### FIRST SEMESTER

#### Scheme of Instruction and Examination

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Name of the course</th>
<th>Periods per week</th>
<th>Exam (Hrs)</th>
<th>Max. marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 101</td>
<td>Methods Engineering and Work Design</td>
<td>4 — — 3</td>
<td>70 30</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IE 102</td>
<td>Probability and Statistics</td>
<td>4 — — 3</td>
<td>70 30</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IE 103</td>
<td>Management Principles &amp; Perspectives</td>
<td>4 — — 3</td>
<td>70 30</td>
<td>4</td>
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</tr>
<tr>
<td>IE 104</td>
<td>Engineering &amp; Managerial Economics</td>
<td>4 — — 3</td>
<td>70 30</td>
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<tr>
<td>IE 105</td>
<td>Advanced Optimization Techniques</td>
<td>4 — — 3</td>
<td>70 30</td>
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<tr>
<td>IE 106</td>
<td>Elective – I</td>
<td>4 — — 3</td>
<td>70 30</td>
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<tr>
<td>IE 107</td>
<td>Seminar</td>
<td>— 3 — —</td>
<td>— 50</td>
<td>2</td>
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<tr>
<td>IE 108</td>
<td>Work study Lab</td>
<td>— 3 — —</td>
<td>— 50</td>
<td>2</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td>24 6 — —</td>
<td>420 280</td>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>

**Elective – I:**
A. Computer Integrated Manufacturing  
B. Maintenance Management  
C. Total Quality Management  
D. Project Management  
E. Corporate Planning  
F. Supply Chain Management

### SECOND SEMESTER

#### Scheme of Instruction and Examination

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Name of the course</th>
<th>Periods per week</th>
<th>Exam (Hrs)</th>
<th>Max. marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td>IE 201</td>
<td>Industrial Quality Management</td>
<td>4 — — 3</td>
<td>70 30</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IE 202</td>
<td>Operations Planning &amp; Control Systems</td>
<td>4 — — 3</td>
<td>70 30</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IE 203</td>
<td>Human Resource Development &amp; Industrial Relations</td>
<td>4 — — 3</td>
<td>70 30</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IE 204</td>
<td>Facility Planning and Design</td>
<td>4 — — 3</td>
<td>70 30</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IE 205</td>
<td>System Dynamics</td>
<td>4 — — 3</td>
<td>70 30</td>
<td>4</td>
<td></td>
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<tr>
<td>IE 206</td>
<td>Elective – II</td>
<td>4 — — 3</td>
<td>70 30</td>
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<td></td>
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<tr>
<td>IE 207</td>
<td>Seminar</td>
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<td>2</td>
<td></td>
</tr>
<tr>
<td>IE 208</td>
<td>Computer Applications Lab</td>
<td>— 3 — —</td>
<td>— 50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>24 6 — —</td>
<td>420 280</td>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>

**Elective – II:**
A. Manufacturing Resource Planning  
B. Technology Management  
C. Management Information Systems  
D. Product Design Management  
E. Production Management - Strategic Perspectives  
F. Human Factor Engineering
<table>
<thead>
<tr>
<th>Course No.</th>
<th>Name of the course</th>
<th>Periods per week</th>
<th>Duration of exam (hours)</th>
<th>Max. marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 301</td>
<td>Project</td>
<td>12</td>
<td>—</td>
<td>Recommended/Not recommended</td>
<td>14</td>
</tr>
</tbody>
</table>

The prerequisite for submission of the ME thesis is that one should communicate his/her work to any referred journal or Publication in a conference.
FIRST SEMESTER

IE 101 METHODS ENGINEERING AND WORK DESIGN
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.                            Ses. : 30 Exam: 70
Examination (Theory): 3hrs.                                                                      Credits: 4

Work study: Concept of work and productivity - Possibility guides - Methods study -
Charting techniques - Concept of standard time and bench mark jobs - Timing techniques and
work sampling - Elemental motions, THERBLIGS and principles of motion - Economy -
Introduction to predetermined motion time standards.

Human factors engineering: Introduction to ergonomics and human factors - Engineering
physiological basis of human performance - Biomechanics - Psychology of work and work
load perception - Physical work environment - Basis of ergonomic problem identification -
Safety.

