration adsorption system. Hypersorber ion-exchange system.


**Recommended Books**


**Title**: Process Plant Design-II  
**Credits**: 1.5  
**Code**: PEC-CSEL 153  
**Semester**: 6th  
**L T P**: - - 3  
**Max.Marks**: End term Mid term Practical:40 Elective N  
**Pre requisites**: Contact Hours 45  

**Practical**

1. Process design and specifications of double pipe heat exchanger, shell and tube heat exchanger, plate type heat exchanger, condenser and reboiler.
2. Design of distillation column, calculation of number of plates, height and design of fractionator internals- sieve tray.
3. Absorber/Stripper design of stage-wise and continuous contact equipment (packed column), height of column and diameter calculations. HTU and NTU.
4. Design aspects of fixed bed reactors and fluidized bed reactors.

**Books Recommended**: 
5. Shell and Tube Type Heat Exchangers, Indian Standards.

Mass Transfer Lab.
PCC-CS 158 Marks: 40 Credit: 1.5
Practical
1. Determination of mass transfer coefficients for naphthalene-air system.
2. To determine drying rate curves for different wet solids in a batch drier under constant drying conditions.
3. Fractional approach to equilibrium for liquid-liquid extraction from single drop.
4. Verification of Rayleigh’s equation for differential distillation.
5. Determination of flooding velocities in packed columns.
6. Determination of HETP for packed distillation columns.
7. Study and operation of a pilot sized distillation column under total reflux.
8. Study of different mass transfer equipments.

CHEMICAL REACTION ENGG.-I LAB.
PCC-CS 157 Marks: 40 Credit: 1.5
Practical
1. Kinetic studies in a batch reactor.
2. Kinetic studies in a plug flow reactor.
3. Kinetic studies in a CSTR.
4. Kinetic studies in a semi batch reactor.
5. RTD studies in CSTR.
6. Dispersion number for packed bed reactor.
7. Adiabatic batch reactor.

CHEMICAL TECHNOLOGY (INORGANIC) LAB.
PCC-CS 159 Marks: 40 Credit: 1.5
1. Fertilizers (i) Determination of N-P-K Values
   (ii) Determination of micronutrients
2. Cement: Loss of ignition, silica, insolubles, estimation of Mg, Ca, Fe.
3. Water

<table>
<thead>
<tr>
<th>Title</th>
<th>CHEMICAL ENGINEERING COMPUTATION LAB.</th>
<th>Credits</th>
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<tr>
<td>Practicals</td>
<td>Contact Hours</td>
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<td>45</td>
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<tr>
<td>Errors analysis, Solution of linear and non-linear algebraic equations.</td>
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<tr>
<td>Numerical differential &amp; integration.</td>
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<tr>
<td>Interpolation.</td>
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<td></td>
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<tr>
<td>Least squares approximation.</td>
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<tr>
<td>Ordinary and partial differential equations.</td>
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<tr>
<td>Development of computer programs based on the above topics using Matlab and their applications in chemical process computations.</td>
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</table>

**Recommended Books:**

## SYLLABUS OF B.E. (Chemical)-MBA 2020-2025
### FOURTH YEAR

### 7th SEMESTER

<table>
<thead>
<tr>
<th>Title</th>
<th>CHEMICAL ENGINEERING-II</th>
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<td>Pre requisites</td>
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<td>Contact Hours</td>
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</table>

### THEORY

#### Note for the Examiner
The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

#### SECTION- A

- Heterogeneous catalyses: A brief review of catalyses catalytic specificity. Preparation of catalysts, catalyst poisoning and catalyst regeneration.
- Fluid Solid catalytic reaction: Kinetics; external transport processes, Reaction -and diffusion within porous spherical catalyst pellet. Effective diffusivity, thermal conductivity and effectiveness factors.

#### SECTION- B

- Fluid - fluid reactions rate equations and their application to the design of reactors.
- Fluid Solid non-catalytic reactors rate equations and their application to the design of reactors.
- Analysis of rate data design outline and selection of fixed bed, fluidised bed and slurry reactors for fluid solid catalytic reactions.

### Recommended Books

1. Levenspiel, O : Chemical Reaction Engg., John Wiley

### PROCESS DYNAMICS & CONTROL

<table>
<thead>
<tr>
<th>Title</th>
<th>PROCESS DYNAMICS &amp; CONTROL</th>
<th>Credits</th>
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</tr>
</thead>
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<tr>
<td>Code</td>
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<td>Semester:-7th</td>
<td>L T P</td>
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<tr>
<td>Max.Marks</td>
<td>End term 50</td>
<td>Mid term 50</td>
<td>Practical</td>
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<td>Pre requisites</td>
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</table>

### THEORY

#### Note for the Examiner
The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

#### SECTION- A

- Incentives for chemical process control, design aspects of a process control system. Difference between feedback and feed forward control configuration. Hardware elements of a control system, Block Diagrams.
- Laplace transform and transfer functions. Difference between lumped and distributed parameter systems, Dynamic behaviour of first and higher order systems, interacting and non-
interacting systems, dead time.
Different modes of control actions and their basic characteristics, controllers and their characteristics, control valve.

**SECTION- B**

Closed-loop transfer functions, transient response of simple control systems, Routh stability criterion, Root Locus.
Introduction to frequency response: Bode diagrams, control system design by frequency response: Ziegler-Nichols controller settings, stability using frequency response, gain margin and phase margin.
Introduction to advanced control techniques such as cascade control, feed forward control, ratio control, inferential control.

**Recommended Books**


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<table>
<thead>
<tr>
<th>Title</th>
<th>Process Modelling &amp; Simulation</th>
<th>Credits</th>
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<td>Code</td>
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<td>Pre requisites</td>
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</tbody>
</table>

**Practical**

Functional design, property estimate as inputs for design. System concepts for computer aided design, computer aided flow sheet design. Process analysis. Process variables selection, equipment design through the selection of free parameters subject to constraints and other parameters, modular design. Simulation optimality. Dynamic design including control stability.

Typical equipments to be considered: heat exchangers, distillations columns, reactor and process equipments.

*Books Recommended:*


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<table>
<thead>
<tr>
<th>Title</th>
<th>Process Engineering Economics</th>
<th>Credits</th>
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</table>
THEORY

Note for the Examiner

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SECTION-A


Interest and Investment Costs: Simple and compound interest. Nominal and effective rates of interest. Continuous interest ordinary annuity. Perpetuities and capitalized costs.

Taxes and Insurance: Types of taxes and tax returns, types of insurance and legal responsibility.

Depreciation: Types of depreciation. Service life, salvage value, present value and methods of determining depreciation, single unit and group depreciation.

SECTION-B


Optimum Design: Procedure with one variable, optimum reflux ratio in distillation and other examples.


Books Recommended:


Title | MARKETING MANAGEMENT | Credits | 4
---|---|---|---
Code | MBA 108 | Semester:-7th | L T P | 3 1 -
Max.Marks | | | | | | |
End term 50 | | | | | | |
Mid term 50 | | | | | | |
Practical | | | | | | |
Elective | | | | | | |
N
"Pre requisites" | - | | | | | |
Contact Hours | | | | | | |
60 (Theory)

THEORY

Course Objective

The course aims at making participants understand concepts, philosophies, processes and techniques of managing the marketing operations of a firm with a view to better understand and appreciate the complexities associated with the marketing function.

Note for the Paper setter: The question paper should be divided into Section A and
Examiner | Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

<table>
<thead>
<tr>
<th>SECTION-A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marketing Environment:</strong> Marketing Environment; New Marketing Realities; New Consumer Capabilities; Demographic Environment; Social-Cultural Environment; Natural Environment; Technological Environment and Political-Legal Environment; Concept of Big Data – Marketing Intelligence Market Strategic Planning – Elements of Marketing Plan SWOT analysis.</td>
</tr>
<tr>
<td><strong>Analyzing Markets:</strong> Marketing Research Process; Sources of data collection; factors influencing consumer behavior; buying decision process; post-purchase behavior; Organizational Buying; Stages in the Buying Process.</td>
</tr>
<tr>
<td><strong>Market Segmentation:</strong> Levels of market segmentation; segmenting consumer markets; Niche Marketing; segmenting business markets; Michael Porter’s five forces model; Analyzing competitors; Competitive Market Strategies – Leaders, Challengers, Followers &amp; Nichers; Targeting and Positioning.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION-B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pricing Strategies:</strong> Understanding Pricing- pricing decisions, determinants of price.; Setting the Price, policies and strategies; Initiating and Responding to Price Changes; Reactions to Competitor’s Price Changes.</td>
</tr>
<tr>
<td><strong>Marketing Channels:</strong> Marketing Channels; Role of Marketing Channels; Identifying Major Channel Alternatives; Types of Intermediaries; Channel-Management Decisions, Retailing, Wholesaling, selection and management of intermediaries.</td>
</tr>
<tr>
<td><strong>Marketing Communication:</strong> The Role of Marketing Communications; Communications Mix-Advertising, Sales Promotion, Public Relations and Publicity, Events and Experiences, Direct and Interactive Marketing, Personal Selling.</td>
</tr>
<tr>
<td><strong>Marketing organization and control:</strong> organizing for marketing; marketing implementation&amp; control-Concept, Process &amp; Types of Marketing Control – Marketing Audit – Marketing Challenges in Globalized Era – Marketing through Social Network &amp; Digital platforms – Social Marketing – Elements of Social Marketing Plan – Green Marketing – Consumerism – Introduction to Marketing Analytics; ethics in marketing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Text books &amp; Reference books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Britt and Boyd (ed): Marketing Management and Administration, 2nd , PHI.</td>
</tr>
<tr>
<td>6. Converse Paul and Harvey W.Hugg: Elements of Marketing, 7th ed., PHI.</td>
</tr>
</tbody>
</table>
1. U-Tube manometer
   (a) To plot the response curve for a given input to a U-tube manometer.
   (b) To determine the transfer function from the response curve obtained in part (a).

