

UNIVERSITY OF DELHI

**NETAJI SUBHAS INSTITUTE OF
TECHNOLOGY**

**CHOICE BASED CREDIT
SYSTEM**

**SCHEME OF COURSES
FOR
M.TECH.
(ENGINEERING MANAGEMENT)**

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PREAMBLE

I. INTRODUCTION

Higher education is very important for the growth and development of any country. It is a living organ and requires continuous changes to ensure the quality of education. National Knowledge Commission and University Grants Commission have recommended many academic reforms to address the challenges of today's networked globalized world. People are coming together with the help of new technologies which is resulting towards new aspirations, expectations, collaborations and associations. The concept of "work in isolation" may not be relevant and significant anymore. The UGC guidelines on adoption of Choice Based Credit System may be an important step to revamp the processes, systems and methodologies of Higher Educational Institutions (HEIs). The teacher centric mode be changed to learner centric mode. Class room teaching and learning be made effective; relevant and interesting. Concepts and theories be explained with examples, experimentation and related applications.

A culture of discussions, arguments, interpretations, counter-interpretations, re-interpretations, and opposing interpretations must be established. Research should not only be confined to redefinition, extension and incremental change. Innovation & creativity should become an epicentre for all research initiatives. The most important capital is the human capital and thus the ultimate objective is to develop good human beings with utmost integrity & professionalism for this new world.

The Choice Based Credit System supports the grading system which is considered to be better than conventional marks system. It is followed in many reputed institutions in India and abroad. The uniform grading system facilitates student mobility across the institutions within and across the countries and also enable potential employers to assess the performance of the students. The Choice Based Credit System makes the curriculum interdisciplinary and bridge the gap between professional and liberal education.

Programme Educational Objectives (PEO) of the programme are as follows:

- Students will apply knowledge of Computer aided design, simulation, manufacturing to pursue successful career in the field of Mechanical Engineering.
- Students will become innovators, entrepreneurs to design and develop products and services to address social, technical and business challenges.
- Students will engross in lifelong learning such as higher studies, research and other continuous professional development activities.

II. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education has been moving from the conventional annual system to semester system. Currently many of the institutions have already introduced the choice based credit system. The semester system accelerates the teaching-learning process and enables vertical and horizontal mobility in learning. The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and then the required credits, and adopt an interdisciplinary approach to learning. It is desirable that the HEIs move to CBCS and implement the grading system.

A. Types of Courses

Courses are the subjects that comprise the M.Tech programme.

1. A course may be designed to comprise lectures, tutorials, laboratory work, field work, outreach activities, project work, vocational training, viva, seminars, term papers, assignments, presentations, self-study etc. or a combination of some of these components.
2. The learning objectives and learning outcomes of each course will be defined before the start of a semester.
3. Courses are of two kinds: Core and Elective.
 - i. **Core Course (CC):** This is a course which is to be compulsorily studied by a student as a core requirement to complete the requirement of M.Tech Computer Engineering.
 - ii. **Elective Course:** An elective course is a course which can be chosen from a pool of subjects. It is intended to support the discipline of study by providing an expanded scope, enabling exposure to another discipline/domain and nurturing a student's proficiency/skill. An elective may be of following types:
 - a) **Discipline Centric Elective (ED):** It is an elective course that adds proficiency to the students in the discipline.
 - b) **Open Elective (EO):** It is an elective course taken from other engineering disciplines that broadens the perspective of an Engineering student.

4. Each course contributes certain credits to the programme. A course can be offered either as a full course (4 credits) or as a half course (2 credits). A full course is conducted with 3 hours of lectures and either 1 hour of tutorial or 2 hours of practical work per week. A half course is conducted with 2 hours of lectures.
5. A student of Postgraduate programme has to accumulate about 40% credits from the Core the remaining credits from the Elective Courses to become eligible for the award of degree/ diploma/ certificate programmes.
6. A course (full/half) may also be designed without lectures or tutorials. However, such courses may comprise Field work, Outreach activities, Project work, Vocational Training, Seminars, Self-study etc. or a combination of some of these.
7. A Project work/Dissertation is considered as a special course involving application of the knowledge gained during the course of study in exploring, analyzing and solving complex problems in real life applications. A candidate completes such a course on his own with an advisory support by a teacher/faculty member.

B. Examination and Assessment

The following system will be implemented in awarding grades and CGPA under the CBCS system.

1. **Letter Grades and Grade Points:** A 10-point grading system shall be used with the letter grades as given in Table 1 below:

Table1:Grades and Grade Points

| Letter Grade | Grade point |
|---------------------|--------------------|
| O (Outstanding) | 10 |
| A+ (Excellent) | 9 |
| A (Very Good) | 8 |
| B+ (Good) | 7 |
| B (Above average) | 6 |
| C (Average) | 5 |
| P (Pass) | 4 |
| F (Fail) | 0 |
| Ab (absent) | 0 |

2. **Fail grade:** A student obtaining Grade F shall be considered failed and will be required to reappear in the examination. If the student does not want to reappear in an elective subject (that is ED, EO *but not CC courses*) then he/she can re-register afresh for a new elective subject.
3. **Non-credit course:** For non-credit courses, ‘Satisfactory’ or ‘Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA. However, a student must get satisfactory to get the degree.
4. **Fairness in Assessment:** The CBCS promotes continuous evaluation system where end semester examinations weightage should not be more than 60%. The Departments should design their own methods for continuous evaluation. They have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi & teaching, learning methods. In this regard, the checks and balances be implemented which enable Departments would effectively and fairly carry out the process of assessment and examination.
5. **Computation of SGPA and CGPA:** The following procedure be used to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

- i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student ,i.e.

$$SGPA(S_i) = \frac{\sum C_i \times G_i}{\sum C_i}$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade points scored by the student in the i^{th} course.

- ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \frac{\sum C_i \times SGPA(S_i)}{\sum C_i}$$

Where S_i is the SGPA of the i_{th} semester and C_i is the total number of credits in that semester.

iii The SGPA and CGPA shall be rounded off to two decimal points and reported in the transcripts.

iv CGPA shall be converted into percentage of mark, if required, by multiplying CGPA with 10.

III. PROGRAMME STRUCTURE

1. The M.Tech. Engineering Management programme spans 4 semesters, normally completed in 2 years.
2. The courses offered in each semester are given in the **Semester-wise Course Allocation**.
3. The discipline centric subjects under CC and ED categories are listed for each discipline separately.
4. A course may have pre-requisite courses that are given in the **Semester-wise Course Allocation**. A student can opt for an elective only if he/she has fulfilled its pre-requisites.
5. A student has to register for all electives before the start of a semester.

IV. COURSE CODIFICATION

The codes for various Postgraduate Programme are as follows:

- i. Department of Electronics and Communication Engineering:
 1. Signal Processing-ECSP
 2. Embedded System and VLSI-ECES
- ii. Department of Computer Engineering:
 1. Information System-COIS
- iii. Department of Instrumentation and Control Engineering:
 1. Process Control-ICPC

2. Industrial Electronics-ICIE
3. Mechatronics-ICMT
- iv. Department of Biotechnology: BT
 1. Biochemical Engineering -BTBC
 2. Bioinformatics-BTBF
- v. Manufacturing processes and Automation Engineering: MPAE
 1. CAD CAM-MACD
 2. Manufacturing process and Automation Engineering.-MAMP
 3. Production Engineering-MAPE
 4. Engineering Management- MAEM
 5. Nano Technology- MANT

The codes for Departmental core subjects and Domain-specific Electives are specific to each Discipline. The first two characters are derived from Departmental codes listed above.

For I semester, the codes are:

| | |
|-------|---------------|
| EMC01 | CC |
| EMC02 | CC |
| EMD** | Elective |
| EMD** | Elective |
| EMD** | Elective |
| EO*** | Open Elective |

For II semester, the codes are:

| | |
|-------|---------------|
| EMC03 | CC |
| EMC04 | CC |
| EMD** | Elective |
| EMD** | Elective |
| EMD** | Elective |
| EO*** | Open Elective |

For III semester, the codes are:

| | |
|-------|---------------|
| EMC05 | Seminar |
| EMC06 | Major Project |
| EMD** | Elective |
| EMD** | Elective |
| EMD** | Elective |

For IV semester, the codes are:

| | |
|-------|--------------|
| EMC07 | Dissertation |
|-------|--------------|

V. EVALUATION SCHEME

The courses are evaluated on the basis of continuous assessments, mid-semester exams and end-semester exams. The weightage of each of these modes of evaluation for the different types of courses are as follows.

| Type of Course | Continuous Assessment (CA), Theory | Mid Semester Exam (MS), Theory | End-semester Exam (ES), Theory | Continuous Assessment (CA), Lab | End-semester Exam (ES), Lab |
|---------------------------------------|-------------------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|------------------------------------|
| CC/ED/EO Theory with/without Tutorial | 25 | 25 | 50 | Nil | Nil |
| CC/ED/EO Theory with Practical | 15 | 15 | 40 | 15 | 15 |
| Major Project and Dissertation | Nil | Nil | Nil | 40 | 60 |

VI. EVALUATION AND REVIEW COMMITTEE

The Committee of Courses and Studies in each department shall appoint one or more Evaluation-cum-Review Committees (ERC), each committee dealing with one course or a group of courses. This ERC consists of all faculty members who are likely to teach such courses in the group. Normally Head of the department shall be ERC Chairman.

The ERC has the following functions-

- (i) To recommend appointment of paper setters/examiners of various examinations at the start of each semester.
- (ii) To prepare quizzes, assignments, test papers etc. for Continuous Assessment (CA), Mid-Semester examination (MS) and End Semester (ES) examination and to evaluate them. Normally, each concerned faculty member, who is also a member of ERC, will do this job for his/her class. However, in exceptional circumstances any part of the work may be entrusted to some other member of the ERC.

- (iii) To consider the individual representation of students about evaluation and take remedial action if needed. After scrutinizing, ERC may alter the grades awarded upward/downward. The decision of the ERC shall be final.
- (iv) To moderate assignments, quizzes etc. for courses given by each of the concerned faculty members for his/her class with a view to maintain uniformity of standards.
- (v) To review and moderate the MS and ES results of each course with a view to maintain uniformity of standards.
- (vi) To lay guidelines for teaching a course.