Integration of methods and time - Learning theory implications on standard time - Work
study applications in production, maintenance, quality and other service functions - Synthetic
time standards - MTM system and its application to production and maintenance.

Organization and methods: Procedure analysis and developing office standards - MTM
application to office work - Forms design and control - Records management.

Value engineering: VE concepts, Principles, Methodologies and standards - Methods of
functional analysis - Creativity - VE case studies/project work.

Job evaluation and incentive scheme: Job description and job analysis - Job evaluation-
different methods - Individual and group incentive concepts and implications - Different
types of incentive schemes - Suggestion schemes.

References:
2. Methods, Standards and Work Design, Benjamin W. Niebel and Andris Freivalds, WCB
   Hill, 1983.
6. Measuring and Enhancing Productivity of Service and Government Organizations by
   Mundel Marvin, E., Asian Productivity Organization, Tokyo.
7. Compendium on Value Engineering by Tufty, H.G., The Indo-American Society,
   Bombay, 1983.
8. Compensation Administration by Belchar, David, W., Prentice Hall, N.J.
IE 102 PROBABILITY AND STATISTICS
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.                    Ses. : 30 Exam: 70
Examination (Theory): 3hrs.                                                                      Credits: 4

Fundamental distributions (with stress on the normal distribution and its applications in industry), Statement and uses of Chi-square and distributions.
Least square principles, Elements of curve fitting, Correlation and regression analysis, Motion of linear regression, Concepts of bi-variable and multivariate distributions, The partial and multiple correlations.
Motion of statistical hypothesis and statistical test large and small sample tests of significance, Motion of non-parametric test.
Stochastic processes, Markov chains and process, Time series components and analysis.
Analysis of variance - Design of experiments.
Industrial applications.

References:
1. Introduction to Mathematical Statistics by Hogg, R.V. and Craig, A.T.
2. Elements of Probability Theory by Cramer, K.

IE 103 MANAGEMENT PRINCIPLES AND PERSPECTIVES
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.                    Ses. : 30 Exam: 70
Examination (Theory): 3hrs.                                                                      Credits: 4

Management principles: Management functions, Roles & Skills - History of management thought - Various theories and approaches to management - Planning process, tools and techniques - Management by objectives - Decision making process, approaches and aids - Formal and informal organizations - Organisation structure and design - Organization principles of line and staff authority and span of control - Delegation, decentralization and autonomy - Managerial control-need and principles - Role of information in control - Control methods and techniques - Managerial ethics and social responsibility.

References:

IE 104 ENGINEERING AND MANAGERIAL ECONOMICS
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.  Ses. : 30 Exam: 70
Examination (Theory): 3hrs.  Credits: 4

The principle and use of economic analysis in engineering practice - Discounted cash-flow analysis - Corporate tax and investment - Depreciation and economic studies - Replacement analysis - Valuation of assets - Economic analysis for projects - Analysis of risk and uncertainty - Elements of demand analysis and forecasting - Theory of firm as an owner and as a producer - Economic of scale - Market models - Production function - Output and pricing decision - Long run and short run cost curves.

References:

IE 105 ADVANCED OPTIMIZATION TECHNIQUES
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th  Ses. : 30 Exam: 70
Examination (Theory): 3hrs.  Credits: 4

Dynamic programming(D.P): Multistage decision processes. Concepts of sub optimization and Principal of optimality, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P. and continuous D.P.
Non-traditional optimization techniques: Multi-objective optimization - Lexicographic method, Goal programming method, Genetic algorithms, Simulated annealing, Neural Networks based Optimization.

References:
5. Genetic Algorithms - In Search, Optimization and Machine Learning by David E. Goldberg, Addison-Wesley Longman (Singapore) Pvt. Ltd.