2. Time constant of a mercury thermometer
   To study the dynamics of the given thermometer and compare the theoretical value of its time constant with the experimental value.

3. Analysis of valve
   Develop a block diagram representing the dynamic behaviour of the given globe valve.

4. (a) Liquid level measurement
   With the given Bubbler System for Liquid Level Measurement, evaluate liquid height in the tank and compare it with actual values.
   (b) Calibration of Pressure Gauge
   Calibrate a pressure gauge in the range 0 psi to 60 psi.

5. Temperature control system
   To maintain the temperature of the fluid at the set point value.

6. Time constant of liquid level tank
   To study the dynamics of liquid level in a tank and compare the analytical value of the time constant with the experimental value.

7. Liquid level control
   (a) To carry out the closed loop experiment on the given liquid level control system and record its response for step change in the inlet flow.
   (b) To plot the experimental response curve and comment on the response obtained.

8. Compurec
   Pressure control simulation with step input and sinusoidal input.
**SYLLABUS OF B.E. (Chemical)-MBA 2020-2025**

**FOURTH YEAR**

**8th SEMESTER**

<table>
<thead>
<tr>
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<th>Process Instrumentation</th>
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<tr>
<td>Semester:</td>
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<td>L T P</td>
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<tr>
<td>Pre requisites</td>
<td></td>
<td>Practical</td>
</tr>
</tbody>
</table>

| Contact Hours          | 60                      |

**THEORY**

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**SECTION-A**

**General Concept:** Need and classification of measurements and instruments, Basic and auxiliary functional elements of a measurement system. Static and Dynamic Characteristics of Instruments: Static Characteristics: Range and span, accuracy and static error, reproducibility and drift, sensitivity and dead zone. Dynamic Characteristics: Speed of response and lag, fidelity and dynamic error, dead time.

**Temperature measurement:** Bimetallic thermometers, filled-in system thermometers. Thermocouples, metal resistance thermometers and thermistors, optical and radiation pyrometers, radiation receiving elements.

**Pressure measurement:** Bourdon gauge, Bellows type gauge. Vacuum measurement– Mcleod gauge, thermoionic type ionization gauge, pirani vacuum gauge. Measurement of pressure in corrosive fluids: Diaphragm seal, liquid seal and purge system.

**SECTION-B**

**Liquid level measurement:** Direct measurement of liquid level– Float & tape liquid level gauge, float and shaft liquid level unit, hydraulic remote transmission of liquid level. Level measurement in open vessels: Bubbler system, diaphragm box system, air trap system. Level measurement in pressure vessels– Differential pressure manometer, use of liquid seals with a manometer, displacement float liquid level gauge.

Measurement of viscosity, conductivity, humidity and pH.

**Density measurement:** Liquid level method, displacement meter and hydrometer.

**Weight measurement:** Spring scale, pneumatic force meter and hydrostatic force meter.

**Process Instrumentation:** Recording instruments, indicating and signaling instruments, control centre, transmission of instrument reading, instrumentation diagrams.
### Books Recommended:

2. Eckman, Donald P. : Industrial Instrumentation, CBS Publisher and Distributors

<table>
<thead>
<tr>
<th>Title</th>
<th>BUSINESS ENVIRONMENT</th>
<th>Credits</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>MBA 109</td>
<td>Semester: 8th Semester</td>
<td>L T P</td>
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<tr>
<td>Max.Marks</td>
<td></td>
<td>End term 50</td>
<td>Mid term 50</td>
</tr>
<tr>
<td>Pre requisites</td>
<td></td>
<td>-</td>
<td>Contact Hours</td>
</tr>
</tbody>
</table>

Course Objective: This course aims at orienting the students with all the external environmental forces which affect the decision making process of an organization.

**THEORY**

Note for the Paper setter: The question paper should be divided into Section A and Section B. Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION – A**

**Concept of business environment:** Its significance and nature, interaction matrix of different environment factors, process of environmental scanning, Economic Environment of Business, Politico-legal environment of business, environmental scanning of important industries of India;

**Economic environment:** The philosophy, strategy and planning in India, monetary policy and their impact on Indian business, industrial policy foreign trade policy and their impact on Indian business, political environment: relation between business and government of India. Constitutional provisions related to business, concept of state intervention in business, ideology of different political parties, bureaucracy and Indian business.

**Economic Planning in India:** Objectives, Strategies and Evaluation of Five Year Plan; Public Sector in India; Privatization and Disinvestment; New Economic Policy-Liberalization and Structural Adjustment Programmes; Economic Systems.

**Economic Policies in India:** Monetary Policy as an instrument of growth; Fiscal Policy and Indian business; Industrial Policy and Industrial Licensing in India; EXIM Policy, MRTP Act, FERA, FEMA

**SECTION – B**
**Technological environment:** Policy for research and development in India, appropriate technology, debate of technology vs labour, MNC as a source of transfer to technology and its implication, institutional infrastructure for exports in India, India’s export-import policy, global business environment, significance of foreign investment in India, opportunities and threats in WTO and the new international trading regime, tariff and non tariff barriers in global trade.

**Socio-cultural environment in India:** Critical elements of socio – cultural environment-salient features of Indian culture values and their implication for Indian business, middle class in India and its implications on industrial growth in India, consumerism as emerging force, social responsibility of business, business ethics and Indian business, impact of mass media on Indian business; Emerging rural sector in India and Indian Business; changing role of rural sector in India: rural income and rural demand of consumer durable.

**International Economic Environment:** Globalization - concept and emergence of globalization; Foreign Direct Investment; Benefits and Problems from MNCs; WTO-its role and functions, implications for India; Devaluation of Rupee

**Text books & Reference books:**
1. RuddarDatt & K.P.M. Sundaram: Indian Economy, Sultan Chand and Sons.

<table>
<thead>
<tr>
<th>Title</th>
<th>PROJECT MANAGEMENT &amp; ENTREPRENEURSHIP</th>
<th>Credits</th>
<th>04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>MBA 110</td>
<td>Semester:-8th</td>
<td>L T P</td>
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<tr>
<td>Max.Marks</td>
<td>End term</td>
<td>Mid term</td>
<td>Practical</td>
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<tr>
<td>THEORY</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECTION- A**

Project Formulations and Planning ,Private commercial criteria for project choice, project cycle, feasibility, marketing feasibility, Financing for Projects and financial feasibility, Project Implementation. Brief outline of social cost benefit analysis: rationale, UNIDO and little Mirrlees approaches, UNIDO IDCAS manual

**Project appraisal:** time value of money, project appraisal techniques: payback period, accounting rate of return, net present value, internal rate of return, benefit cost ratio, social cost benefit analysis, effective rate of protection, risk analysis: measures of risk, sensitivity analysis, simulation analysis, decision tree analysis.
Project scheduling/network techniques in project management: CPM and PERT analysis, float times, crashing of activities, contraction of network for cost optimization, updating, cost analysis of resources allocation, multiple projects: project dependence, capital rationing, ranking methods of projects, mathematical programming approach, linear programming model, post project evaluation.

SECTION- B


Text books & Reference books:

1. Prasanna Chandra: Projects: Preparation, Appraisal Budgeting and Control, 7th edition, TMH.
6. IMD little and J.A. Mirrles: Project Appraisal and Planning in Developing Countries,
9. Peter F. Drucker: Innovation and development

Title | Financial Accounting | Credits | 4
--- | --- | --- | ---
Code | MBA 111 | Semester:-8th | L T P 3 1 -
Max.Marks | End term 50 | Mid term 50 | Practical -- | Elective N
Pre requisites | - | Contact Hours 60 (Theory)

THEORY

Note for the Examiner: Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Accounting: Accounting and its functions; Accounting as an information system; Basic Accounting Concepts and Accounting Conventions; Accounting Principles; Generally Accepted Accounting Policies (GAAP); Accounting Standards.