VII. ATTENDANCE, PROMOTION AND DETENTION RULES

1. A student should normally attend all the classes. However, a student will be allowed to appear in the examination if he/ she has put in a minimum of 75% attendance separately in each course for which he / she has registered. A relaxation up to a maximum of 25% may be given on the production of satisfactory evidence that (a) the student was busy in authorized activities, (b) the student was ill.
2. A student should submit the evidence to the fact 1(a) and / or 1(b) above within seven working days of resuming the studies. Certificates submitted later will not be considered.
3. No relaxation in attendance beyond 25% is permitted in any case.
4. A student may re-register for a course if he/ she want to avoid a decrement in the grades.
5. There shall be no supplementary examinations. A student who has failed in a course will have to re-register for the course in a subsequent year.
6. If the student does not want to reappear in an elective course (that is, ED, EO, but not CC courses) then he/she can re-register afresh for a new elective course.

VIII. DECLARATION OF RESULTS

1. The Mtech (ES) programme consists of 82 credits. A student will be awarded the degree if he/she has earned all 82 credits.
2. CGPA will be calculated on the basis of the best 78 credits earned by the student.
3. The candidate seeking re-evaluation of a course shall apply for the same on a prescribed proforma along with the evaluation fee prescribed by the university from time to time only for the End Semester Examination within seven days from the date of declaration of result.

4. The Institution/University may cancel the registration of all the courses in a given semester if
 - i. The student has not cleared the dues to the institution/hostel.
 - ii. A punishment is awarded leading to cancellation of the student's registration.

IX. CURRICULUM MODIFICATION

The curriculum will be updated regularly within a period of 5 to 10 years since last revision, to keep pace with the advancements in the field of Engineering management.

X. CENTRAL ADVISORY COMMITTEE

There shall be a Central Advisory Committee consisting of the following—

- a) Dean, Faculty of Technology, Chairman
- b) Dean PGS
- c) Head of Institution
- d) Heads of Departments running MTech Courses

PROGRAMME OUTCOME

- An ability to apply knowledge of mathematics and engineering.
- An ability to design, analyze and interpret data using Engineering Management tools & techniques.
- An ability to design and develop a manufacturing system, process etc. to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
- An ability to function in multi-disciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- Responsiveness towards professionalism and ethics.
- An ability to communicate effectively.
- Domain knowledge necessary to understand the impact of engineering solution in a global and societal context.
- Recognition of the need for, and an ability to engross in lifelong learning.
- Knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- An ability to demonstrate the knowledge of engineering and management principles and apply these to manage the projects and its financial aspects.

SEMESTER-WISE COURSE ALLOCATION

M.TECH. Engineering Management (Full Time) SEMESTER I

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION (MARKS) | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------------|---|---|---|-------|--------------------|----|----|-----------|----|-------|
| | | | | | | | Theory | | | Practical | | Total |
| | | | | | | | CA | MS | ES | CA | ES | |
| EMC01 | CC | Operation Planning and Control | 3 | 0 | 2 | 4 | 15 | 15 | 40 | 15 | 15 | 100 |
| EMC02 | CC | Inventory Control and Materials Management | 3 | 0 | 2 | 4 | 15 | 15 | 40 | 15 | 15 | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EO*** | EO | Open Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| | | Total | | | | \$ 24 | | | | | | |
| # The LTP allocation evaluation scheme and pre-requisites for elective(s) are given in Table 2-3. \$ The actual weekly load will depend upon the elective(s) chosen by the student. | | | | | | | | | | | | |

M.TECH. Engineering Management (Full Time) SEMESTER II

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION (MARKS) | | | | | |
|-------|------|-------------------------------------|---|---|---|-------|--------------------|----|----|-----------|----|-------|
| | | | | | | | Theory | | | Practical | | Total |
| | | | | | | | CA | MS | ES | CA | ES | |
| EM03 | CC | Operations Research | 3 | 0 | 2 | 4 | 10 | 20 | 40 | 15 | 15 | 100 |
| EM04 | CC | Industrial Statistics & Forecasting | 3 | 0 | 2 | 4 | 10 | 20 | 40 | 15 | 15 | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EO*** | EO | Open Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| | | TOTAL | | | | \$ 24 | | | | | | |

The LTP allocation evaluation scheme and pre-requisites for elective(s) are given in Table 2-3.
 \$ The actual weekly load will depend upon the elective(s) chosen by the student.

M.TECH. Engineering Management (Full Time) SEMESTER III

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION (MARKS) | | | | | |
|-------|------|-----------------|---|---|---|-------|--------------------|----|-----|-----------|----|-------|
| | | | | | | | Theory | | | Practical | | Total |
| | | | | | | | CA | MS | ES | CA | ES | |
| EMC05 | CC | Seminar | 0 | 0 | 4 | 2 | 100 | - | - | - | - | 100 |
| EMC06 | CC | Major Project | - | - | - | 6 | - | - | - | 40 | 60 | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | 50 | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | 100 | - | - | 100 |
| | | TOTAL | | | | \$ 20 | | | | | | |

The LTP allocation evaluation scheme and pre-requisites for elective(s) are given in Table 2-3.
 \$ The actual weekly load will depend upon the elective(s) chosen by the student.

M.TECH. Engineering Management (Full Time) SEMESTER IV

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION (MARKS) | | | | | |
|------|------|-----------------|---|---|---|----|--------------------|----|----|-----------|----|-------|
| | | | | | | | Theory | | | Practical | | Total |
| | | | | | | | CA | MS | ES | CA | ES | |
| EM07 | CC | Dissertation | 0 | 0 | - | 14 | - | - | - | 40 | 60 | 100 |
| | | TOTAL | - | - | - | 14 | | | | | | |
| | | | | | | | | | | | | |

SEMESTER-WISE COURSE ALLOCATION-PART-TIME

Engineering Management (Part Time) SEMESTER I

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION SCHEME | | | | | |
|-------|------|--------------------------------------------|----|----|---|----|------------------------|----|----|-----------|----|-------|
| | | | | | | | Percentage (Weightage) | | | | | Total |
| | | | | | | | Theory | | | Practical | | |
| CA | MS | ES | CA | ES | | | | | | | | |
| EMC01 | CC | Operation Planning and Control | 3 | 0 | 2 | 4 | 15 | 15 | 40 | 15 | 15 | 100 |
| EMC02 | CC | Inventory Control and Materials Management | 3 | 0 | 2 | 4 | 15 | 15 | 40 | 15 | 15 | 100 |
| EO*** | EO | Open Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| | | TOTAL | | | | \$ | | | | | | |

The LTP allocation evaluation scheme and pre-requisites for elective (s) are given in table 2-3.
 \$ The actual weekly load will depend upon the elective (s) as chosen by the students.

Engineering Management (Part Time) SEMESTER II

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION SCHEME Percentage (Wightage) | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------------------------------|---|----|---|----|--------------------------------------------|----|----|-----------|----|-------|
| | | | | | | | Theory | | | Practical | | Total |
| | | | | | | | CA | MS | ES | CA | ES | |
| EM03 | CC | Operations Research | 3 | 0 | 2 | 4 | 15 | 15 | 40 | 15 | 15 | 100 |
| EM04 | CC | Industrial Statistics & Forecasting | 3 | 0 | 2 | 4 | 15 | 15 | 40 | 15 | 15 | 100 |
| EO*** | EO | Open Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| | | TOTAL | | \$ | | 12 | | | | | | |
| # The LTP allocation evaluation scheme and pre-requisites for elective (s) are given in table 2-3. \$ The actual weekly load will depend upon the elective (s) as chosen by the students. | | | | | | | | | | | | |

M.TECH. Engineering Management (Part Time) SEMESTER III

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION SCHEME Percentage (Wightage) | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------|---|----|---|----|--------------------------------------------|----|----|-----------|----|-------|
| | | | | | | | Theory | | | Practical | | Total |
| | | | | | | | CA | MS | ES | CA | ES | |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| | | TOTAL | | \$ | | 12 | | | | | | |
| # The LTP allocation evaluation scheme and pre-requisites for elective (s) are given in table 2-3. \$ The actual weekly load will depend upon the elective (s) as chosen by the students. | | | | | | | | | | | | |

M.TECH. Engineering Management (Part Time) SEMESTER IV

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION SCHEME Percentage (Weightage) | | | | | |
|----------------------------------------------------------------------------------------------------|------|-----------------|---|----|---|----|------------------------------------------|--------|--------|-----------|----|-------|
| | | | | | | | Theory | | | Practical | | Total |
| | | | | | | | C A | M S | E S | CA | ES | |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| | | TOTAL | | \$ | | 12 | | | | | | |
| # The LTP allocation evaluation scheme and pre-requisites for elective (s) are given in table 2-3. | | | | | | | | | | | | |
| \$ The actual weekly load will depend upon the elective (s) as chosen by the students. | | | | | | | | | | | | |

M.TECH. Engineering Management (Part Time) SEMESTER V

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION SCHEME Percentage (Weightage) | | | | | |
|----------------------------------------------------------------------------------------------------|------|-----------------|---|----|---|----|------------------------------------------|----|----|-----------|----|-------|
| | | | | | | | Theory | | | Practical | | Total |
| | | | | | | | CA | MS | ES | CA | ES | |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | - | - | - | 100 |
| EMC06 | CC | Major Project | - | - | - | 6 | - | - | - | 40 | 60 | 100 |
| | | TOTAL | | \$ | | 14 | | | | | | |
| # The LTP allocation evaluation scheme and pre-requisites for elective (s) are given in table 2-3. | | | | | | | | | | | | |
| \$ The actual weekly load will depend upon the elective (s) as chosen by the students. | | | | | | | | | | | | |