Elective - I
(A) IE 106 COMPUTER INTEGRATED MANUFACTURING
(Four-Semester Course -Credit System- w.e.f. 2007-2008)
Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4

Introduction: Scope of computer integrated manufacturing, Product cycle, Production automation.
Group technology: Role of group technology in CAD/CAM integration, Methods for developing part families, Classification and coding, Examples of coding systems, Facility design using group technology, Economics of group technology.
Integrative manufacturing planning and control: Role of integrative manufacturing in CAD/CAM integration, Over view of production control - Forecasting, Master production schedule, Capacity planning, M.R.P., Order release, Shop-floor control, Quality assurance, Planning and control systems, Cellular manufacturing, JIT manufacturing philosophy.
Computer aided quality control: Terminology in quality control, Contact inspection methods, Non-contact inspection methods, Computer aided testing, Integration of CAQC with CAD/CAM.
Computer integrated manufacturing systems: Types of manufacturing systems, Machine tools and related equipment, Material handling systems, Computer control systems, FMS.

References:
B) IE 106 MAINTENANCE MANAGEMENT
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.                  Ses. : 30 Exam: 70
Examination (Theory): 3hrs.              Credits: 4


Reliability measurement and life testing application of reliability: Maintenance strategies - Maintainability and availability and criteria - Maintenance manpower planning spare parts management - Maintenance downtime analysis - Computerized maintenance system - Application of simulation technique - Design - Implementation and Operation of an integrated maintenance system.

References:

C) IE 106 TOTAL QUALITY MANAGEMENT
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.                  Ses. : 30 Exam: 70
Examination (Theory): 3hrs.              Credits: 4

Concepts of TQM: Philosophy of TQM, Customer focus, Organization, Top management commitment, Team work, Quality philosophies of Deming, Crossby and Muller.

TQM process: QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Benchmarking, Strategic quality planning.

TQM systems: Quality policy deployment, Quality function deployment, Standardization, Designing for quality, Manufacturing for quality.

Quality system: Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies.

Implementation of TQM: Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, Case studies.

References:
(D) IE 106 PROJECT MANAGEMENT
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4


References:

(E) IE 106 CORPORATE PLANNING
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4


References:
(F) IE 106 SUPPLY CHAIN MANAGEMENT  
(Four-Semester Course -Credit System- w.e.f. 2007-2008)
Periods/week: 4 Th.  
Examination (Theory): 3hrs.  
Ses. : 30 Exam: 70  
Credits: 4

IE 107 SEMINAR  
(Four-Semester Course -Credit System- w.e.f. 2007-2008)
Periods/week: 3 Pr.  
Ses. : 50
Credits: 2
The student has to give at least three seminars on topics related to Industrial Engineering.

IE 108 WORK STUDY LAB  
(Four-Semester Course -Credit System- w.e.f. 2007-2008)
Periods/week: 3 Pr.  
Ses. : 50
Credits: 2
IE 101 METHODS ENGINEERING AND WORK DESIGN
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.                                                                 Max. Marks : 70

Answer any FIVE questions.
All questions carry equal marks.

1. a) How do work study techniques help in improving productivity? Explain.
    b) Explain (i) Flow process chart, (ii) Man-machine chart.
2. Explain the principles of motion economy in detail.
3. a) Define the term ergonomics and discuss the objectives and goals of ergonomic studies.
    b) Explain Bio-mechanical design considerations. What are the functions performed by man and the involved mechanism in order to make a system success?
4. Discuss various techniques of work-measurement.
5. What is O and M analysis? How do you design and apply the same in the control office of a large business organization?
6. What is job evaluation? Explain the different methods of job evaluation techniques.
7. Explain the various wage incentive schemes.
8. Write notes on:
    i) Therbligs.
    ii) Value engineering.
    iii) Learning theory.
    iv) MTM.

IE 102 PROBABILITY AND STATISTICS
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.                                                                 Max. Marks : 70

Answer any FOUR questions.
All questions carry equal marks.

1. Given below is the distribution of 140 candidates obtaining marks x or more in certain examination.
   
   \[
   \begin{array}{cccccccccc}
   x : & 10 & 20 & 30 & 40 & 50 & 60 & 70 & 80 & 90 \\
   100 & 140 & 133 & 118 & 100 & 75 & 45 & 25 & 9 & 2 \\
   c.f. : & 140 & 133 & 118 & 100 & 75 & 45 & 25 & 9 & 2 & 0
   \end{array}
   \]
   
   Calculate the mean, median, mode and standard deviation.