Branches of Accounting: Financial Accounting; Cost Accounting; Management Accounting; Accounting Equation; Accounting Structure; Types of Accounts. Rules regarding Journal Entries; Recording of Journal Entries; Ledger Posting; Cash book; Trial Balance; Preparation of Final Accounts; Trading Account; Profit & Loss Account; Balance Sheet; Treatment of Adjustments into trial balance.

Meaning of Management Accounting: Nature; Scope; Objectives; Functions of Management Accounting; Relationship between Financial and Management Accounting; Meaning of Financial Statement; Importance and Limitations of Financial Statement; Meaning and Objectives of Financial Statement Analysis; Limitation of Financial Analysis.

SECTION-B

Tools of financial analysis: Ratio analysis; Common size statements; Trend analysis; Fund flow and
cash flow statement.
Cost Accounting: Meaning, scope and classification of costs; Absorption costing; Marginal costing and break even analysis; Use of cost data in managerial decision making.
Cost Control Techniques: Preparation of budgets and their control; Zero base budgeting; Standard costing and variance analysis; Responsibility Accounting; Target costing; Kaizen costing; Activity based costing.
Responsibility Accounting: Meaning; Steps involved in Responsibility Accounting; Responsibility Centre; Advantages of Responsibility Accounting.
Price Level Accounting: Meaning; Methods or Techniques of Price Level Accounting; Advantages; Disadvantages;
Social Accounting: Concept of Social Cost Benefit Analysis; Meaning of Social Accounting; Need; Social Accounting Approaches.
Human Resource Accounting: Meaning; Need; Methods of Human Resource Accounting; Objections Against Human Resource Accounting; HRA in India.

Text books & Reference books:

PROJECT WORK
Proj. Marks: 50 Credit: 2
Each student is required to submit a project report on the design of a chemical plant, selecting the best process with optimum equipment size and operating conditions. The object is to test the ability of the student to apply his entire knowledge of Chemical Engineering principles to conceptualize, analyze and solve the problems. To judge his knowledge and originality and capacity for application of laboratory data in designing chemical plants and to determine the level of his proficiency at the end of the course.

<table>
<thead>
<tr>
<th>Title</th>
<th>Literature Survey, Report Writing &amp; Seminar</th>
<th>Credits</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Proj.</td>
<td>Semester:-8th</td>
<td>L T P</td>
</tr>
<tr>
<td>Max.Marks</td>
<td>End term</td>
<td>Mid term</td>
<td>Practical: 40</td>
</tr>
<tr>
<td>Pre requisites</td>
<td>Contact Hours</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

Practical

Forms of technical reports: aims and forms according to type of readership and extent of circulation. Abstracts, extended abstracts, tables, graphs. Visual representation of data: slides, microfilms, others techniques including those of audio-visual representation. Correct use of audio equipment.
Research papers and their presentation and publication. Information retrieve direct and through abstracts.
Practical training in writing and presentation of technical reports through audio-visual means. Technique of effective public speaking organized and imprompt discussions.
Preparation of technical report on an assigned topic after survey of scientific, technical and commercial literature, using card indexes, microfilms and other information retrieval methods.
Use of Computer softwares for report writing.

Books Recommended:
2. Sottle, R.T. : The Use of Chemical Literature, Butter Worths.

Paper Title: Open Elective (Theory)

Course Duration: 45 Lectures of one hour each.

FUEL CELL TECHNOLOGY (Theory)

<table>
<thead>
<tr>
<th>Theory</th>
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Section-A
Overview of fuel cells: Low and high temperature fuel cells;
Fuel cell thermodynamics - heat, work potentials, prediction of reversible voltage, fuel cell efficiency.
Fuel cell reaction kinetics - electrode kinetics, overvoltages, Tafel equation, charge transfer reaction, exchange currents,
Electrocatalyses - design, activation kinetics,
Fuel cell charge and mass transport - flow field, transport in electrode and electrolyte.

Section-B
Fuel cell characterization: - in-situ and ex-situ characterization techniques, i-V curve, frequency response analyses; Fuel cell modeling and system integration: - 1D model - analytical solution and CFD models. Balance of plant; Hydrogen production from renewable sources and storage; safety issues, cost expectation and life cycle analysis of fuel cells.

Books Recommended


NANO TECHNOLOGY (Theory)
Section-A

Introduction: Plenty of room at the bottom-Feynman’s concept, evolution of ultra-fine materials, the missing link between conventional laws in physics and chemistry and new theories.

Building Blocks of Nanotechnology: covalent architecture, coordinated architecture and weakly bound aggregates, Interactions and topology

Chemical Properties: The effect of nanoscale metals on chemical reactivity, effect of nanostructure on mass transport, metal nanocrystallites support on oxides, supported nanoscale catalysts.

General principles for synthesis of monodispersed nanoparticles, metals and intermetallics, Ceramics, composites, nanoparticles, colloids/Micelles/vesicles/Polymers/glasses, Crystalline, and zeolite hosts.

Review of fundamental behaviour of 0-D(nanoclusters), 1-D(nanowires), 2-D(thin film multilayers), and 3-D(bulk nanostructures) materials. Introduction to size dependent phenomenon in nanostructure for various applications, specific production techniques like chemical vapor deposition, arc ignition etc. Formation of clusters and nanoparticles from supersaturated vapor and selected properties, sputtering and thermal evaporation and laser methods. Synthesis of nanoparticles by chemical routes.

Section-B

Approaches to production: Top down and bottom up, Mechanical attrition, high energy ball milling, and mechanical attrition, nanocomposites by mechano-chemistry, mechanism of grain size reduction, property of microstructure relationships.

Characterization techniques: Tools in nanotechnology: Scanning electron microscopy(SEM), Transmission electron microscopy and high resolution(TEM), energy dispersive spectroscopy (EDX), Atomic force microscopy(AFM), Magnetic force microscopy(MFM), Chemical Force Microscopy(CFM), Focused ion beam, nanolithography, powder x-ray diffractometry, UV visible.

Nanomaterials: CNTs, Polymer Nanocomposites nanoceramics, nanometals, nanopolymers, structures-properties-applications, Quantum dots. Concepts Bio-Nanotechnology.

Applications: Nanotherapeutics, Molecular diagnostics, tissue engineering, nanopumps, nanoroboics cells, molecular motors, nanomembranes, Organic molecular based computers, bionanodevices (sensors & actuators).

Books Recommended

2. Nanotechnology – An introduction to nanostructure of technique by Michel Kohler and Wolfgang Frittsche 2004- Wiley VCH
3. Springer Handbook of Nanotechnology by Bharat Bhushan
5. Nanostructures and Nanomaterials by G. Cao, Imperial College Press, 2004
6. Introduction to Nanotechnology by Owen and Poole, Wiley
THEORY Time 3 Hours

Note for the Examiner
The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section-A

Chemistry of polymers:
Monomers, functionality, degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubberiness,
Polymerization methods: addition and condensation; their kinetics, copolymerization, monomer reactivity ratios and its significance, kinetics, different copolymers, random, alternating, azeotropic copolymerization, block and graft copolymers, techniques for copolymerization-bulk, solution, suspension, emulsion.

Polymer Characterization:
Solubility and swelling, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights, polymer crystallinity, analysis of polymers using IR, XRD, thermal (DSC, DMTA, TGA), microscopic (optical and electronic) techniques.

Polymer Technology:
Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, crosslinking and vulcanization

Polymer processing:
Compression molding, transfer molding, injection molding, blow molding, reaction injection molding, extrusion, pultrusion, calendaring, rotational molding, thermoforming, rubber processing in two-roll mill, internal mixer.

Books Recommended:


Title MATHEMATICAL AND STATISTICAL METHODS Credits 3

Objectives The students shall
- Learn to solve difference equations with constant coefficients.
Learn to find Z-transforms and inverse Z-transforms and apply these to solve difference equations.
Learn to find correlation, coefficient of correlation, rank correlation, regression and standard error of estimate.
Learn various Probability distributions, test of significance and goodness of fit.

Note for examiner
The semester question paper of the subject will be of 40 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting atleast two questions from each Section.