M.TECH. Engineering Management (Part Time) SEMESTER VI

| CODE | Type | COURSE OF STUDY | L | T | P | C | EVALUATION SCHEME | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------|----|----|---|-------|------------------------|---|-----|-----------|----|-------|
| | | | | | | | Percentage (Weightage) | | | | | |
| | | | | | | | Theory | | | Practical | | Total |
| CA | MS | ES | CA | ES | | | | | | | | |
| EMD** | ED | Elective # | - | - | - | 4 | - | - | 100 | - | - | 100 |
| EMC05 | CC | Seminar | 0 | 0 | 4 | 2 | - | - | - | 40 | 60 | 100 |
| EMC07 | CC | Dissertation | 0 | 0 | - | 14 | - | - | - | 40 | 60 | 100 |
| | | TOTAL | | | | \$ 20 | | | | | | |
| # The LTP allocation evaluation scheme and pre-requisites for elective (s) are given in table 2-3. \$ The actual weekly load will depend upon the elective (s) as chosen by the students. | | | | | | | | | | | | |

| TABLE 2A: LIST OF DISCIPLINE CENTRIC ELECTIVES WITH TUTORIAL | | | | | | | |
|---------------------------------------------------------------------|--------------------------------------------------|----------|--------------------------|-----------|-----------|-----------|-----------|
| LTP Allocation | | | Evaluation Scheme | | | | |
| L | T | P | CA | MS | ES | CA | MS |
| 3 | 1 | 0 | 25 | 25 | 50 | - | - |
| Code | Name of Elective | | Pre-Requisite(s) | | | | |
| EMD01 | Quality Control | | | | | | |
| EMD02 | Financial Engineering | | | | | | |
| EMD03 | Work study and ergonomics | | | | | | |
| EMD04 | Management Concepts and Organizational Behaviour | | | | | | |
| EMD05 | Supply chain logistics Management | | | | | | |
| EMD06 | Design of Facilities | | | | | | |
| EMD07 | Reliability Engineering | | | | | | |
| EMD08 | Total Quality management | | | | | | |
| EMD09 | Production Management | | | | | | |
| EMD10 | Advanced Concurrent Engineering | | | | | | |
| EMD11 | Project management | | | | | | |
| EMD12 | Design for Manufacture | | | | | | |
| EMD13 | Value Engineering | | | | | | |
| EMD14 | Industrial waste Management | | | | | | |
| EMD15 | IT in Manufacturing Enterprise | | | | | | |
| EMD16 | Applied Operations Research | | | | | | |

| | | |
|-------|-------------------------|--|
| EMD17 | Optimization Techniques | |
| EMD19 | Design of experiments | |

| TABLE 2B: LIST OF DISCIPLINE CENTRIC ELECTIVES WITH PRACTICAL | | | | | | | |
|----------------------------------------------------------------------|-----------------------------------------|----------|--------------------------|-----------|-----------|-----------|-----------|
| LTP Allocation | | | Evaluation Scheme | | | | |
| L | T | P | CA | MS | ES | CA | ES |
| 3 | 0 | 2 | 15 | 15 | 40 | 15 | 15 |
| Code | Name of Elective | | Pre-Requisites | | | | |
| EMD31 | Design of Management Information System | | | | | | |
| EMD32 | Systems Engineering | | | | | | |
| EMD33 | Automation in manufacturing | | | | | | |
| EMD34 | Advanced Operations Research | | | | | | |
| EMD35 | Computer integrated Manufacturing | | | | | | |
| EMD36 | Metrology | | | | | | |
| EMD37 | Flexible Manufacturing System | | | | | | |

| TABLE 3: LIST OF OPEN ELECTIVES EO-*** | | | | | | | |
|-----------------------------------------------|--------------------------------------------------|----------|--------------------------|-----------|-----------|-----------|-----------|
| LTP Allocation | | | Evaluation Scheme | | | | |
| L | T | P | CA | MS | ES | CA | ES |
| 3 | 1 | 0 | 25 | 25 | 50 | - | - |
| Code | Name of Elective | | Pre-Requisites | | | | |
| EO001 | Technical Communication | | None | | | | |
| EO002 | Disaster Management | | None | | | | |
| EO003 | Basics of Finance Management | | None | | | | |
| EO004 | Basics of Human Resources Management | | None | | | | |
| EO005 | Project Management | | None | | | | |
| EO006 | Basics of Corporate Law | | None | | | | |
| EO007 | Biological computing | | None | | | | |
| EO008 | Basic of social science | | None | | | | |
| EO009 | Entrepreneurship | | None | | | | |
| EO010 | Social work | | None | | | | |
| EO011 | IP and Patenting | | None | | | | |
| EO012 | Supply Chain Management-Planning and logistics | | None | | | | |
| EO013 | Organization Development | | None | | | | |
| EO014 | Industrial Organization and Managerial Economics | | None | | | | |
| EO015 | Global Strategy and Technology | | None | | | | |
| EO016 | Engineering System Analysis and Design | | None | | | | |
| EO017 | Biology for Engineers | | None | | | | |
| EO018 | Energy, Environment and Society | | None | | | | |
| EO019 | Public Policy and Governance | | None | | | | |