2. a) Fit a Poisson distribution to the following data with respect to the number of red blood corpuscles (x) per cell:
   
   \[
   \begin{array}{ccccccc}
   x : & 0 & 1 & 2 & 3 & 4 & 5 \\
   No. of cells f: & 142 & 156 & 69 & 27 & 5 & 1
   \end{array}
   \]
   
   Do you support with reasons, the decision to fit a Poisson distribution?
   b) Define normal distribution and find its variance.
   c) In a normal population with mean 15 and standard deviation 3.5, it is known that 647 observations exceed 1625. What is the total number of observations in the population?
3. a) The results of measurement of electric resistance $R$ of a Copper bar at various temperatures $t \degree C$ are listed below:

<table>
<thead>
<tr>
<th>$t$</th>
<th>19</th>
<th>25</th>
<th>30</th>
<th>36</th>
<th>40</th>
<th>45</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R$</td>
<td>79</td>
<td>77</td>
<td>79</td>
<td>80</td>
<td>82</td>
<td>83</td>
<td>85</td>
</tr>
</tbody>
</table>

Find a relation $R = a + b A$ by the method of least square.

b) Find the correlation coefficient between $x$ and $y$ from the given data:

<table>
<thead>
<tr>
<th>$x$</th>
<th>78</th>
<th>89</th>
<th>97</th>
<th>69</th>
<th>59</th>
<th>79</th>
<th>68</th>
<th>57</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>125</td>
<td>137</td>
<td>156</td>
<td>112</td>
<td>107</td>
<td>138</td>
<td>123</td>
<td>108</td>
</tr>
</tbody>
</table>

4. a) Find the standard error of a linear function of a number of variables.

b) Test the significance of the difference between the means of the sample from the following data:

<table>
<thead>
<tr>
<th>Size of sample</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample A</td>
<td>100</td>
<td>61</td>
</tr>
<tr>
<td>Sample B</td>
<td>200</td>
<td>63</td>
</tr>
</tbody>
</table>

5. a) Explain random variable, its distribution expectation and variance.

b) A random variable $x$ has the following probability function:

<table>
<thead>
<tr>
<th>Values of $x$</th>
<th>–2</th>
<th>–1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P(x)$</td>
<td>0.1</td>
<td>$k$</td>
<td>0.2</td>
<td>2$k$</td>
<td>0.3</td>
<td>$k$</td>
</tr>
</tbody>
</table>

Find the value of $k$ and calculate mean and variance.

6. a) Explain the procedure generally followed in testing of hypothesis. Distinguish between large and small sample tests.

b) A group of 10 boys fed on a diet A and another group of 8 boys fed on a different diet B recorded the following increase in weights:

<table>
<thead>
<tr>
<th>Diet A</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>1</th>
<th>12</th>
<th>4</th>
<th>3</th>
<th>9</th>
<th>6</th>
<th>10</th>
<th>kgs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet B</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td></td>
<td></td>
<td>kgs</td>
</tr>
</tbody>
</table>

Does it show the superiority of diet A over that of B?

7. a) Describe the technique of analysis of variance with an illustration for a one way classification.

b) The following table gives the retail prices of commodity in same shops selected at random in four cities:

<table>
<thead>
<tr>
<th>City</th>
<th>Price (Rs. per lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>22 24 27 23</td>
</tr>
<tr>
<td>B</td>
<td>20 19 23 –</td>
</tr>
<tr>
<td>C</td>
<td>19 17 21 18</td>
</tr>
<tr>
<td>D</td>
<td>24 26 29 26</td>
</tr>
</tbody>
</table>

Carry out analysis of variance to test the significance of the difference between the prices of commodity in four cities.
1. “Management is regarded as an art of some, science by others and inexact science by many more. The truth seems to be somewhere in between”. In the light of this statement, explain the exact nature of management.

2. a) What steps are involved in planning process?
   b) What are the major limitations of planning? What action can be taken to make planning effective?

3. a) Distinguish between delegation of authority and decentralization.
   b) What should be done to ensure effective delegation of authority in a business enterprise?