<table>
<thead>
<tr>
<th>SECTION A</th>
<th>Hrs</th>
</tr>
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<tbody>
<tr>
<td><strong>Difference equations:</strong> Solution of difference equations with constant coefficients, Complementary function and Particular solution.</td>
<td>5</td>
</tr>
<tr>
<td><strong>Z-Transforms:</strong> Introduction, Some standard Z-transforms, Linearity property, Damping rule, Some standard results, Shifting rules, Initial and Final value theorems, Evaluation of inverse transforms: Power series method, Partial fractions method, Inversion integral method, Applications in the solution of difference equations.</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION B</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Statistical Methods:</strong> Correlation, Coefficient of correlation, Lines of regression, Standard error of estimate and Rank correlation.</td>
<td>6</td>
</tr>
<tr>
<td><strong>Probability Distributions:</strong> Binomial distribution, Poisson distribution and Normal distribution, Test of significance for large samples, Comparison of large samples, Means of two large samples, Student’s t-distribution, chi²-test, Goodness of fit.</td>
<td>12</td>
</tr>
</tbody>
</table>

**Text Books**

**Reference Books**

**Course Assessment Methods**
Assessment will consist of the following components
1. Mid-Term
   e. One best of two minor tests (50% of Mid-term marks)
   f. Assignments (20% of Mid-term marks)
   g. Class Surprise Tests/Quizzes/Presentations/Term paper (20% of Mid-term marks)
   h. Attendance (10% of Mid-term marks)
2. End-Term

**Course Outcomes**
The students are able to:
- solve difference equations with constant coefficients.
- find Z-transforms and inverse Z-transforms and apply these to solve difference equations.
- find correlation, coefficient of correlation, rank correlation, regression and standard error of estimate.
- apply various probability distributions, test of significance and goodness of fit.
### Paper Technology

<table>
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</table>

**SECTION-A**

Introduction, raw materials, pulping processes, sulphate pulp, soda pulp, sulphite pulp, beating, refining, filling, sizing and colouring.

**SECTION-B**

Manufacture of paper, calendaring, pollution problem, recovery of chemicals from spent liquor from sulphate and sulphite process.

**Books Recommended:**


### Fertilizers

<table>
<thead>
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**SECTION-A**

Introduction, classification of fertilizers, mixed fertilizers, fixation of nitrogen, manufacture of ammonia based fertilizers.

Phosphatic fertilizers: Raw materials, single superphosphate, triple superphosphate.

**SECTION-B**

Potassic fertilizers: Manufacture of potassium chloride and potassium sulphate, compound and complex fertilizers, bulk blended fertilizers, fluid fertilizers and pollution problems.

**Books Recommended:**

Paper Title: Departmental Elective (Theory)

Course Duration: 60 Lectures of one hour each.

PETROLEUM PROCESSING ENGINEERING (Theory)

<table>
<thead>
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<th>THEORY</th>
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<td></td>
</tr>
</tbody>
</table>

Section-A
Introduction to petroleum industry, world petroleum resources, petroleum industry in India. Origin, exploration & drilling of petroleum crude. Transportation of crude and products.
Crude pretreatment: Refining and distillation of petroleum crude, composition and classification of petroleum crude, methods of evaluation: ASTM, TBP and EFV distillation. Properties and specifications of petroleum products such as LPG, gasoline, naphtha, kerosene, diesel, lubricating oils and waxes.

Section-B
Separation Processes: Design and operation of topping and vacuum distillation units and tube still furnaces. Solvent extraction processes for lube oil base stock and for aromatics from naphtha and kerosene steams, solvent dewaxing.
Conversion Processes: Thermal cracking: visbreaking and coking processes, catalytic cracking, thermal reforming and catalytic reforming, alkylation, polymerization, isomerisation and hydroprocessing.
Safety and pollution considerations in refineries.

Books Recommended:

INDUSTRIAL SAFETY & HAZARDS (Theory)

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Section-A
Definition, Hazards identification, Hazards and operability studies (HAZOP), Failure mode and effect analysis (FMEA), classification and assessment of various types of hazards in work-place environment and Industrial Hygiene, protective and preventive measures in hazard control.
Toxic Chemicals: maximum allowable concentrations and other standards. Biological threshold limit values.

Section-B
Fire prevention, design to prevent fire and explosion (inverting static electricity, sprinkler system), boiling liquid expending vapour explosion (BLEVE). Fire triangle, Dow’s Fire and explosion index, dilution and ventilation.


Case Studies of typical hazardous industries.

**Books Recommended:**


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### PLANT UTILITIES (Theory)

**THEORY**

<table>
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</table>

**Section-A**

Importance of Process utilities in Chemical Plant.

*Compressed air and Vacuum*: Reciprocating air compressors, vacuum pumps, air receivers, piping systems.

*Steam*: Boiler, steam handling and distribution steam nozzles.

**Section-B**

*Refrigeration*: Air refrigeration cycle, vapour compression cycle, liquification processes.

*Power Generation*: Internal Combustion engines. Gas turbines, steam power plants.


**Books Recommended:**


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### PETROCHEMICAL TECHNOLOGY (Theory)

**THEORY**

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</table>
Section-A
General Introduction: Definition, history and economic perspective of petrochemical industry, raw materials for petrochemical industry-petroleum, natural gas, coal, bio-mass, agro-residues, etc.
First Generation Petrochemicals: Petrochemicals based on aliphatic, olefinic, acetylene, aromatics, etc. Hydrocarbons-processing and applications.

Section-B
Nylon Monomers, Polyester Monomers, Styrene, Other Monomers - Bisphenol A, Epichlorohydrin, diisocyanates, Pentaerythritol, etc. - properties, process technologies and applications.
Third Generation Petrochemicals: Important Polymers such as Polyethylene, Polypropylene and their Copolymers and other Derivatives Rubbers, Diene Polymers, Styrene Polymers, Vinyl Polymers and Condensation Polymers - properties, process technologies and applications.

Books Recommended:

BIOCHEMICAL ENGINEERING (Theory)

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biological reactors. Fermentation technology, product manufacture by fermentation, reactors for biomass production.

Books Recommended:


FOOD PROCESSING (Theory)

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SECTION A


SECTION B


Reference Books


Department Elective Lab.
Code: PEC-CSEL 152  Marks: 40  Credit: 1.5

Petroleum Processing Engineering
Practicals
1. To plot ASTM distillation curve for gasoline, diesel oil.
2. To determine Flash point (Closed – cup) and smoke point for kerosene.
3. To determine Aniline point, Diesel Index and cetane number for diesel oil.
4. To determine pour point and cloud point for furnace oil and diesel oil.
5. To determine viscosity at different temperatures using Ostwald viscometer for hydrocarbon solvents.
6. To determine softening point and penetration number for asphalt and grease samples.
7. To determine viscosity index of lubricating oil by Redwood viscometer.
8. To determine water content in petroleum products by Dean and Starks method.
# SYLLABUS OF B.E. (Chemical)-MBA 2020-2025

## FIFTH YEAR

### 9th SEMESTER

<table>
<thead>
<tr>
<th>Title</th>
<th>FINANCIAL MANAGEMENT</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>Code</td>
<td>MBA 112</td>
<td>04</td>
</tr>
<tr>
<td>Semester: 9th</td>
<td>L T P</td>
<td>3 1 0</td>
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<tr>
<td>Max.Marks</td>
<td>End term 50</td>
<td>Mid-term 50</td>
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<tr>
<td></td>
<td>Practical - Elective</td>
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</tr>
<tr>
<td>Pre requisites</td>
<td>Financial Accounting</td>
<td>Contact Hours</td>
</tr>
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### SECTION- A

- **Introduction to Financial Management**: Meaning; Scope; Finance Function; Financial Goals; Agency Problem; Relationship of Finance with Accounts and Economics
- **Sources of Finance: Features**: Advantages and Limitations of Equity Shares; Preference Shares; Debentures; Term-Loans; Right Issue, Venture Capital, Private Equity GDR, ADR.
- **Cost of Capital: Meaning**: Calculation of Cost of Debt Capital; Equity Capital; Preference Capital; Retained Earnings; Weighted Average Cost of Capital.
- **Capital Structure: Meaning**: Determinants; Assumptions; Net Income and Operating Income Approach; Traditional Position; M-M Position; EBIT and EPS Analysis; Capital Structure and Taxation.
- **Leverage Analysis: Meaning**: Types; Estimation of Financial; Operating and Combined Leverage; Relation of Financial Leverage with Risk and Return.
- **Management of Working Capital**: Meaning of WC; Need of WC Management; Determinants of WC; Operating Cycle; Estimation of WC; Working Capital Financing; Trade Credit, Bank finance, commercial paper, factoring, money market instruments.

### SECTION- B

- **Cash Management**: Meaning; Facets of Cash Management; Motives for Holding Cash; Optimal Cash Balance; Short-term and Long-Term Cash Forecasting.
- **Receivable Management**: Meaning; Credit Policy Variable; Credit Evaluation; Credit Decisions; Control of Account Receivable.
- **Inventory Management**: Meaning; Need to hold Inventory; Objective of Inventory Management; Inventory Investment Analysis; Inventory Control System.
- **Capital Budgeting**: Meaning; Basic Principles of Costs and Benefits; Investment Criteria; Pay back Method; Accounting Rate of Return method; Net Present Value method; Benefit-Cost Ratio; Internal Rate of Return; Capital Rationing; Introduction to Basic Techniques of Risk Analysis in Capital Budgeting.
- **Dividend Decisions**: Meaning and Types of Dividend; Issues in Dividend Policy; Traditional Model; Walter Model; Gordon Model; Miller and Modigliani Model; Bonus Shares and Stock Splits.
- **Corporate Restructuring**: Meaning and forms of corporate restructuring, merger and amalgamation takeover and acquisition, types or forms of mergers and takeovers, their benefits and motives.