COURSE CONTENTS OF DISCIPLINE CENTRIC ELECTIVES WITH TUTORIAL

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD01 | Quality Control | L-T-P : 3-1-0 | None |
| COURSE OUTCOMESS (CO): <ul style="list-style-type: none">• Student can maturely utilize the knowledge gained in solving quality related issues.• Student learns about the various quality control techniques prevalent in industry along with their applications• Student understands the basic concepts of quality, its cost and value of quality, standardization.• Student learns the importance of quality certifications and the awarding agencies involved.• Student learns the role and importance of computer in controlling the quality related issues | | | |
| COURSE CONTENT: <p>Introduction to quality, quality planning and control, specification, tolerances and process capabilities, random and relative assembly system, total quality concepts, TQM models, six sigma, Quality circles, Quality function deployment.</p> <p>Analysis of variance and covariance, design of sampling investigations and experiments Two stage sampling, random block, Latin square, correlation and regression analysis control charts, significance tests. Designs of sampling, inspection by attributes and variables, sequential analysis.</p> | | | |
| SUGGESTED READINGS: <p>Laudon, Kenneth C., and Laudon, Jane P., “Management Information Systems-Managing Digital Firm”, Prentice Hall.</p> | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD02 | Financial Engineering | L-T-P : 3-1-0 | None |
| COURSE OUTCOMESS (CO): <ul style="list-style-type: none">• To understand various fields involving financial theory, the methods of engineering, the tools of mathematics and the practice of programming.• To understand the application of engineering methodologies and quantitative methods to finance.• Understanding of the tools of the trade and their use in modeling financial markets and instruments.• To understand portfolio theory, derivatives valuation, and financial risk analysis, making use of the methods they have learned | | | |
| COURSE CONTENT: <p>Introduction, factors affecting the growth of financial engineering, price volatility, liquidity needs, cash flow, time value, sensitivity analysis of time value, risk and return, managing risks, credit policy, asset management. Fixed assets and depreciation, analysis, and interpretation of financial statements, cash management, sources of funds for working capital, cost accumulation systems, budgeting, standard budgeting and control. Use of software like matlab, dot net, data mining software's.</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Sheldon Ross “An Elementary Introduction to Mathematical Finance: Options and Other Topics”, Cambridge University Press.2. Lawrence J Gitman, “Principles of Managerial Finance”, Pearson Education. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD03 | Work study and ergonomics | L-T-P : 3-1-0 | None |
| COURSE OUTCOMESS (CO): <ul style="list-style-type: none">• Identify, explain and evaluate the impact of various personal attributes (anatomical, physiological, anthropometric and psychological) on proper safe working practice;• Assess the effect of physical environment factors on comfort and performance;• Apply principles of good ergonomic design of work areas and equipment to a range of occupational settings;• Explain the influence of ergonomic principles on work organisation and culture. | | | |
| COURSE CONTENT: <p>Introduction, Measurement of productivity, Method study, principles of motion economy, Macro motions analysis, work measurement, Time study, performance rating, standard allowances, work sampling, PMT MTM standard data system.</p> <p>Ergonomics: Man machine system, types of displays, autodoxy presentation of information and speech communication Man-machine dynamics, Design of control, layout of workplace environmental effects and anthropometry.</p> | | | |
| SUGGESTED READINGS: <p>O.P Khanna, “Work Study: Motion &Time Study-O.P Khanna, Dhanpat Rai Publication.</p> <p>Barnes , “ Motion and Time Study Design and Measurement of Work” , Wiley Publication.</p> | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------|----------------------|
| EMD04 | Management Concepts and Organizational Behaviour | L-T-P : 3-1-0 | None |
| COURSE OUTCOMESS (CO): <ul style="list-style-type: none">To enable the students to understand the multiplicity of Interrelated factors which influence the behavior and performance of people as members of work organizations | | | |
| COURSE CONTENT: <p>Unit I: Evolution of management Thought-Classical, Behavioral and Management Science Approaches; The Hawthorne Studies; Systems and Contingency Approach for understanding organizations; Application of Management thought to the current scenario; Fundamental Concepts of Organizational Behavior; The role of OB in Management; Managerial Process, Functions; Managerial Skills and Roles in Organizations.</p> <p>Unit II: Foundations of Individual Behavior-Personality-Meaning; Development of Personality; Personality Determinants; the “Big Five” Personality Traits; Emotional Intelligence. Perception;- Nature and importance; Factors influencing perception; Managing the Perception Process.</p> <p>Unit-III: Learning- Components of learning process; Theoretical process of learning- Classical Conditioning; Operant Conditioning; Cognitive and Social Learning Theory. Attitude: Nature and dimensions; Components and functions of attitude, Formation and attitude change.</p> <p>Unit-IV: Motivation in organizations: Nature and importance; The motivational framework; The content theories of work motivation- Maslow’s Need Hierarchy Theory; The Dual Structure Theory of Motivation; Process theory of work motivation- Vroom’s Expectancy Theory; J. Stacy Adam’s Equity Theory.</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Griffin, “Fundamentals of Management”, Houghton Mifflin Company, Boston New York, U.S.A.2. Andrew J and DuBrin, “Essentials of Management”.3. Hersey/Balanchard/Johnson, “Management of Organizational Behavior”, Pearson Education-New Delhi. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------|----------------------|
| EMD05 | Supply chain logistics Management | L-T-P : 3-1-0 | None |
| COURSE OUTCOMESS (CO): <ul style="list-style-type: none">• An understanding of the primary differences between logistics and supply chain management An understanding of the individual processes of supply chain management and their interrelationships within individual companies and across the supply chain• An understanding of the management components of supply chain management• An understanding of the tools and techniques useful in implementing supply chain management• Knowledge about the professional opportunities in supply chain management. | | | |
| COURSE CONTENT: <p>Topics covered include:</p> <ul style="list-style-type: none">• Supply Chain Management Principles• Supply Chain Networks and Organizations• Product Lifecycle Implications to Supply Chains• Forecasting and Inventory Management• Supply Chain Processes• Supply Chain Information Systems• Supply Chain Performance and Metrics• Lean Supply Chains• Risk Management• Legal and Ethical Issues | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Chopra, Sunil, P. Meindl, “Supply Chain Management, Fourth Edition, Pearson Prentice Hall.2. Bowersox, “Supply Chain Logistics Management”, McGraw Hill.3. Jacob, “Manufacturing Planning for Supply Chain”, McGraw Hill. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD06 | Design of Facilities | L-T-P : 3-1-0 | None |
| Course Outcomes: <ul style="list-style-type: none">• To understand various approach for the planning and design of facilities.• To understand quantitative approaches to plant layout, computerized layout.• To understand assembly line balancing, plant maintenance.• To understand and analyze real material handling problems. | | | |
| COURSE CONTENT: <p>System approach for the planning and design of facilities, plant location factors and theories, location of plant operation locational dynamics, Transportation models in plant location, Types of layout, Quantitative approaches to plant layout, computerized layout- planning, CRAFT, CORELAP, ALDEP. Analysis of material handling problems, selection of materials handling equipments automated warehousing and comeyorized systems. Assembly line balancing, plant maintenance, optimal maintenance policies, manpower planning and scheduling for maintenance, recent advancements.</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Tompkins, “Facilities Planning”, Wiley Publications.2. Buffa, “Modern Production/Operations Management”, Wiley Publication. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD07 | Reliability Engineering | L-T-P : 3-1-0 | None |
| Course Outcomes: <ul style="list-style-type: none">• Understand the basic concepts of quality, reliability & safety.• Compute measures of reliability of products and systems.• Analyze failure data I Perform a Failure Modes, Effects and Criticality Analysis.• Conduct a Fault Tree Analysis.• Construct and analyze reliability block diagrams.• Identify component importance.• Use redundancy to achieve reliability | | | |
| COURSE CONTENT: <p>Introduction, failure data analysis, MTTF, MTBF, Hazard models, series, parallel and mixed configuration, reliability improvement, reliability allocation, maintainability and availability, reliability based design, maintenance policies.</p> <p>Reliability testing: Burn in testing, Binomial Testing, Acceptance testing, Accelerated life Testing, Degradation Models.</p> <p>Reliability Improvement: Reliability specification and system measurements, System effectiveness, Economic analysis and life cycle cost, Reliability allocation (AGREE method, Redundancies).</p> <p>Reliability Design Methods: Parts and material selection, De-rating, Stress-Strength analysis, Complexity and Technology, Redundancy. Maintenances systems and economics of reliability.</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. ADS Carter, “Mechanical Reliability Engineering”, Mc Milan.2. Roy Bilington and R. N. Allen, “Reliability Evaluation of Engineering Systems, Pitman.3. Balagurusamy.E., "Reliability Engineering", Tata McGraw Hill Publishing Company. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD08 | Total Quality management | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs): On completion, students would be able to: <ul style="list-style-type: none">● Understand the basics of Total Quality Management;● Understand the essentials of customer satisfaction;● Create successful systems for employee involvement;● Develop strategies for continuous process improvement;● Apply the five-phase approach of Total Quality Management implementation; | | | |
| Course Content: Module I : Introduction to TQM; Customer Orientation, Continuous Improvement, Quality, Productivity and Flexibility, Approaches and philosophies of TQM, Quality Awards, Strategic Quality Management, TQM and corporate culture, Total Quality Control; Basic Analytical tools-Check Sheets; Histograms; Pareto charts, Cause and Effect diagrams; Flow charts. Module II : Statistical Process Control; Advanced Analytical tools- Statistical Design of Experiments; Taguchi Approach; Cost of Quality; Reliability and failure analysis. FMECA, Quality Function Deployment, Benchmarking, Concurrent Engineering. Module III : Quality Teams, Employee practices in TQM organisations: Leadership, delegation; empowerment and motivation; role of communication in Total Quality, Quality Circles; Total Employee Involvement; Problem Solving in TQM- Brain storming; Nominal Group Technique Team process; Kaizen and Innovation; Measurement and audit for TQM; Quality Information Systems, ISO 9000 series of Quality Standards; TQM Implementation; Reengineering and TQM. | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Gilton, “Quality Management”, McGraw Hill.2. Gryna, “Juran’s Quality Planning & Analysis for Enterprise”, McGraw Hill.3. Besterfield, “Total Quality Management”, Pearson Education. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD09 | Production Management | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) <ul style="list-style-type: none">• Understand and appreciate the concept of Production Management.• Recognise the scope of Production Management and its role in creating competitive advantage for business organisations.• Understand the concept and contribution of various constituents of production operations (both manufacturing and service) viz. Product design, Process design, Location planning, Layout planning, Capacity planning, Work study, Quality management, Purchasing management and Inventory management towards effective production management. | | | |
| COURSE CONTENT: <p>Concept, Definition, Types of Production Systems; Demand Forecasting; Facility Location; Plant Layout; Production Scheduling; Inventory Control; Tools and Techniques of Modern Production Management. Managing People, Work Systems Design. Quality Management and Control. Sustainable Development, Conservation and Energy. Facility Location. Facility Layout. Supply Chain Management. Resource Planning.</p> | | | |
| SUGGESTED READINGS: <p>Stevenson, “Operations Management”, McGraw-Hill. Young, Scott T “Essentials of Operations Management” Thousand Oaks, CA: Sage Publications.</p> | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------|----------------------|
| EMD10 | Advanced Concurrent Engineering | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) Students will be able: <ol style="list-style-type: none">1. To familiarize with the basics of concurrent engineering.2. To use tools and methodologies available in CE.3. To understand various approaches of CE.4. To apply various aspects of CE for a real system. | | | |
| COURSE CONTENT: <ol style="list-style-type: none">1. INTRODUCTION Extensive definition of CE - CE design methodologies - Organizing for CE - CE tool box collaborative product development.2. USE OF INFORMATION TECHNOLOGY IT support - Solid modeling - Product data management - Collaborative product commerce - Artificial Intelligence - Expert systems - Software hardware co-design.3. DESIGN STAGE Life-cycle design of products - opportunity for manufacturing enterprises - modality of Concurrent Engineering Design - Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints.4. MANUFACTURING CONCEPTS AND ANALYSIS Manufacturing competitiveness - Checking the design process - conceptual design mechanism – Qualitative physical approach - An intelligent design for manufacturing system - JIT system - low inventory - modular - Modeling and reasoning for computer based assembly planning - Design of Automated manufacturing.5. PROJECT MANAGEMENT Life Cycle semi realization - design for economics - evaluation of design for manufacturing cost – concurrent mechanical design - decomposition in concurrent design - negotiation in concurrent engineering design studies - product realization taxonomy - plan for Project Management on new product development – bottleneck technology development. | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Hamid R. Parsaei and William G. Sullivan, “Concurrent Engineering”, Springer | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD11 | Project management | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) <ul style="list-style-type: none">• Students will possess knowledge of current theory and techniques of the Project Management Discipline.• Students will demonstrate the ability to adapt and innovate through problem solving applied through project management techniques.• Students will demonstrate critical thinking skills in the area of Project Management.• Students will understand the ethical implications of Project Management decisions and be familiar with common ethical dilemmas associated with the discipline.• Students will understand the impact to global perspectives on Project Management. | | | |
| COURSE CONTENT: <p>The nature of projects, the project as a non-repetitive unit production system, the project as an agent of change. Project Identification considering objectives and SWOT analysis, Screening of project ideas, Technical, Market, Financial, Socio-economic and Ecological Appraisal of a project. Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats, Scheduling under probabilistic durations, Time Cost tradeoffs, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and project completion.</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Kerzher, “Project Management: A Systems Approach to Planning, Scheduling, and Controlling”, Wiley Publication.2. Maylor, “Project Management”, Pearson Education.3. Burke, “Project Management: Planning and control Techniques”, Wiley Publication. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD12 | Design for Manufacture | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs): <ul style="list-style-type: none">• Perform the essential stages of a Design for Manufacture process.• Recognize and list the benefits of the DFM/DFA method in creating product designs which support manufacturing processes and cost reduction.• Outline a Robust Manufacturing Plan that optimizes and simplifies product design without sacrificing quality.• Objectively determine which designs would be suitable as DFM/DFA candidates.• Construct an actual DFM/DFA worksheet and calculate design efficiency using an instructor provided project. | | | |
| COURSE CONTENT: <ol style="list-style-type: none">1. INTRODUCTION General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances - Geometric tolerances - Assembly limits – Datum features - Tolerance stacks.2. FACTORS INFLUENCING FORM DESIGN Working principle, Material, Manufacture, Design - Possible solutions - Materials choice - Influence of materials on form design - from design of welded members, forgings and castings.3. COMPONENT DESIGN-MACHINING CONSIDERATION Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area - simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.4. COMPONENT DESIGN - CASTING CONSIDERATIONS Redesign of castings based on parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores.5. REDESIGN FOR MANUFACTURE AND CASE STUDIES Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Harry Peck, "Design for Manufacture", Pittman Publication.2. Robert Matousek, "Engineering Design - A systematic approach", Blackie & sons Ltd.3. James G. Bralla, "Hand Book of Product Design for Manufacturing", McGraw Hill Co. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD13 | Value Engineering | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs): <ul style="list-style-type: none">• Understand the basics of Value Engineering (VE) to ensure that a standardized method is used for VE applications to projects• Learn to perform “function analysis” for buildings and civil projects• Understand the appropriate time to apply VE for building design projects• Gain an understanding of the total decision-making methodology of value engineering• Learn of the “SAVE International Value Methodology Standard” and the convention to be followed for application of VE to projects• Acquire the necessary information on VE to recognize the benefits resulting from their adoption as a standard practice within an organization• Be able to engage clients in a meaningful discussion on VE as well as demonstrate a commitment to optimize the value for facilities | | | |
| COURSE CONTENT: <p>UNIT I: Introduction to Value Engineering (V.E.) and Value Analysis, Life Cycle of a Product, Methodology of V.E., Quantitative definition of Value, Use Value and Prestige Value, Estimation of product quality performance</p> <p>UNIT II: Types of Functions, Relationship between Use Functions and Esteem Functions in product design, Functional Cost and Functional Worth, Effect of value improvement on profitability, Aims of VE systematic Approach.</p> <p>UNIT III: Introduction to V.E. Job plan / Functional Approach to Value Improvement, Various phases and techniques of the job plan, Factors governing project selection, Life Cycle Costing for managing the Total Value, Concepts in LCC, Present Value concept, Annuity concept, Net Present Value, Pay Back period, Internal rate of return on investment (IRR), Examples and illustrations.</p> <p>UNIT IV: Creative thinking and creative judgment, False material, labor and overhead saving, System Reliability, Reliability elements in series and parallel, Decision matrix, Estimation of weights and efficiencies, Sensitivity analysis, Utility functions, Fast diagramming, Critical path of functions.</p> | | | |

SUGGESTED READINGS:

1. S.S. Iyer, “Value Engineering”, New Age International.
2. Miles, Lawrence D., “Technology of Value Analysis And Engineering”, McGraw Hill.
3. Mudge Arthur E., “Value Engineering : Systematic Approach”, Mcgraw Hill, New York.