4. a) What are the essential features of good organization structure?
   b) How do clearly defined objectives help in managing the organization?

5. a) Write about decision making process.
   b) What is the need of management control? Explain the principles of managerial control.

6. What is the systems approach of organization theory? Describe the implication of systems approach in organization design.

7. What do you understand by a system? Discuss management as a system bringing out the basic features.

8. Write short notes on any FOUR of the following:
   a) Managerial ethics.
   b) Benefits of MBO.
   c) Concept of feedback.
   d) Open and closed loop system.
   e) Role of information in control.

1. Explain the law of demand and supply in detail.

2. Define a production function. Explain and illustrate isoquant and isocost curves.

3. What are the characteristics of monopolistic competition? Explain how output and price is determined under monopolistic competition.

4. a) Explain the concept of break-even analysis and point out its assumptions.
b) Given the following total cost and total revenue functions, find (i) break-even point, (ii) profit at output 30.

Total cost = 100 + kx,
Total revenue = 10x

where x is the quantity sold or purchased.

5. a) Discuss the various methods of depreciation.

b) Find out the depreciation annuity by the annuity charging method after 3 years, when the cost of machine is Rs.8000/- and the scrap value is Rs.4000/- only. Rate of interest is 5 percent. Also calculate the value of the machine after two years.

6. a) Discuss the various methods of appraising project profitability.

b) ABC Co. has got up to Rs.20,000 to invest. The following proposals are under consideration.

<table>
<thead>
<tr>
<th>Project</th>
<th>Initial outlay Rs.</th>
<th>Annual cash flow Rs.</th>
<th>Life Yrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10,000</td>
<td>2,500</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>8,000</td>
<td>2,600</td>
<td>7</td>
</tr>
<tr>
<td>C</td>
<td>4,000</td>
<td>1,000</td>
<td>15</td>
</tr>
<tr>
<td>D</td>
<td>10,000</td>
<td>2,400</td>
<td>20</td>
</tr>
<tr>
<td>E</td>
<td>5,000</td>
<td>1,125</td>
<td>15</td>
</tr>
<tr>
<td>F</td>
<td>6,000</td>
<td>2,400</td>
<td>6</td>
</tr>
<tr>
<td>G</td>
<td>2,000</td>
<td>1,000</td>
<td>2</td>
</tr>
</tbody>
</table>

i) Rank these projects in order of their desirability under the pay-back method.

ii) Rank these projects under the net present value index method, assuming the cost of capital to be 10 percent.

iii) Explain any glaring inconsistencies between (i) and (ii).

7. A manufacturer is offered two machines A and B. A has cost price of Rs.2,500, its running cost is Rs.400 for each of the first 5 years and increases by Rs.100 every subsequent year. Machine B having the same capacity as A, costs Rs.1,250, has running cost of Rs.600 for 6 years, increasing by Rs.100 per year thereafter. If money is worth 10% per year, which machine should be purchased? Scrap value of both machines is negligibly small.

8. Write short notes on any FOUR of the following:

i) Opportunity cost.

ii) Economies of scale.

iii) Exponential smoothing technique.

iv) Long run and short run cost curves.

v) Risk and uncertainty.
1. a) What is arithmetic – geometric inequality?  
   b) Minimize the following function: 
   \[ f(X) = \frac{1}{2} x_1^2 + x_2 + \frac{2}{3} x_1^{-1} x_2^{-1} \]

2. a) Explain the problem of Dimensionality in Dynamic programming.  
   b) Maximize \( f(x_1, x_2) = 50x_1 + 100x_2 \) 
   Subjected to 
   \[ \begin{align*} 
   10x_1 + 5x_2 & \leq 2500 \\
   4x_1 + 10x_2 & \leq 2000 \\
   x_1 + 1.5x_2 & \leq 450 \\
   x_1 & \geq 0, \\
   x_2 & \geq 0 
   \end{align*} \]

3. Solve the following problem using Bala’s method. 
   Minimize \( f = 3x_1 + 2x_2 + x_3 + x_4 \) 
   Subjected to 
   \[ \begin{align*} 
   x_2 x_3 + x_4 & \leq 1 \\
   2x_1 + x_2 x_3 + x_4 & \geq 3 \\
   x_i & = 0 \text{ or } 1, \quad i = 1, 2, 3, 4. 
   \end{align*} \]

4. A contractor plans to use four tractors to work on a project in a remote area. The probability of a tractor functioning for a year without a breakdown is known to be 82%. If \( X \) denotes the number of tractors operating at the end of a year, determine the probability mass and distribution function of \( X \) and also find the expected value and the standard deviation of the number of tractors operating at the end of one year.