### Text books & Reference books:
- James C.Van Horne: Financial Management, Pearson Education
GROUP-A: FUNCTIONAL SUBJECTS 1& 2

<table>
<thead>
<tr>
<th>Title</th>
<th>MARKET RESEARCH AND PRODUCT MANAGEMENT</th>
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THEORY Time

Note for the Examiner
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

SECTION- A

An overview of marketing research-definition and scope; phases, changes due to technology including the internet; the marketing research industry, experimental research design, application of marketing research and the following techniques of multivariate analysis to marketing mix elements viz.-factor analysis, cluster analysis, multi dimensional scaling and conjoint analysis, product research, advertising research-setting advertising objectives, concept testing, audience profiling, copy research, media research.

Pricing research including use of conjoint analysis for this purpose, package research distribution research, research for market segmenting including the use of cluster analysis for this purpose, scale validation-relationship of validity and reliability-their types and their estimation, qualitative research tools including ethnography and laddering

SECTION- B

Product management : in context of business strategy, the relationship of product management to the marketing concept, product mix concept, product classification, product planning: marketing plan, portfolio analysis, market potential and forecasting, product market strategies, product life cycle : stages and corresponding strategies, product evaluation, product positioning : concept, product differentiation, positioning strategies, preference analysis, benefit segmentation, new products : the importance of innovation, new product categories, organization for product management, prototyping, new product development process, test marketing.

Socio cultural meaning of brands: understanding the social psychology of brands, emotions and brands, symbolic meaning of brands, cultural meaning systems and brands, brand equity:introduction and definition, name value, model of brand equity synthesis, auditing and measuring brand equity managing brands, branding strategies for functional and symbolic brands, brand stretching and retrenching, branding services and managing the corporate brand, brands and advertising

Text books & Reference books:
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

**SECTION- A**

**Introduction to Supply Chain Management:** Definition; Scope & Importance of Supply Chain Management; Key Drivers Of the SCM; Features of Supply Chain Management; Supply Chain Network – 1st Tier, 2nd Tier; Network decisions in SCM; Suppliers and Customers; Customer Service Dimension (Seven “R” Principles, Service after sale, Customer delight)

**Role of Logistics in Supply Chains:** Definition of Logistics Management; Scope and role of Transportation, Traffic & transportation; Relationship between transportation and other business functions, Transport Economics: Distance – volume-density, Freight Cost, Handling, Liability, market factors; Third party logistics (3 PL) & fourth party logistics service provider (4 PL), Logistics equipment; Reverse Logistics, Government rule & regulations related to Logistics; Purchase Cycle, Make or Buy, Price analysis, Negotiations.

**SECTION- B**

**Inventory Management:** Inventory Control, Planning & Managing Inventories; Warehouse Management (Receipt, issue, storage and preservation, stock verification, In bound and out bound distribution operations); Order Management; Competitive advantage through logistics and supply chain management; Responsive Supply Chain; Supply chain process integration, performance measurement; Value Chain, Value System and Supply Chain.

**Planning demand and supply:** Planning & Sourcing in Supply Chain, Demand forecasting, Type and Time horizon of forecast and category of forecasting, aggregate planning; Financial issues in Supply Chain - Macro and micro view, Asset management, Du Pont Model, Supply Chain Costing; Decision environment in SCM; Global supply chain perspectives - New business models, role of IT in SCM.
<table>
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<th>Title</th>
<th>SALES AND DISTRIBUTION MANAGEMENT</th>
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<td>Max.Marks</td>
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<td>Practical - Elective</td>
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<tr>
<td>Pre requisites</td>
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<td>Contact Hours</td>
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</table>

**THEORY**

**Note for the Examiner**
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

**SECTION- A**


Sales organization: Types sales potential – Determining the sales force profile – Product market analysis – Determining the sales force size – Territory management: Accounts and sales potential salesperson workload, designing territories, reasons and procedures and assigning to sales persons-routing time management.

**SECTION- B**

Sales force management: Recruitment and Selection: Job analysis, Manpower Planning, Job specification and Job description, sources of sales recruits, Problems in screening and selecting the applicants – Sales targets: Quantitative & Quantitative methods. Planning sales force training methods, content, and execution, training the dealer salespersons and evaluating the training programmes – Leadership and supervision – Compensation: Objectives, remuneration methods, incentives – Motivating the sales force – Sales meetings and Sales Contents.


**Distribution Objective/Strategy** - Interface between Sales force and Channel, Channel Design, Implementing Channel Design, Managing the Channel Members, Channel Power and Conflict Channel Evaluation ; Distribution planning, costs and control- Functions of intermediaries (wholesaler & retailers), Selection and motivation of intermediaries, Need, criterion and establishing objectives for intermediaries; Control issues- Major cost centers in distribution, Establishing standards for control, Controlling channel members and tools for control

**Text books & Reference books:**
### INTERNATIONAL HUMAN RESOURCE MANAGEMENT

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**Note for the Examiner:** The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

#### SECTION- A

**International HRM:** Concept, Defining International HRM, Differences between domestic and international HRM, Variables moderating the difference between domestic and International HRM, Developments leading to global HRM, Issues in global organizations, Management of external environment, Relevance and importance of IHRM.

**Sustaining International Business Operations:** Approaches to staffing- ethnocentric, polycentric, geocentric, regiocentric, reasons and types of international assignments, role of expatriates, role of non expatriates.

**Recruiting and selecting staff for international assignments:** issues in staff selection, reasons for expatriate failure, factors moderating performance, selection criteria.

**Training and development:** Role of expatriate training, effective pre-departure training programmes, effectiveness of pre departure training, developing staff through international assignments.

**Compensation:** Objectives of International compensation, key components of international compensation programme, approaches to international compensation.

**Re-entry and Career Issues:** Repatriation Process, individual reactions to re-entry, Multinational responses, designing repatriation programme.

#### SECTION- B

**HRM in host country context:** standardisation and adaptation of work practices, retaining, developing and retrenching staff.

**Industrial Relations:** Key issues in international Industrial relations, trade unions and international industrial relations, response of trade unions to multinationals.

**Performance Management:** Multinational performance management, performance management of international employees, Performance appraisal of international employees, Appraisal of HCNs.

**Culture and IHRM:** Concept of Culture, Cross Cultural Studies, Hofstede’s Model of National Culture

**Cross Cultural Communication:** Cultural Variables Affecting Communication, Managing Cross-Cultural Communication.

**IHRM Trends and future challenges:** International business ethics and HRM, research issues and theoretical developments in international HRM.

**GHRM in Select Countries:** America, Japan, China, Korea, Africa, Europe, India.

#### Text books & Reference books:
8. V. Nilakant and C.S. Ramnarayan: Change Management – Altering Mindsets is a Global Context, Response Books

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<th>Title</th>
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<td>Note for the Examiner</td>
<td>The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.</td>
</tr>
<tr>
<td>SECTION- A</td>
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<tr>
<td>Issues, Concerns and Purchasing: Disadvantages of ERP Solutions, users, developers, customers of ERP, purchasing or outsourcing, planning, purchasing and selection of ERP, Managing implementation partners; ERP strategy options and risk mitigation.</td>
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<tr>
<td>SECTION- B</td>
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<tr>
<td>Implementation of ERP: Implementation plan of ERP, Methods and tools, business process mapping, gap analysis, risks and dependencies, project timeline plan, project organization plan, structure and coding, data migration and historical record, prototype testing, user training program, knowledge management, disaster recovery plan, RDBMS, data communication system, hardware requirements, sample system architecture.</td>
<td></td>
</tr>
<tr>
<td>ERP Project Success and failure: Introduction to ERP Project success and failure with case studies, Current and future ERP market, key players and market shares, market issues; Continuous business improvement in ERP.</td>
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<thead>
<tr>
<th>Text books &amp; Reference books:</th>
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# GROUP-B: FUNCTIONAL SUBJECTS 3 & 4

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## THEORY

### Note for the Examiner
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

### SECTION - A

**Introduction**: Services – Importance, role in economy, service sector – growth; Nature of services - Service classification, Service Package, distinctive characteristics, open-systems view; Service Strategy – Strategic service vision, competitive environment, generic strategies, winning customers; Role of information technology; stages in service firm competitiveness; Internet strategies - Environmental strategies.