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------|----------------------|
| EMD14 | Industrial waste Management | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs): On completion, students would be able to: <ul style="list-style-type: none">• Sampling and characterization of solid waste; analysis of hazardous waste constituents including QA/QC issues;• Understand health and environmental issues related to solid waste management;• Apply steps in solid waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, transport, optimization of solid waste transport, treatment and disposal techniques. | | | |
| COURSE CONTENT: Value engineering, design waste and cost reduction. Inspection rejects and quality management. Reliability, maintenance, breakdown and management of waste. Space waste and layout planning. Time management, manpower waste in industry, absenteeism. Capacity utilization. Waste heat recovery and energy waste in industry. Resource conversation/loss prevention in process industries. Data and information waste, management of hazardous waste. Waste treatment. Natural calamities. Accident prevention, industrial safety and waste management. Module III :Waste management in Indian industries- present practices, potentials and perspectives. Management of waste in different industrial systems- steel, aluminum, power, automobile, transport and other service industries. Economic analysis and system models of industrial waste management systems. Analytical and Creative techniques to waste control. | | | |
| SUGGESTED READINGS: PL Buckingham and JC Evans, "Hazardous Waste Management", McGraw-Hill. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------|----------------------|
| EMD15 | IT in Manufacturing Enterprise | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) <ul style="list-style-type: none">• To gain an understanding and appreciation of the principles and applications relevant to the planning, design, and operations of manufacturing.• To understand importance of information technology in manufacturing enterprise.• To develop skills necessary to effectively analyze and synthesize the many inter relationships inherent in complex socio-economic productive systems.• To understand how Enterprise Resource Planning and MRPII systems are used in managing operations.. | | | |
| COURSE CONTENT: <p>Production Systems, Manufacturing Enterprises as Systems, Appreciate the evolving manufacturing environment and multi0attributed competition; IT role Challenges and Opportunities, Evolving Role of information Technology in Enterprises; P&I Implications, Technology Management Challenges, Technical Fundamentals; MIS in Manufacturing Enterprises, FMS (Flexible manufacturing Systems), CIM Systems, Intelligent Manufacturing Systems, Concurrent Engineering and Extended Enterprises, ERP (Enterprise Resource Planning), E-Business and supply Chain Management, Discrete Event Simulation and AI Applications in manufacturing enterprises, Implementation Issues, Future Treands Careers etc, use of software like DOT NET, DATA MINING etc.</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. John P.T & Nemes, Laszlo, “Global Engineering, Manufacturing and Enterprise Networks”, Springer | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------|----------------------|
| EMD16 | Applied Operations Research | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) Upon completion of the subject, students will be able to <ul style="list-style-type: none">• Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry;• Formulate a managerial decision problem into a mathematical model;• Understand Operations Research models and apply them to real-life problems;• Able to design new simple models, like: CPM, PERT to improve decision making and develop critical thinking and objective analysis of decision problems | | | |
| COURSE CONTENT: Introduction, Concepts, development, applications, Linear Programming, Definitions, assumption, formulation, graphical method, computational procedure, dual, sensitivity analysis, revised simplex, LP limitations, Net Work Methods, Transportation, assignment, maximum flow, shortest route, spanning tree problems, PERT / CPM. Dynamic programming, Concepts , formulation, recursive approach, computation procedure. Waiting Line Models, Queuing characteristics and terminology, poisson and non-poisson models. | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Hamdy M.Taha, "Operations research an introduction", Mc Millan Co.2. Don T.Phillips, A.Ravindran & James Solberg, Operations Research: Principles and practice, John Wiley & Sons.3. Guisseppi, " A.Forgionne, Quantitative decision making" , Wordsworth Publishing Co. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD17 | Optimization Techniques | L-T-P : 3-0-2 | None |
| COURSE OUTCOMES (COs) <ol style="list-style-type: none">1. Formulate real problems in terms of input-output parameters relationships and identify the solution methods.2. Analyze problems in engineering, management, or business environment, focusing on important details.3. Describe basic optimization and simulation techniques applied to various industries | | | |
| COURSE CONTENT: <p>Unit 1: Introduction: historical development, engineering applications; statement of problem-objective function, constraints, classification, techniques. Single variable optimization, multivariable optimization with equality and inequality constraints.</p> <p>Unit II: Linear programming: Formulations of linear programs, graphical method, simplex method, simplex algorithm, sensitivity analysis. Duality, decomposition principle.</p> <p>Unit III: Mathematical statement of transportation problem, methods of finding Basic Feasible Solution, test of optimality, MODI'S method for optimal solution, variation in transportation problem. Network Analysis: Project planning and control with PERT-CPM</p> <p>Unit IV: Non-linear programming: one dimensional minimization methods, unrestricted search, golden search method, interpolation methods, unconstrained optimization techniques-direct search method, univariate method</p> <p>Unit V: Decision analysis: decision under certainty, risk probability and uncertainty; AHP-assigning weight and consistency test of AHP. Meta-heuristics: Definition of heuristic and meta-heuristic algorithms; introduction to Tabu search, Simulated Annealing and Genetic algorithms.</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Hillier FS and Liberman GJ, "Introduction to Operations Research concept and cases", McGraw-Hill.2. Taha H, " Operations research" , PHI | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD18 | Design of experiments | L-T-P : 3-0-2 | None |
| COURSE OUTCOMES (COs) Upon completion of the subject, students will be able to <ul style="list-style-type: none">• Plan, design, and conduct experimental investigations efficiently and effectively;• Understand strategy in planning and conducting experiments;• Choose an appropriate experiment to evaluate a new product design or process improvement through experimentation strategy, data analysis, and interpretation of experimental results. | | | |
| COURSE CONTENT: Objectives, principles, terminologies, guidelines, and applications of design of experiments. Completely randomized design. Randomized block design. Latin square design. Two level and three level full factorial designs. Fractional factorial designs. Robust design. Mixture experiments. Central composite and Box-Behnken designs. Response surface methodology. Multi-response optimization. Analysis of variance. Statistical test of hypothesis. Analysis of multiple linear regression. Use of statistical software packages. | | | |
| SUGGESTED READINGS: Montgomery, “Design and Analysis of Experiments”, Wiley Publication. | | | |