5. Find the minimum of 
   \[ \begin{align*} 
   f_1 &= x_1^2 + x_2^2 \\
   f_2 &= (x_1 - 2)^2 + x_2^2 
   \end{align*} \] 
   Subject to 
   \[ x_1 - x_2 - 1 \leq 0 \]

6. a) Construct the objective function to be used in GAs for a minimization problem with mixed equality and inequality constraints.  
   b) Consider the following two strings denoting the vector \( X_1 \) and \( X_2 \) 
   \[ \begin{align*} 
   X_1: \{1 0 0 0 1 0 1 1 0 1\} \\
   X_2: \{0 1 1 1 1 1 0 1 1 0\} 
   \end{align*} \] 
   Find the result of crossover at location 2. Also, determine the decimal value of the variable before and after crossover if each string denotes a vector of two variables.

7. a) What is a sigmoid function? How it is affected by weighted sum of inputs, explain.  
   b) How is a neuron modeled in neural network-based model, explain with one example.
8. Explain any four of the following.
   a) Goal programming method
   b) Simulated Annealing Algorithm
   c) Continuous Dynamic programming
   d) Branch & Bound method
   e) Complementary Geometric programming

MODEL QUESTION PAPER-Mechanical Engineering
M.E. (INDUSTRIAL ENGINEERING)-I SEMESTER

IE-106 TOTAL QUALITY MANAGEMENT
(Elective-I)
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.                                                                                                     Max. Marks : 70

Answer any FIVE questions.
All questions carry equal marks.

1. Describe the total quality management philosophy.
2. What is the role of top management in setting a road map for quality improvement in an organization?
3. What are the advantages of using quality function deployment? What are the key ingredients that are necessary for its success?
4. What are the different types of quality audits? Discuss each and identify the context in which they are used.
5. Discuss the emerging role of ISO 9000 standards in the global economy.
6. Describe the steps of benchmarking relative to a company of your choice.
7. a) State the merits and demerits of JIT production system.
   b) Explain quality circles.
8. Answer any THREE of the following:
   a) Kaizen.
   b) Taguchi method.
   c) QC tools.
   d) Quality policy.
   e) Designing for quality.
SECOND SEMESTER
IE 201 INDUSTRIAL QUALITY MANAGEMENT
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.                         Ses. : 30 Exam: 70
Examination (Theory): 3hrs.                 Credits: 4

Basic concepts of quality assurance system - Statistical quality control - Processes capability analysis - Inspection standards - Control charts for process control - Acceptance sampling including sampling tables - Quality costs estimation and reduction - Quality circles including fault-tree analysis - Total quality control including automation - Product and system reliability: Basic concepts, Quantitative measurement, Prediction, Evaluation and Optimization, Maintainability, Case studies in quality and reliability management in manufacturing and service organizations.

References:
7. Introduction to Statistical Quality Control by Montagomery, John Wiely.

IE 202 OPERATIONS PLANNING AND CONTROL SYSTEMS
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.                         Ses. : 30 Exam: 70
Examination (Theory): 3hrs.                 Credits: 4

Operations strategy - Concept of operation planning and control for various operational systems in manufacturing and non-manufacturing sector - Operations planning and control as an integrated system - Aggregate planning and master planning scheduling - Hierarchical productions planning - Material requirement planning, Lot sizing, MRP-II - Scheduling - Group technology - Engineering trends in planning and scheduling, Concepts of just-in-time, Pull and push system of work flow, Opt, etc. - project planning, Monitoring and control - Logistics, Distribution planning and control - Maintenance planning and control. Implementation and evaluation of operations planning and control system.
Forecasting techniques including box jenkins - Material requirements, Explosion and levels - Classification and inventory analysis - Codification, Standardization and variety reduction - Make or buy decision - Inventory control techniques - Inventory systems - Material requirement planning, Phasing. Materials functions including budgeting, Purchasing and vendor development - Spare parts management - Stores and material accounting - Import export policies, Legal aspects of purchasing, Evaluation of materials management performance.
References:
1. Production Planning and Inventory Control, Narasimhan, Mc Leavy, Billington, PHI(1999)