**Service Design**: New Service Development – Design elements – Service Blue-printing - process structure – generic approaches – Value to customer; Retail design strategies – store size – Network configuration; Managing Service Experience – experience economy, key dimensions; Vehicle Routing and Scheduling

**Service Quality**: Service Quality - Dimensions, Service Quality Gap Model; Measuring Service Quality – SERVQUAL - Walk-through Audit; Quality service by design - Service Recovery - Service Guarantees; Service Encounter – triad, creating service orientation, service profit chain; Front-office Back-office Interface – service decoupling.

### SECTION - B

**Service Facility**: Services capes – behaviour - environmental dimensions – framework; Facility design – nature, objectives, process analysis – process flow diagram, process steps, simulation; Service facility layout; Service Facility Location – considerations, facility location techniques – metropolitan metric, Euclidean, centre of gravity, retail outlet location, location set covering problem

**Managing Capacity And Demand**: Managing Demand – strategies; Managing capacity – basic strategies, supply management tactics, operations planning and control; Yield management; Inventory Management in Services– Retail Discounting Model, Newsvendor Model; Managing Waiting Lines – Queuing systems, psychology of waiting; Managing for growth- expansion strategies, franchising, globalization.
Text books & Reference books:

Title | TECHNOLOGY MANAGEMENT | Credits | 04
---|---|---|---
Code | Semester:-9\textsuperscript{th} | L T P | 3 1 0
Max.Marks | End term 50 | Mid term 50 | Practical - | Elective | Y
Pre requisites | | | | Contact Hours | 60

THEORY | Time
---|---
Note for the Examiner | The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting atleast two questions from each Section.

SECTION- A
Technology management Concepts - Scope, components, and overview. Technology and environment, Technology and society, Technology Impact analysis, environmental, social, legal, political aspects, methods or techniques for analysis - steps involved. Technology policy strategy: Science and technology Policy of India, implications to industry.

Technology forecasting and Selection - Forecasting need, methodology and methods - trend Analysis, Analogy, Delphi, Soft System Methodology, Mathematical Models, Simulation, and System Dynamics. Technology Choice and Evaluation :Methods of analyzing alternate technologies, Techno-economic feasibility studies, Need for multi-criteria considerations such as, social, environmental, and political, Analytic hierarchy method, Fuzzy multi-criteria decision making, and other methods.

SECTION- B
Technology Transfer and Acquisition - Import regulations, Implications of "Uruguay Round", and WTO, Bargaining process, Transfer option, MOU -Technology Adoption and Productivity, Organizational redesign and re-engineering, Technology productivity. Technology Absorption and Innovation: present status in India, Need for new outlook, Absorption strategies for acquired technology, Creating new/improved technologies, Innovations- Technology Audit.


Technological environment in India - technology policy, role of various government organisations such as DST, CSIR in development and dissemination of technology, technology development at organisation level, role of information system, quality systems and market feedback.

Product Development Cycle - Integration of Design & Manufacturing- Management of Technological Innovation-Technology Fusion & the new R&D Core competencies in Technology and
its Commercialization, Building Organization Culture, Cooperation between Government and Industry, Coping with continuous change, The structure of the Japanese Innovation System

Text books & Reference books:
7. Sharif Nawaz, Management of Technology Transfer and Technology, APCTT Bangalore.
UN-ESCAP: Technology for Development, ESCAP Secretariat

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<tr>
<th>Title</th>
<th>PURCHASE AND MATERIALS MANAGEMENT</th>
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**THEORY**

**Note for the Examiner**
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

**SECTION- A**

**Introduction to Purchasing Management** - Responsibilities of Purchase Department – Purchase Cycle – Purchase Order – Relevant positions of State / Central Sales Tax Act, Central Excise Act and Import/Export Procedures, Role of Purchasing Manager.

**Creative Purchasing** – It’s Importance, Goals of purchasing, Negotiation, Purchase Budget, Bill Market Scheme.


**Purchase systems** – Introduction - Pre purchase systems, Ordering System, Post Purchase system, Special purchasing systems. Purchasing under fluctuating Prices, Conservative & Hand Sight Policy, Determining the optimal buying strategy.

**International Purchasing** - Procedures and Documentation; Purchasing of Capital Equipment – Appraisal Methods, Evaluating Suppliers Efficiency, Stores Layout, Classification and Codification; Legal Aspects of Purchasing, Public Purchasing and Tendering.

**SECTION- B**

**Materials Management** Introduction - Evolution, Scope and Objectives - Interface with other functions. Scope of Profitability through MM - Primary and secondary objectives of MM.
**Forecasting** - Methods of forecasting - Moving Average Method, Regression Analysis, Exponential Smoothing Method

**Inventory** - Types of Inventory - Need of Inventory - Costs associated with Inventory - Basic EOQ Model - EOQ with discounts - Classification of material - ABC Analysis - VED, FSN, GOLF, SOS.

**Material Logistics** – Warehousing Management, Material handling, Traffic and Transportation, Disposal of Scrap, Surplus and Obsolete Materials; Inventory Control of Spare Parts, Materials Information System

– Advantages over conventional planning (Order Point Material Requirement Planning Method)– Master Production Schedule – Bill of Materials – Material flow in MRP.


**Text books & Reference books:**
1. Menon, K. S., Purchasing Management, Macmillan
2. Menon, K. S., Stores Management, Macmillan
Advertising: concepts, types, forms, importance and role of advertising in the marketing process, legal, ethical and social aspects of advertising, the advertising plan and setting of objectives, DAGMAR approach, determination of target audience.

Developing advertising programmes - message, headlines, copy, logo, illustration, appeal, layout, campaign planning; media planning, budgeting; evaluation - opinion and attitude tests, measurement of advertising effectiveness, advertising organisation – selection, compensation and appraisal of an agency, role of creativity in advertising.

SECTION- B

Consumer behaviour and marketing strategy: consumer involvement and decision making, information search process, evaluative criteria and decision rules, consumer motivation, information processing and consumer perception, Indian consumer market-economic, social, cultural and psychographic aspects.

Consumer attitudes and attitude change, influence of personality and self concept on buying behaviour, psychographics and lifestyle, influence of culture, subculture and social class, reference group influence, diffusion of innovation and opinion leadership, family decision making, industrial buying behaviour, consumer behaviour audit.

Text books & Reference books:

Title | MANUFACTURING MANAGEMENT | SYSTEMS | Credits | 04
--- | --- | --- | --- | ---
Code | | Semester:-9th | L T P | 3 1 0
Max.Marks | End term 50 | Mid term 50 | Practical - Elective | Y
Pre requisites | | | Contact Hours | 60

THEORY Time

Note for the Examiner: The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

SECTION- A

Introduction: The challenge and Requirements of Manufacturing, Various methodologies, Cellular Manufacturing
Cell Formation - Early methods: Production Flow Analysis, Rank Order Clustering, Similarity based methods.
Cell formation algorithms: P median formulation, Assignment formulation, ZODIAC algorithm, Metaheuristics, Considering sequence, Considering workload.
Minimizing intercell movement: Remainder cells, Machine duplication, Part subcontracting, Product based cell formation.
### SECTION- B

Operator Allocation: Rabbit chasing, Dedicating operators, Static operator allocation problems, Network Models.
Cell scheduling and sequencing: Part Family sequencing, Dispatching rules; Cell layout.
Just In Time Manufacturing: Concepts and definitions Implementation issues’, Kanban, CONWIP and Kanban
Synchronous Manufacturing: The Goal, Principles of SM, TOC and LP, Scheduling.

**Text books & Reference books:**

<table>
<thead>
<tr>
<th>Title</th>
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<td>End term -</td>
<td>Mid term - 25</td>
<td>Practical -</td>
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</table>

### SECTION- A

Introduction- Classification of statistical techniques, Classification of multivariate techniques, Application of multivariate techniques in research in different functional areas of business. Specific Techniques of MVA – MANOVA , Discriminant Analysis

### SECTION- B

Specific Techniques of MVA contd. -Factor Analysis, Cluster Analysis, Multidimensional Scaling, Conjoint Analysis. Multiple Regression