COURSE CONTENTS OF DISCIPLINE CENTRIC ELECTIVES WITH PRACTICAL

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------|----------------------|
| EMD31 | Design of Management Information System | L-T-P : 3-0-2 | None |
| COURSE OUTCOMES (COs) Upon completion of the subject, students will be able to <ul style="list-style-type: none">• Describe the major technological, organizational, behavioral, and ethical issues facing today’s information systems professional.• Describe IT strategy formulation and explain its alignment with organizational strategy.• Conduct research on and describe, several current and emerging technologies and explain their impact on corporate performance.• Explain the difference between supporting a business with technology and driving a business with technology.• Describe ways in which technology can provide an organization with competitive advantages. | | | |
| COURSE CONTENT: Concepts is MIS, Role of information is decision making, characteristics of good MIS objectives of MIS, Reliability and availability of information on quality of decision making, Decision making without information (under uncertainty), Information kinds for various kinds of management, formal and informal information system, Distinction between physical system and information system, Information flow periodicity, forms and storage, Basic steps is determining the information cost. Frequency and form of information flow, computer purchases for various functional areas, selective information management, information in MIS design. E.R.P, M.R.P., S.R.S., S.D.D., MIS for financial system, Inventory Management, Relative software platforms like DOT NET technology, data mining softwares. | | | |
| SUGGESTED READINGS: Laudon, Kenneth C., and Laudon, Jane P., “Management Information Systems-Managing Digital Firm”, Prentice Hall. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD32 | Systems Engineering | L-T-P : 3-0-2 | None |
| Course outcome Upon completion of the subject, students will be able to <ul style="list-style-type: none">• Emphasizes the links of systems engineering to fundamentals of decision theory, statistics, and optimization.• Able to introduce the most current, commercially successful techniques for systems engineering.• Focuses on defining customer needs and required functionality early in the development cycle, documenting requirements.• Proceeding with design synthesis and system validation while considering the complete problem including operations, performance, test, manufacturing, cost, and schedule. | | | |
| COURSE CONTENT: Elements of systems engineering, methods and standards, software engineering, recent trends and directions, architecture of large scale engineering. Systems, Integrated nature of systems engineering, Application and case studies. | | | |
| SUGGESTED READINGS: Benjamin , “System Engineering Management” , S. Blanchard | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------|----------------------|
| EMD33 | Automation in manufacturing | L-T-P : 3-0-2 | None |
| Course Outcomes: <ul style="list-style-type: none">• Understand basic conceptions and development of manufacturing automation and information;• Master basic methods in automated manufacturing system design;• Master basic plan management and schedule control methods in manufacturing systems• Understand functions of manufacturing information systems; | | | |
| Course Content: <p>Control systems, concepts of feedback control, types of control systems, effect on control systems performances, stability, Adaptive control, electrical, hydraulic and pneumatic systems, Numerical control, point to point systems, programming control, straight line and contouring systems, automation, evaluation of automatic production, automation in machine tools, mechanized feeding, Transfer lines.</p> | | | |
| SUGGESTED READINGS: <p>S. K. Taneja and S. P. Rana, “Automation in Manufacturing”, Springer.</p> | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------|----------------------|
| EMD34 | Computer integrated Manufacturing | L-T-P : 3-0-2 | None |
| COURSE OUTCOMES (COs) The student will able to: <ul style="list-style-type: none">• Develop an understanding of classical and state-of-the-art production systems, control systems, management technology, cost systems, and evaluation techniques.• Develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.• Obtain an overview of computer technologies including computers, database and data collection, networks, machine control, etc, as they apply to factory management and factory floor operations.• Describe the integration of manufacturing activities into a complete system• Acquire sensitivity to human-factors related issues as they affect decision making in the factory environment. | | | |
| COURSE CONTENT: Production Systems: Concepts; Classification; Characteristics Group Technology: Need of GT; Part Families Formation; Parts Classification and Coding; Production Flow Analysis; Machine Cell Formation; GT layout; Merits and Demerits. Computer Aided Process Planning (CAPP): Process Planning; Limitations of Manual Process Planning; Need of CAPP; Flexible Manufacturing Systems (FMS): Concepts and Definition; Components; Types of FMS; Various Types of Flexibilities in FMS; Design, Planning, Control, and Scheduling in FMS. CIMS: Definition and Components of CIMS; Computer Integrated Production Planning; Material Requirement Planning (MRP); Capacity Planning; Aggregate Planning; Shop Floor Control; Computer Networks for Manufacturing; Manufacturing Automation Protocol; Implementation of CIMS; Factories of Future. Automated Material Handling and Storage: Types of Material Handling Equipments; Design and Analysis of Materials Handling Equipments; Automated Guided Vehicles (AGV); Automated Storage and Retrieval System (AS/RS). Automated Inspection and Quality Control: Principles and Methods; Sensors for Automated Inspection; Contact and Non-Contact Inspection Methods; Coordinate Measuring Machines (CMM). | | | |
| SUGGESTED READINGS: 1. Groover, “Computer Integrated Manufacturing”, McGraw-Hill. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------|----------------------|
| EMD35 | Advanced Operations Research | L-T-P : 3-0-2 | None |
| COURSE OUTCOMES (COs) Upon completion of the subject, students will be able to <ul style="list-style-type: none">• Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry;• Formulate a managerial decision problem into a mathematical model;• Understand Operations Research models and apply them to real-life problems;• Able to design new simple models, like: CPM, PERT to improve decision making and develop critical thinking and objective analysis of decision problems | | | |
| COURSE CONTENT: Introduction, Concepts, development, applications, Linear Programming, Definitions, assumption, formulation, graphical method, computational procedure, dual, sensitivity analysis, revised simples, LP limitations, Net Work Methods, Transportation, assignment, maximum flow, shortest route, spanning tree problems, PERT / CPM. Dynamic programming, Concepts, formulation, recursive approach, computation procedure. Waiting Line Models, Queuing characteristics and terminology, poisson and non-poisson models. | | | |
| SUGGESTED READINGS: 1. Taha H, “ Operations research” , PHI | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EMD36 | Metrology | L-T-P : 3-0-2 | None |
| COURSE OUTCOMES (COs) <ul style="list-style-type: none">• Student learns the importance of different types of measurements, measuring instruments and measuring techniques.• Student will be able to relate the ideas conveyed, to the industrial applications.• Student learns about vast variety of measuring instruments available along with their right usage point.• Student learns about the design aspects of gauges, their tolerances and selection.• Student can maturely utilize the knowledge gained in solving quality related issues.• Student learns about the various quality control techniques prevalent in industry along with their applications• Student understands the basic concepts of quality, its cost and value of quality, standardization.• Student learns the importance of quality certifications and the awarding agencies involved.• Student learns the role and importance of computer in controlling the quality related issues. | | | |
| COURSE CONTENT: <p>Introduction to Dimensional Metrology, standardization, interchangeability, selective assembly, Indian standard specifications, application of tolerances, Limit gauging-Taylor’s principles of limit gauging, Design of Gauges, Inspection by measurement; interferometers. GD&T, Applications of Dimensional Inspection, Inspection of Surface Quality, Feature inspection-straightness, flatness, parallelism, squareness, circularity and roundness. Automated Dimensional Measurements: Introduction, Automatic Gauging, Automatic Measuring Machines for inspecting multiple workpiece dimensions, Automatic Gauging Machine Part-Matching Functions, Coordinate Measuring Machines-Types, Probes, Accessories, Measurement, Computer supported Coordinate Measurements.</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Bewoor, “Metrology and Measurement” Tata McGraw-Hill Education.2. A.M.Badadhe, “Metrology And Quality Control” Technical Publications. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------|-------------------------------|-------------------------|----------------------|
| EMD37 | Flexible manufacturing System | L-T-P : 3-0-2 | None |

COURSE OUTCOMES (COs)

At the end of the course, the student shall be able to:

- Classify and distinguish FMS and other manufacturing systems including job-shop and mass production systems.
- Explain processing stations and material handling systems used in FMS environments.
- Design and analyze FMS using simulation and analytical techniques.
- Understand tool management in FMS.
- Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

COURSE CONTENT:

Introduction to FMS: Definition of FMS – types and configuration concepts – types of flexibility and performance measures. Functions of FMS host computer – FMS host and area controller function distribution.

Development and implementation of FMS: Planning phases – integration – system configuration – FMS layouts – simulation – FMS project development steps. Project management – equipment development – host system development – planning - hardware and software development.

Distributed numerical control: DNC system – communication between DNC computer and machine control unit – hierarchical processing of data in DNC system – features of DNC system.

Automated material handling: Function - types – analysis of material handling equipments.

Design of conveyor and AGV systems.

Automated storage: Storage system performance – AS/RS – carousel storage system – WIP storage – interfacing handling storage with manufacturing.

Programmable logic controllers: Components of the PLC – PLC operating cycle – additional capabilities of a PLC – programming the PLC - Ladder logic diagrams, counters etc– Industrial process control using PLC.

FMS rationale: Economic and technological justification for FMS – GT, JIT – operation and evaluation – personnel and infra structural aspects – typical case studies – future prospects.

SUGGESTED READINGS:

1. Parrish D. J, “Flexible manufacturing”. Butterworth – Heinemann Ltd.
2. Groover M. P, “Automation, production systems and computer integrated manufacturing” Prentice Hall India (P) Ltd.
3. Shivanand H. K., Benal M. M and Koti V, “Flexible manufacturing system” New Age International (P) Limited.
4. Kusiak A., “Intelligent manufacturing systems” Prentice Hall.

5. Considine D. M. & Considine G. D, “Standard handbook of industrial automation”, Chapman and Hall, London, 1986
6. Viswanadhan N. and Narahari Y, “Performance modelling of automated manufacturing systems”, Prentice Hall India (P) Ltd., 1992
7. Ranky P. G, “The design and operation of FMS”, IFS Pub, U. K, 1998

COURSE CONTENTS OF OPEN ELECTIVES

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO001 | Technical Communication | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) <ul style="list-style-type: none">• The course will improve writing and documentation skills of students with emphasis on the importance of effective communication with focus on choice of words, formation of proper sentence structures and writing styles.• This will enhance the students capability to prepare technical documents and correspondence.• The course will equip the student with good communications skills for placements, preparing SOPs and CVs.• The course will sensitize the students towards research ethics, copyright and plagiarism. | | | |
| COURSE CONTENT <ul style="list-style-type: none">• Definition of communication, meaning, importance & process of communication, objectives, types, C's of communication, barriers to communication• human & non -human communication, distinctive features of human languages• Business correspondence-definition, meaning and importance of business communication, business letters- purchase, enquiry, quotation, order, followup, acceptance-refusal• Emphasis on (i) paragraph writing, its kinds, coherence & cohesion (ii)writing a paragraph/thesis: selection of topic and its development (iii) writing reports, manuals, notices, memos, agendas, minutes (iv)Interviews, speeches, presentations,• Research ethics, methodologies, copyright, plagiarism | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. Martin Hewing, "Advanced English Grammar" Cambridge.2. Meenakshi Raman & Sangeeta Sharma, "Technical Communication" Oxford University Press. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO002 | Disaster Management | L-T-P : 3-1-0 | None |
| <p>COURSE OUTCOMES (COs)</p> <ul style="list-style-type: none"> • Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response. • Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. • Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in. | | | |
| <p>COURSE CONTENT</p> <p>Unit -I: Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.</p> <p>Unit -II: Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics</p> <p>Unit -III: Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.</p> <p>Unit -IV: Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People’s Participation In Risk Assessment. Strategies for Survival.</p> <p>Unit -V: Disaster Mitigation Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.</p> | | | |

SUGGESTED READINGS:

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives issues and strategies” New Royal book Company.
2. Goel S. L., “Disaster Administration And Management Text And Case Studies” Deep & Deep Publication Pvt. Ltd.