IE 203 HUMAN RESOURCE DEVELOPMENT & INDUSTRIAL RELATIONS
(Four-Semester Course -Credit System- w.e.f. 2007-2008)
Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4

Personnel function: Its evolution, Objective principles, Philosophies, Duties and responsibilities of the personnel management in India. Manpower planning: Its uses and benefits - Problems and limitations - Manpower inventory: Manpower forecasting - Manpower skills analysis and practices in Indian industry recruitment: Selection process, Psychological testing - Interviewing techniques, Transfer, Promotion and its policies - Induction placement and exit interview wage and salary administration.

Training and development: Its objective and policy planning and organizing the training department - Training manager and his job - On and off the job training - Techniques, Career planning, Objective of performance appraisal and its methods.


References:
IE 204  FACILITY PLANNING AND DESIGN  
(Four-Semester Course -Credit System- w.e.f. 2007-2008) 
Periods/week: 4 Th.                             Ses. : 30 Exam: 70 
Examination (Theory): 3hrs.                      Credits: 4 

Introduction to layout design process - Systematic layout planning - Computerized layout planning - ALDEP, CORELAP, CRAFT, Single and multi-facility location problems - Desuate and continuous location and layout problems - Quadratic assignment location problems - Minmax layout and location problems - Discrete plant location and covering problems. 
Weberian location theory: Contribution of Hoover, Greenhut and Losch, Isard and others to locational dynamics of manufacturing facilities - Plant and warehouse location and multiproduct distribution system design problems. 
Approaches for solving location decision problems with private or public sector goals - Economics of scale - Capacity and configuration constraints and multiperiods 

References: 
2. Facilities Planning, James A. Tompkins and John A. White, John Wiely 

IE 205  SYSTEM DYNAMICS 
(Four-Semester Course -Credit System- w.e.f. 2007-2008) 
Periods/week: 4 Th.                             Ses. : 30 Exam: 70 
Examination (Theory): 3hrs.                      Credits: 4 

Introduction to system dynamics: Basic problem - Fundamental system concepts - Occurrence of dynamic phenomena in managerial and economic systems - Objectives of a system dynamic analysis. 
Examples of dynamic system model: Model of production distribution system (Forrester models). 
Further examples: System dynamics in manufacturing - Marketing and distribution - Research and development - Managerial control and financial applications. 
Application of system dynamics to societal: Problems - Regional economic simulation model - Urban transportation planning model - Natural resources management and sociological systems - Case studies. 
References: 
1. A Study Notes on System Dynamics, Goodman, MIT Press 
2. Industrial Dynamics, Forester, MIT Press 

Elective - II

(A) IE 206 MANUFACTURING RESOURCE PLANNING
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4

An overview of MRP-II, Master production scheduling and final assembly scheduling, Strategic and business planning, Sales and operations planning, Demand management, Master production scheduling, Bill of materials, Capacity management, Shop floor control, Introduction to ERP, SCM and CRM.

Reference:

Elective - II

(B) IE 206 TECHNOLOGY MANAGEMENT
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4

Technology development and society: Technology and Corporate growth, Technology forecasting, Technology transfer, Adoption and diffusion, Technology innovation and applied research, Technology assessment, Evaluation of R & D projects, Budgeting and cost control, Managing technology development, Product development, Market development.

References:

Elective - II

(C) IE 206 MANAGEMENT INFORMATION SYSTEMS
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4

Concepts of MIS: Meaning and role of MIS in an organization. Analysis and design of information systems; Conceptual modelling of data and process in organizations. Tools for modelling and analysis of data: Data flow diagram, Data dictionary.