**Text books & Reference books:**

<table>
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<th>Title</th>
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<td>SECTION- A</td>
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<tr>
<td><strong>Meaning and importance of communication in business:</strong> Process, types of communication: formal and informal and their characteristics, essentials of effective business communication, Channels of communication, their effectiveness, limitations, Barriers of communication, approaches to effective Communication, Negotiation skills and participating decision making in Management Presentations, Book Reviews and Summaries</td>
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<td><strong>Time Management and Goal Setting:</strong> Identification of Time Wasters, Prioritisation of Work (ABC Method), Goal Setting.</td>
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<td><strong>Listening Skills:</strong> Listening to Specific Information, Identifying Main Issues, Seeing Beyond the Surface</td>
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<td><strong>Team Assignment:</strong> Effects of Competition on Individual and Group Behaviour, Competitive and Collaborative Team Behaviour; Team/ Group Dynamics, Team Assignment</td>
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<td><strong>Stress Management:</strong> Symptoms of Stress, Coping Approaches.</td>
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<tr>
<td><strong>Report Writing:</strong> Process, Structure and Layout. Principles of clear writing, often misused words, applications and requests, positive and negative responses to requests, routine messages, memos, organizing meetings, preparation of agenda and minutes, business etiquette, telephone etiquette, e-mail etiquette.</td>
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<tr>
<td><strong>Interpersonal Skills:</strong> Negotiations, social skills, assertive skills, cross-cultural communications.</td>
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<tr>
<td><strong>Leadership Skills:</strong> Concepts of leadership, leadership styles, insights from great leaders.</td>
</tr>
<tr>
<td><strong>Text books &amp; Reference books:</strong></td>
</tr>
<tr>
<td>2. Poe &amp;Fruchling: Basic Communication, AITBS.</td>
</tr>
<tr>
<td>5. Baugh, Frayer&amp; Thomas: How to write first class Business Correspondence, Viva Books.</td>
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Title: STRATEGIC MANAGEMENT

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Semester: 10th

Max. Marks: End term 50, Mid term 50, Practical --

Elective: N

Pre requisites: Contact Hours 60

Max. Marks: End term 50, Mid term 50, Practical --

Pre requisites: Contact Hours 60

THEORY

Note for the Examiner:
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SECTION- A

Basic Concepts of Strategic Management and Business Policy - Evolution of strategic management - strategic management process - levels of strategy - constitution of board - role and functions of corporate board and top management in strategic management.

Environmental Scanning - External and internal analysis - SWOT - industry analysis - Porter’s five force model and strategies groups - resource based view and value chain analysis - core competency and competitive advantage - VRIO model


SECTION- B

Building and Restructuring Business: Start up route, Acquisition, Joint venture, Merger, Takeover, Restructuring, Retrenchment, Divestment, Harvest, Liquidation, Turnaround strategy


Implementation of Strategy: Designing of structure, Designing of effective control system, ISO 9000, Strategic system, Strategic change process, McKinsey 7S framework


Text books & Reference books:
1. J. David Hunger, Thomas L. Wheelen and tom Wheelen: Essentials of Strategic Management, Prentice Hall India
### Title: LEGAL ASPECTS OF BUSINESS

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#### THEORY

**Note for the Examiner**
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

#### SECTION- A

**Company Law**: Definition and nature of a company, kinds of companies, formation of a company, memorandum of association, articles of association, prospectus, membership in a company, shares, transfer and transmission of shares, meetings and proceedings.

**Information Technology Act-2000**: Objective of the act, documents excluded from the scope of the act, digital signatures, types of digital signatures in India, certifying authorities in India, regulation of certifying authorities, duties of subscribers, offences, appellate tribunal, penalties and adjudication

#### SECTION- B


A brief introduction to trademarks, geographical indications, industrial Designs, trade secrets, copyright - Definition and functions

**Consumer Protection Act 1986**: Definitions under the act: complaint, consumer, defect, deficiency, unfair trade practice, consumer protection councils, redressal machinery under the act, district forum, state commission, national commission

#### Text books & Reference books:

2. Mamoria CB, Mamoria, Gankar - Dynamics of Industrial Relations (Himalaya Publications, 15th Ed.)

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### GROUP-C: FUNCTIONAL SUBJECTS 5& 6

<table>
<thead>
<tr>
<th>Title</th>
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#### THEORY
Note for the Examiner | The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

### SECTION- A


**Value Analysis:** Meaning of Value Analysis and value addition, Strategic Application of Value Chain Analysis.

**Strategic Positioning Analysis:** Critical Success Factors and SWOT Analysis.

**Cost Volume Profit Analysis:** Cost Behaviour Pattern, Cost Estimation Methods, Assumptions of CVP Analysis, Applications of CVP, Break Even Analysis, CVP Analysis in the choice of Cost Structure, Multiple Product Analysis.

### SECTION- B


Responsibility Accounting: Activity based Responsibility Accounting, Behavioural aspects of responsibility accounting, Transfer Pricing.


**Productivity improvement:** Various tools and techniques including Kaizen and Six Sigma.

### Text books & Reference books:
### SECTION- A

**Introduction to Industrial Marketing:** Definition of Industrial & Consumer Product, Basis of Classification; Difference between Industrial & Consumer Marketing, Concept of Derived Demand, Classification of Industrial Consumers, Industrial goods, Key Characteristics of Organizational Buying Process.

**Purchasing Organization:** Structure / Functions; Commercial Enterprises - Government / Institutional Markets Industrial Buying Process.


### SECTION- B


Promotion Strategies: Advertising, Sales Promotion, Communication in Rural Marketing - Language and Culture Distribution Strategies for rural Marketing and channels of distribution, Role of Co-operative, Government, financial institutions, public sector undertaking, regulated markets and public distribution systems, Intervention of IT in rural Markets

**Text books & Reference books:**
2. Francis Cherunilam: Industrial Marketing Text and Cases, Himalaya Publishing House

<table>
<thead>
<tr>
<th>Title</th>
<th>PRODUCT INNOVATION IN TECHNOLOGY BUSINESS</th>
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### THEORY

**Note for the Examiner**
The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

### SECTION- A

Production function: production function & the organization, five Ps of production, production strategy, planning & controlling the operations - product selection linking the product with marketing, planning the
operation, setting up production system, controlling the production, manufacturing system design: organization of manufacturing operation, job batch and flow production methods, group technology - coding composite component, product flow analysis, group technology and just-in-time.

Just-in-time manufacturing: JIT manufacturing, people involvement, total quality control, advantage of JIT manufacturing, elements that support JIT flow, the kanban system optimized production technology OPT.

manufacturing & service strategies: manufacturing as a competitive advantage, corporate strategy & manufacturing strategy, production planning and inventory control in manufacturing strategy.

SECTION- B

Theory of constraints & synchronous manufacturing: introduction, theory of constraints, the goal of performance measures, synchronous manufacturing, speed to market, benchmarking, simultaneous engineering, reverse engineering, technology audit, strategic alliances.

Technological innovation in manufacturing: automated design support, computer numerical control (CNC) machines, computer aided manufacturing (CAM), flexible manufacturing system (FMS), computer integrated manufacturing (CIM), artificial intelligence (AI), automation in services.

Textbooks & Reference books:
2. Narasimhan, S.L., Mcleavey, D.W. and Billington, D.W., Production Planning & Inventory Control, Prentice Hall of India.

Title | PERFORMANCE MANAGEMENT | Credits | 04
--- | --- | --- | ---
Code |  | Semester: - 9
Max. Marks | End term 50 | Mid term 50 | Practical - Elective
Pre requisites |  | Contact Hours | 60

THEORY

Note for the Examiner: The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting atleast two questions from each Section.

SECTION- A

Performance Management: Definition, Disadvantages of poorly implemented Performance Management (PM) Systems - aims and role of PM Systems, Characteristics of ideal PM Systems.


Performance Management Theatre: Concept, pillars of Performance management theatre, planning managee performance and development, monitoring managee performance and development, annual stocktaking.

Planning Management Performance and Development: Setting objectives, Organisational and individual performance plans, Components of Managee performance and development plan, setting mutual expectations and performance criteria

Monitoring and Mentoring Manager Performance and Development: Introduction, Supervision, Objectives and Principles of Monitoring, monitoring process, periodic reviews, problem solving, process and principles of managee development, role efficacy.

SECTION- B
Annual Stocktaking: Stock taking performance, stock taking discussions, stocktaking potential, Tools for stocktaking potential (assessment centres, 360 degree feedback, managee career development window).

Appraising for Recognition and Rewards: Pros and cons of appraising, appraiser and appraisee concerns, common rating errors, purposes for appraising, methods of appraisal, implementing the appraisal system

Reward Management: Definition, foundations of reward management, financial and non-financial rewards, factors affecting level of pay, developing reward processes.

Pay Structures: fixed vs variable pay, graded pay structures, broadbanding, developing pay structures.

Pay systems: team based pay, performance related pay, short term incentives, long term incentives, executive compensation, international compensation, benefits

Text books & Reference books:


Textbooks & Reference books:

GROUP-D: FUNCTIONAL SUBJECTS 7 & 8

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THEORY
Objectives

Note for the Examiner: The semester question paper of the subject will be of 50 marks having 8 questions of equal marks. The paper will be divided into two parts having four questions each from Section A and Section B. The candidate is required to attempt total 5 questions selecting at least two questions from each Section.

SECTION- A


Financial Regulation: Need for Regulation of Financial Market, Theoretical and Economic

**Depository Services:** Introduction to Depository Services, Depository Participants in India, Role of NSDL and CDSL, Difference Between NSDL and Bank, Services Offered By Depository Participants, Products Offered By Depository Participants, Process of Dematerialisation, Difference Between Physical and Electronic Holding of Securities.