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------|----------------------|
| EO003 | Basics of Finance Management | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) | | | |
| <ul style="list-style-type: none"> • To provide a theoretical framework for considering corporate finance problems and issues and to apply these concepts in practice. • Enhance knowledge and understanding of financial management. • How managers should organize their financial transactions effectively and with integrity and how to give everybody the ability and confidence to tackle common financial problems in practice. • Provide adequate preparation for future finance classes. | | | |
| COURSE CONTENT | | | |
| Unit I | | | |
| Nature, scope and objectives of financial management, Time value of money, Risk and return (including Capital Asset Pricing Model). | | | |
| Unit II | | | |
| Long term investment decisions: The Capital Budgeting Process, Cash Flow Estimation, Payback Period Method, Accounting Rate of Return, Net Present Value (NPV), Net Terminal Value, Internal Rate of Return (IRR), Profitability Index. | | | |
| Unit III | | | |
| Financing Decisions: Sources of long-term financing, Estimation of components of cost of capital, Methods for calculating Cost of Equity, Cost of Retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average Cost of Capital (WACC). Capital Structure-Theories of Capital Structure (Net Income, Net Operating Income, MM Hypothesis, Traditional Approach). Operating and Financial leverage. Determinants of capital structure | | | |
| Unit IV | | | |
| Dividend Decisions: Theories for Relevance and irrelevance of dividend decision for corporate valuation-Walter's Model, Gordon's Model, MM Approach, Cash and stock dividends. Dividend policies in practice. | | | |
| Unit V | | | |
| Working Capital Decisions: Concepts of Working Capital, Operating & Cash Cycles, sources of short term finance, working capital estimation, cash management, receivables management, inventory management. | | | |
| SUGGESTED READINGS: | | | |
| <ol style="list-style-type: none"> 1. Khan, M.Y. and P.K. Jain, "Financial Management: Text and Problems" Tata McGraw Hill. 2. Srivastava, Rajiv, and Anil Mishra, "Financial Management" Oxford University Press. 3. Chandra, P. "Financial Management-Theory and Practice" Tata McGraw Hill. 4. Horne, Van; James C., John Wachowicz, "Fundamentals of Financial Management" Pearson Education. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------|----------------------|
| EO004 | Basics of Finance Management | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) This course is designed to provide students with an understanding of human resource management (HRM) functions within organizations, including an appreciation of the roles of both HRM specialists and line managers in designing and implementing effective HRM policies and practices. | | | |
| COURSE CONTENT Unit - I Evolution and growth of human resource management (with special reference to scientific management and Human relations approaches).Role of HR in strategic management.Nature.objectives, scope, and functions of HR management. Unit - II Challenges of HR (the changing profile of the workforce - knowledge workers, employment opportunities in BPOs, IT and service industries, Flexi options), Workforce diversity (causes, paradox, resolution of diversity by management). Unit III HRD; Human resource management as a profession.Concepts of line-staff in the structure of human resource department and the role of human resource manager. Unit - IV Manpower planning -objectives, elements, advantages, process. Job design - (simplification, rotation, enlargement, enrichment and approaches}.Job analysis.Job evaluation. Unit - V Recruitment (factors affecting, sources, policy, evaluation). Selection(procedure, tests, interviews). Placement and Induction. | | | |
| SUGGESTED READINGS: 1. Aswathappa K., "Human Resource and Personnel Management" Tata McGraw-Hill. 2. Chhabra T.N. "Human Resource Management" DhanpatRai and Co. Delhi. 3. Saiyadain S. Mirza, "Human Resource Management" Tata Mc-GrawHill. 4.Chadha, N.K. Human Resource Management-issues, case studies, experiential exercises, Sri SaiPrintographers, New Delhi. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO005 | Project Management | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) In this comprehensive course, student will learn the fundamentals of project management: how to initiate, plan, and execute a project that meets objectives and satisfies stakeholders. This course provides a step-by-step guide to planning and executing a project and to develop a manageable project schedule. | | | |
| COURSE CONTENT Unit-I Objectives of Project Planning, monitoring and control of investment projects. Relevance of social cost benefit analysis, identification of investment opportunities. Pre-feasibility studies. Unit-II Project Preparation: Technical feasibility, estimation of costs, demand analysis and commercial viability, risk analysis, collaboration arrangements; financial planning; Estimation of fund requirements, sources of funds.Loan syndication for the projects.Tax considerations in project preparation and the legal aspects. Unit-III Project appraisal: Business criterion of growth, liquidity and profitability, social cost benefit analysis in public and private sectors, investment criterion and choice of techniques. Estimation of shadow prices and social discount rate. Unit-IV Project review/control-Evaluation of project.PERT/CPM.resource handling/leveling. Unit-V Cost and Time Management issues in Project planning and management, success criteria and success factors, risk management. | | | |
| SUGGESTED READINGS: 1. Ravi Ravindran, "Operations Research and Management Science Handbook" CRC Press. 2. Harold Kerzner, "Applied Project Management: Best Practices on Implementation" John Wiley & Sons. 3. Goodpasture, J. C, "Quantitative Methods in Project Management" J Ross Publishing. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO006 | Basics of Corporate Law | L-T-P : 3-1-0 | None |
| Course outcome The objective of this Course is to provide in-depth knowledge of the Corporate laws and process related to integrate these aspects of management studies in decision making within an organization; analyze and interpret management information; make decisions based on the information available; communicate information effectively; understand and apply the theoretical aspects of accounting methods used for collecting, recording and reporting financial information; explain and appraise the taxation laws which govern corporations and individuals. | | | |
| Course Content Unit I: Introduction : Administration of Company Law, characteristics of a company; common seal; lifting of corporate veil; types of companies including private and public company, government company, foreign company, one person company, small company, associate company, dormant company, producer company; association not for profit; illegal association; formation of company, promoters and their legal position, pre incorporation contract and provisional contracts; on-line registration of a company. Unit II: Documents: Memorandum of association and its alteration, articles of association and its alteration, doctrine of constructive notice and indoor management, prospectus, shelf prospectus and red herring prospectus, misstatement in a prospectus; GDR; book building; issue, allotment and forfeiture of shares, calls on shares; public offer and private placement; issue of sweat capital; employee stock options; issue of bonus shares; transmission of shares, buyback and provisions regarding buyback; share certificate; D-Mat system; membership of a company. Unit III: Management and Meetings: Classification of directors, additional, alternate and adhoc director; women directors, independent director, small shareholders' director; director identity number (DIN); appointment, who can appoint a director, disqualifications, removal of directors; legal position, powers and duties; key managerial personnel, managing director, manager; meetings of shareholders and board; types of meeting, convening and conduct of meetings, requisites of a valid meeting; postal ballot, meeting through video conferencing, e-voting; committees of board of directors – audit committee, nomination and remuneration committee, stakeholders relationship committee, corporate social responsibility committee; prohibition of insider trading. | | | |
| SUGGESTED READINGS: 4. Franklin Gevurtz, "Global Issues in Corporate Law" Thomson West. 5. P. Narayanan, "Law of Copyright and Industrial Designs" Eastern Law House. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO007 | Biological computing | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) <ul style="list-style-type: none">• To understand computing in context of biological systems• To understand computing languages needed to solve biological problems• To acquire computational skills for analysis of biological processes through grid computing• To gain knowledge of different biological databases and their usage• To gain innovative insight into DNA computing | | | |
| COURSE CONTENT <p>Introduction, Orientation and UNIX, Python: Introduction to Variables and Control flow, Python II - Parsing In and Output, Python III - Scripting and Functions, Python IV- Number Crunching and Plotting, Grid computing, Biogrid, R basics and Visualization, Unix for fast text processing, SQL Database Biological databases, R for speed, R for fun, Local BLAST, Unit Testing and Code Correctness DNA computing,</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. H. Bolouri, R. Paton, “Computations in cells & tissues” Springer.2. Haubold, Bernhard, Wiehe, Thomas, “Introduction to Computational Biology: An Evolutionary Approach” Springer. | | | |

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO008 | Basic of social science | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) Sociology is a major category of academic disciplines, concerned with society and the relationships among individuals within a society. It in turn has many branches, each of which is considered a "social science". | | | |
| COURSE CONTENT Unit 1. The Development of Sociology in the 19th Century Unit 2. Sociology as Science: <ul style="list-style-type: none">a. Science, scientific method and critique.b. Major theoretical strands of research methodology.c. Positivism and its critique.d. Fact value and objectivity.e. Non- positivist methodologies. Unit 3. Religion and Society: <ul style="list-style-type: none">a. Sociological theories of religion.b. Types of religious practices: animism, monism, pluralism, sects, cults.c. Religion in modern society: religion and science, secularization, religious revivalism, fundamentalism. Unit 4. Politics and Society: <ul style="list-style-type: none">a. Sociological theories of power.b. Power elite, bureaucracy, pressure groups, and political parties.c. Nation, state, citizenship, democracy, civil society, ideology.d. Protest, agitation, social movements, collective action, revolution. Unit 5. Sociological Thinkers: <ul style="list-style-type: none">a. Kar l Marx- Historical materialism, mode of production, alienation, class struggle.b. Emile Durkheim- Division of labour, social fact, suicide, religion and society. | | | |

- c. Max Weber- Social action, ideal types, authority, bureaucracy, protestant ethic and the spirit of capitalism.
- d. Talcott Parsons- Social system, pattern variables.
- e. Robert K. Merton- Latent and manifest functions, conformity and deviance, reference groups.
- f. Mead - Self and identity.

SUGGESTED READINGS:

1. Beteille, Andre, "Sociology: Essays in Approach and Method" Oxford University Press.
2. Giddens, Anthony, "Sociology" Polity Press.
3. Weber, M. "The Methodology of the Social Sciences " New York: Free Press.

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO009 | Entrepreneurship | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES (COs) This Course Aims at Instituting Entrepreneurial skills in the students by giving an overview of who the entrepreneurs are and what competences are needed to become an entrepreneur. contents: | | | |
| COURSE CONTENT Unit I-Introduction: Concept and Definitions, Entrepreneur v/s Intrapreneur; Role of entrepreneurship in economic development; Entrepreneurship process; Factors impacting emergence of entrepreneurship; Managerial versus entrepreneurial Decision Making; Entrepreneur v/s Investors; Entrepreneurial attributes and characteristics; Entrepreneurs versus inventors; Entrepreneurial Culture; Women Entrepreneurs; Social Entrepreneurship; Classification and Types of Entrepreneurs; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs. Unit II- Creating Entrepreneurial Venture: Generating Business idea- Sources of Innovation, methods of generating ideas, Creativity and Entrepreneurship; Challenges in managing innovation; Business planning process; Drawing business plan; Business plan failures; Entrepreneurial leadership- components of entrepreneurial leadership; Entrepreneurial Challenges; Legal issues – forming business entity, considerations and Criteria, requirements for formation of a Private/Public Limited Company, Intellectual Property Protection- Patents Trademarks and Copyrights – importance for startups, Legal Acts Governing Business in India. Unit III-Functional plans: Marketing plan– for the new venture, environmental analysis, steps in preparing marketing plan, marketing mix, contingency planning; Organizational plan – designing organization structure and Systems; Financial plan – pro forma income statements, pro forma cash budget, funds Flow and Cash flow statements; Pro forma balance sheet; Break Even Analysis; Ratio Analysis. Unit IV- Entrepreneurial Finance: Debt or equity financing, Sources of Finance- Commercial banks, private placements, venture capital, financial institutions supporting entrepreneurs; Lease Financing; Funding opportunities for Startups in India. Unit V- Enterprise Management: Managing growth and sustenance- growth norms; Factors for growth; Time management, Negotiations, Joint ventures, Mergers & acquisitions. | | | |
| SUGGESTED READINGS: 1. Kumar, Arya, “Entrepreneurship: Creating and Leading an Entrepreneurial Organization” Pearson, India. | | | |

2. Hishrich., Peters, “Entrepreneurship: Starting, Developing and Managing a New Enterprise” Irwin.
3. Barringer, Brace R., and R. Duane Ireland, “Entrepreneurship” Pearson Prentice Hall.