Tools for modelling and analysis of processes: Flow charts, Structured english and pseudocode, Decision tables, Decision trees. Structured design of data processes: Structured design of data (File design), Structure chart, Transform analysis, Transaction analysis.
Semi structured problems and DSS. Management perspectives: Evolution of MIS in an organization (Nolan's state model), System development life cycle model and Project planning for MIS.


References:
3. Design of Computer Data Files by Owen Hansan, Pitman.

Elective – II
(D) IE 206 PRODUCT DESIGN MANAGEMENT
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.                                    Ses. : 30 Exam: 70
Examination (Theory): 3hrs.                                    Credits: 4

Introduction to design, Product design, Design management, Product management. Traditional & modern design, Design process, Organizational objectives.
Need related intelligence, Identification of latent needs, Technology related intelligence, Development of technological competence.
Organizational strength & weakness, Criteria for a new product, New product management, Forward planning, Coordination and communication.
Investigating user behaviour - User habits, Expectations, Perception, Techniques for investigating user behaviour.
Stating objectives, Product formulation, Development of business analysis, Analysis for development, Boundary search and functional innovation.
Product design and design methods, Selection of methods appropriate to design stage. Design evaluation - Analysis for fault, Value and Reliability. Ergonomic analysis, Analysis for maintenance and useful life.
Market preparation vendor search, Sales promotion, Test marketing product and introduction strategy.
Organizational structure for effective product innovation and role of product manager.

References:
Elective – II

(E) IE 206 PRODUCTION MANAGEMENT - STRATEGIC PERSPECTIVES
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4

Strategic role of production management - Meshing of short and medium term operations planning and control with long term strategic goals of the organisation.
Emerging production management concepts and practices, Such as just-in-time with examples and cases.
Manufacturing strategy interconnectedness with financial, Costing and reward systems and need for change in reporting and evaluation systems.
Service operations strategy - Comparison with manufacturing strategy.

References:

Elective - II

(F) IE 206 HUMAN FACTORS ENGINEERING
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th. Ses. : 30 Exam: 70
Examination (Theory): 3hrs. Credits: 4

Introduction to Human factors and systems.
Information Input: Information input and processing, Text, Graphics, Symbols, and Codes, Visual displays of dynamic information, Auditory, Tactual, and Olfactory displays, communications
Human Output and Control: Physical Work and Manual Materials Handling, Motor Skills, Human Control of Systems, Controls and Data Entry Devices, Hand Tools and Devices
Workplace Design: Applied Anthropometry, Work-Space Design and Seating, Arrangement of Components within Physical Space, Interpersonal Aspects of Workplace Design
Environmental Conditions: Illumination, Climate, Noise, Motion
Human Factors Applications: Human Error. Accidents, and Safety, Human Factors In Systems Design
References:
3. Ergonomics at Work by David J. Oborne, John Wiely & Sons Ltd.

IE 207 SEMINAR
(Four-Semester Course -Credit System- w.e.f. 2007-2008)
Periods/week: 3 Pr.  Ses. : 50
Credits: 2
The student has to give at least three seminars on topics related to Industrial Engineering.

IE 208 COMPUTER APPLICATIONS LAB
(Four-Semester Course -Credit System- w.e.f. 2007-2008)
Periods/week: 3 Pr.  Ses. : 50
Credits: 2
Data analysis:
Statistical analysis of data with graphs - Linear regression - Multiple linear regression.
Operations research:
Linear programming - Networks - Queuing.
Production management:
Inventory - Layout/Line balancing - Forecasting - Scheduling.
Simulation models.
THIRD SEMESTER
(Four-Semester Course -Credit System- w.e.f. 2007-2008)
IE 301 PROJECT

Project (to be continued in Fourth semester)
Periods per week: 12         Credits: 14

Semester end appraisal of Project Through seminar by a committee consisting of Head of the Department, Chairman, Board of Studies & Guide

FOURTH SEMESTER
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Project (continued from Third semester)
Periods per week: 12

Presentation followed by Viva-Voce Examination with the following members.

1. Chairman, Board of Studies.
2. Head of the Department.
3. External Examiner.

No marks are allotted for the Project work.
Viva-voce - Examination: Recommended/Not recommended.
For final result the dissertation credits are not added for CGPA.