**Broking:** Broking Services and Trading in Equity Broking and Trading in Debt;

**Mutual Funds:** Concept of Mutual Funds, Types of Mutual Funds, Advantages, Structure of Mutual Funds and tax treatment, SEBI and Mutual Funds Regulations;

**Insurance Services:** Introduction, Types of Insurance, Life Products, Non-Life Products.

**SECTION- B**

Debt Securitisation and Corporate Advisory Services: Introduction, Securitisation as a funding Mechanism, Securitisation of Mortgaged and Non- Mortgaged Assets Issue Management;

Credit Rating: Meaning of Credit Rating, Process of Credit Rating, and Factors affecting Rating, Types of Rating, Advantages and Disadvantages of Credit Rating, Methodology of Credit Rating, Credit Rating Agency Regulation Act 1974, Credit Rating in India.


**Leasing:** Definition, Types of Leases, Advantages, Disadvantages, Leasing and Commercial Banking Sector, Risk in Leasing, Lease Proposal Analysis, Comparison Between Lease and Hire Purchase, Legal Aspects of leasing, Taxation Aspects of leasing, Lease Accounting and Reporting.

**Housing Finance:** Introduction to Housing Finance, Housing Finance Schemes, Procedure of Loan Disbursement, Legal Framework of Housing Finance; Credit Cards, Types, Settlement Process, Mechanism, Member Establishment, Member Affiliates.

**Factoring:** Meaning, Forms, Functions, Legal Aspects, Evaluation.

**Text books & Reference books:**
7. Satish K. Matta: Management of Financial Institutions and Services, Vrinda Publications

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**THEORY**

**Time**

**Note for the Examiner**
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**Business Ethics:** nature, characteristics and need. Ethical theories and approaches: traditional, deontological and teleological theories, Gandhian philosophy of wealth management, philosophy of trusteeship.

**SECTION- B**
Indian value system and values, Indian ethos in management, creating ethical corporate structures, ethical leadership, law and ethics, work ethics: nature and scope, ethical issues at workplace, cross cultural ethics, ethical dilemmas.
Ethics in business disciplines: HRM (downsizing, balance of power, compensation, conflicts), marketing (commodity culture, pricing, advertising), finance and accounting (stock market, financial reporting, insider trading), technology (privacy at workplace, genetically modified foods).

**Text books & Reference books:**

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**THEORY**

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**SECTION- A**
Basics of Facilities Location Selection – basic concepts, importance of site selection for facilities, factors affecting site selection - objective and subjective factors, considerations in site selection, different types of facilities layout – product, process, combination, fixed, and cellular layouts – comparison of layouts and the factors affecting the layout decisions
Location Selection Schemes and Layout Schemes – methods to select location for single facility problems and multiple facility problems - tools to analyse the flow requirements in a facility, systematic layout planning – examples, assembly lines, line balancing methods

**SECTION- B**
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 types of plant services like steam, compressed air etc.

**Materials Handling System and Equipment** – principles, materials handling in plants, stores, and warehouses, receiving and dispatch area – choice of material handling equipment – cost control in material handling - automatic guided vehicles – basic concept, design and operational control of an AVG system

**Elements of Industrial Safety** – health hazards and health standards, NIOSH guidelines and health standards - accidents – causes and prevention of accidents, safety measures and standards, fire and fire fighting equipment, heat stress and prevention, pollution and environmental considerations,
occupational safety and health norms

**Text books & Reference books:**
3. Manufacturing Facilities Design and Materials Handling, 2nd ed, Mathew P. Stephens, Fred E. Meyers, Purdue University Press 2013

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**THEORY Time**

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**SECTION- A**

**Overview of Industrial Relations**: Concept of IR, Nature of IR, Objectives of IR, Evolution of IR in India, Theories of IR, Systems approach to IR.

**Trade Unionism**: Concept of Trade Unions, Functions of Trade Unions, Approaches, Structures of Trade Unions.

**The Trade Unions Act, 1926**: Trade Union, Registration of Trade Unions, Rights and Liabilities of registered trade unions.

**Grievance Handling**: Grievance, Causes/Sources of Grievances, Grievance Redressal Machinery, Legislative Aspects of the Grievance Redressal Procedure in India, Domestic enquiry.

**The Industrial Disputes Act, 1947**: Industry, workman, Industrial Dispute - methods and authorities for the settlement of industrial disputes, Strikes and Lockouts, Lay off and Retrenchment.

**Collective Bargaining**: Concept, meaning - objectives of collective bargaining, Negotiating techniques and skills, process of collective bargaining, Impact of Collective Bargaining.

**SECTION- B**

**The Workmen's Compensation Act, 1923**: Workman, employer’s liability to pay compensation, disablement, amount of compensation.

**Tripartite and bipartite bodies**: Workers Participation in Management.

**Factories Act, 1948**: Factory, worker, manufacturing process, provisions of health, safety and welfare, working hours of adults, special provisions relating to children, annual leave with wages.

**Industrial Relations and emerging scenario**: Industrial Relations and technological change, International Labour Organisation (ILO): Objectives and Structure, Future of Industrial Relations

**Standing Orders Act, 1948**: Standing orders, certification of draft standing orders, duration and modification of certified orders.

**Employee’s State Insurance Act, 1948**: Contribution, principle employer, immediate employer, different benefits.

**Text books & Reference books:**
6. S.N. Dhayani: Industrial Relations System, Sultan Chand and Sons

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<th>INTERNATIONAL MANAGEMENT</th>
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**SECTION- A**

**Internationalization of financial function**: International financial management - An overview, Objectives of international firm and impact of risk; Financial function in multinational corporation.

**Foreign Exchange Risk**: Foreign exchange market, foreign exchange risk and exposure, exposure information system, strategies for exposure management and techniques for foreign exchange rate projections, devices for foreign exchange risk and exposure devices.

**Managing Short-term Assets and Liabilities**: International working capital management, Investment of international money market; Euro currency and other important international money market, International ranking and payment settlement mechanism.

**SECTION- B**

**Internationalization of financial function**: International financial management - An overview, Objectives of international firm and impact of risk; Financial function in multinational corporation.

**Foreign Exchange Risk**: Foreign exchange market, foreign exchange risk and exposure, exposure information system, strategies for exposure management and techniques for foreign exchange rate projections, devices for foreign exchange risk and exposure devices.

**Managing Short-term Assets and Liabilities**: International working capital management, Investment of international money market; Euro currency and other important international money market, International ranking and payment settlement mechanism.
### Text books & Reference books:

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### Practical

**SECTION- A**

**Corporate Governance:** Introduction, Overview.

**Corporate Board:** Attributes, Duties, Responsibilities, Liabilities; Shaping Directorial Competence and Board Effectiveness; Financial Institutions and Nominee Directors.

**Corporate Governance and Security:** Corporate Disclosure and Investor Protection, Corporate Restructuring and Revival of Sick Units, Corporate Reputation, Corporate Legitimacy and Corporate Crime.

**SECTION- B**

**Culture:** An introduction; organization culture - Building and maintaining; Managing cultural diversity in organization; Indian culture characteristics.

**General Issues regarding Corporate Governance:** Takeover Codes, Corporate Board Committees, Globalisation and Corporate Governance, Emerging Trends in Corporate Governance.

### Text books & Reference books:
2. C.V. Baxi: Corporate Governance, Excel books.
4. Dr. S. Singh: Corporate Governance, Excel books.
5. Swami (Dr.) Parthasarathy: Corporate Governance, biz tantra.
7. Jill Solomon: Corporate Governance & Accountability, Wiley India.
10. Subhash Chandra Das: Corporate Governance in India, Prentice Hall India.

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<th>Title</th>
<th>WORKSHOP ON MANAGEMENT INFORMATION SYSTEMS</th>
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**SECTION- A**

**Introduction:** why information system, Perspectives and contemporary approach to information system, usage of information systems, Information system in the enterprise: major types of system in organisation, systems from functional perspectives, integrating functions and business processes. Management opportunities, challenges and solutions, Information systems, organisations.

**Management and strategy:** organisations and information systems, how information system impact organisations and business firms, the impact of IT on Management Decision Making, Information Business and Business Strategy, Management opportunities, challenges and solutions,

**SECTION- B**

**Enterprise application and business process integration:** Enterprise systems, supply chain management systems, customer’s relationship management system, and enterprise integration trends.

**Redesigning the organisation with the information systems:** system as planned organizational change, business process re-engineering and process improvement, overview of system development, alternative systems building approaches, management opportunities, challenges and solutions, Managing international information systems: growth of international information systems, organizing and managing international information systems, technology issues and opportunities challenges and solutions.

**Text books & Reference books:**