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO0010 | Social work | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES(COs) | | | |
| In this course students will learn about various methods of social work, about community organization, social welfare administration, Problems pertaining to Marriage, Family and caste | | | |
| COURSE CONTENT | | | |
| Unit 1.Social work | | | |
| Philosophy and Methods. Social work: Meaning, Objectives, Scope, Assumptions & Values; History of Social work in U.K. U.S.A.and India, philosophy of Social Work. Democratic (Equality, Justice Liberty & Fraternity) and Humanitarian (Human Rights) Matrix.Social works as a profession. | | | |
| Unit 2. Methods of Social work | | | |
| Meaning, Scope Principles, Processes (Psychosocial study, Assessments, treatment-goal formulation and techniques), Evaluation, Follow-up and Rehabilitation. Social Groups work: Meaning,Objective, Principles, Skills, Processes (Study, Diagnosis, treatment and evaluation), Programme, Planningand Development, Role of Social group worker, Leadership Development. | | | |
| Unit 3 Community organization Meaning, Objective, Principles, Approaches, Roles of Community Organization Worker. | | | |
| Unit 4 Social Welfare Administration | | | |
| Meaning Scope, Auspices-Private and Public, Principles, Basic Administrative Processes and Practice decision making communication, planning.organisation, budgeting and finacial control, reporting. Social work Research: Meaning objectives, types, scope, scientific method, Selection and formulation of the problem Research Design Sampling, Sources and Methods of Data Collection, Processing of Data, analysing and interpretation, Report writing. Social Action: Meaning,Scope, approaches (Sarvodays, Antyodaya etc.) and Strategies. | | | |
| Unit 5 Work in India Problem pertaining to Marriage, Family and caste | | | |
| Dowry- child Marriage, Divorce, Families with working couples, Disorganised Families, Families with Emigrant Heads of the Households, Gender Inequality, Authoritarian Family | | | |

structure, Major Changes in Caste systems and problem of casteism. Problems Pertaining of Weaker Sections. Problems of Children, Women Aged. Handicapped and Backward Classes (SCs, STs, and other Backward Classes). **Problems of Deviance:** Truancy Vagrancy and Juvenile Delinquency, Crime, White Collar Crime, Organized Crime, Collective Violence, Terrorism, Prostitution and Sex Related Crimes. Social Vices: Alcoholism. Drug Addiction, Beggary, Corruption and communalism. **Problems of Social Structure :** Poverty, Unemployment, Bonded Labour, Child Labour. **Fields of Social work India :** Child Development, Development of Youth, Women's Empowerment, Welfare of aged, Welfare of Physically. Mentally and Social Handicapped, Welfare of backward Classes (SCs, STs and Other Backward Classes) Rural Development Urban Community Development, Medical And Psychiatric Social work, Industrial Social work, Social Security offender Reforms.

SUGGESTED READINGS:

1. Malcolm Payne Modern, "Social Work Theory" Palgrave MacMillan.
2. Sanjay Bhattacharya, "Social Work: An Integrated Approach" Deep & Deep Publications.

| Course No. | Title of the Course | Course Structure | Pre-Requisite |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------|----------------------|
| EO011 | IP and Patenting | L-T-P : 3-1-0 | None |
| COURSE OUTCOMES(COs) | | | |
| The objective of this Course is to provide in-depth knowledge of the laws and process related to Trademarks, Copyrights and other forms of IPs with focus on Patents, the Indian and International Patent filing procedure, drafting patent application and conducting prior art searches. Students will be exposed to the technical, management and legal aspects of IP and Patents. | | | |
| COURSE CONTENT | | | |
| <p>UNIT I: Introduction: Historical and philosophical background of patents and other intellectual property, Patent System: the Constitution, Congress, Patent Office (PTO), and courts; Analyzing and understanding judicial opinions</p> <p>UNITII: Comparative overview of patents, copyrights, trade secrets, and trademarks: Legal fundamentals of patent protection for useful inventions, Design and plant patents, Legal fundamentals of copyright protection, Similarity and access, Expression vs. ideas and information, merger, Fair use of copyrighted works (e.g., for classroom use), Contributory copyright infringement, Critical differences between patent and copyright protection, Copyright infringement distinguished from plagiarism, Legal fundamentals of trade-secret protection, Legal fundamentals of trademark protection</p> <p>UNIT III: Requirements and limitations of patentability: New and useful: (A) The legal requirement of novelty (B) First to invent vs. first inventor to file, The legal requirement of non-obviousness.</p> <p>UNIT IV: The process of applying for a patent ("patent prosecution"): Anatomy of a patent application, Adequate disclosure, The art of drafting patent claims, Patent searching: (A) Purposes and techniques, Actions for patent infringement, Interpretation of claims, Doctrine of equivalents, Product testing as a possibly infringing use, Doctrine of exhaustion</p> | | | |
| SUGGESTED READINGS: | | | |
| 1. Rines, Robert H. "Create or Perish: The Case for Inventions and Patents" Acropolis. | | | |

| .Course No. | Title of the Course | Course Structure | Pre-Requisite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------|----------------------|
| EO012 | Supply Chain Management and Logistics | L-T-P : 3-1-0 | None |
| <p>Course outcomes(COs) Supply chain management consist of all parties (including manufacturer, marketer, suppliers, transporters, warehouses, retailers and even customers) directly or indirectly involved in fulfillment of a customer. The main objective is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for a business firm.</p> | | | |
| <p>Course Content</p> <p>Unit I</p> <p>Introduction: Concept of supply chain management (SCM) and trade logistics; Scope of logistics; Logistic activities – an Overview; Contribution of logistics at macro and micro levels; SCM and trade logistics; Business view of SCM; Concept, span and process of integrated SCM; Demand management – methods of forecasting; Supply chain metrics (KPIs), performance measurement and continuous improvement; Product development Process and SCM; Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle.</p> <p>Unit II</p> <p>Managing Relationship: Role of Relationship marketing in SCM; Managing relationships with suppliers and customers; Captive buyers and suppliers; Strategic partnerships; Supplier-retailer collaboration and alliances.</p> <p>Unit III</p> <p>Focus Areas of Logistics and Supply Chain management: Transportation-Importance of effective transportation system; Service choices and their characteristics; inter-modal services; Transport cost characteristics and rate fixation; In-company management vs. out-sourcing; World sea borne trade; International shipping- characteristics and structure; Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Development in sea transportation-Unitization, containerisation, inter and multimodal transport; CFC and ICD. Air transport: Set up for air transport and freight rates; Carriage of Goods by sea -Role and types of cargo intermediaries. Warehousing and inventory management: Reasons for warehousing; Warehousing evaluation and requirements; Warehousing location strategies; Inventory management principles and approaches; Inventory categories -EOQ, LT, ICC</p> <p>Unit IV</p> | | | |

IT Enabling Logistics and Supply Chain: Technology in logistics – EDI, bar Coding, RFID etc., data warehousing, electronic payment transfers; Business management systems; TRADITIONAL ERP, SPECIAL ERP, MR, DRP, PDM, EIP, CPFR, WMS, TMS; Re-engineering the supply chain- Future directions.

Unit V

Trends and Challenges in logistics and supply chain management: Third party logistic outsourcing –challenges and future directions.

SUGGESTED READINGS:

1. Christopher, M., “Logistics and Supply Chain Management” Prentice Hall.
2. Handfield and Nicholas, Jr., “Introduction to Supply Chain Management” Prentice Hall.
3. Jhon J Coyle, C. JhonandLangley, Brian J Gibs, “Logistics approach to Supply Chain Management” Cengage Learning.

| Course No | Title of the Course | Course Structure | Pre-Requisite |
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| EO013 | ORGANISATION DEVELOPMENT | L-T-P: 3-1-0 | None |
| COURSE OUT COMES (COs) Organisation Development is a growing field of Human Resource Management. It has its foundations in a number of behavioural and social sciences. | | | |
| COURSE CONTENT Topics included are <ul style="list-style-type: none">• Organizational Systems and Human Behaviour - Developing a basic knowledge of how organizations and groups function as systems; introducing and discussing various theoretical approaches and issues.• Interpersonal and Consulting Skills - Increasing effectiveness as a change agent by providing a variety of opportunities in order to increase self-awareness, practice alternative ways of approaching personal and interpersonal problem-solving and develop basic consulting and interviewing skills.• Introduction to organization development - introducing some basic theories, models and methods in the field of organization development, especially those relating to the role of consultant and strategies for change.• Intervention and Change in Organizations - Consolidating and further developing consulting skills and strategies Action Research Project - Carrying out a change activity in an organization, while also researching the effects and or the process. This provides participants with an opportunity to consolidate and demonstrate skills and knowledge gained in other units of the course. | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. W. Burke and Debra Noumair, "Organization Development" Pearson.2. Chris Argyris and David Schon, "Organizational Learning II Theory, Method, and Practice" Pearson. | | | |

| Course No | Title of the Course | Course Structure | Pre-Requisite |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------|---------------|
| EO014 | Industrial organization and managerial economics | L-T-P: 3-1-0 | None |
| COURSE OUT COMES (COs) This course help students in understanding the basics of management and Industrial organization. | | | |
| COURSE CONTENT Unit I: Principles of management, General idea, various functions, scope of engineering. Organisation structure, Types, merits and demerits. Unit II: Plant location and layout, Factors effecting location, types of layout. Production planning and control, Sequence of planning and control of production. Scheduling , routing, despatching., Methods Study, Methods analysis, time study methods of rating. Unit III: General idea of personnel management, Industrial psychology, job evaluation and monitoring. Business decision making and forward planning. Demand and demand forecasting of production analysis- prices and pricing decision-profit and capital, management. Analysis of inter-industry relation, macro-economics and business. | | | |
| SUGGESTED READINGS: 1. Koutsoyiannis, “Modern Microeconomics” International Edition. 2. Pearson and Lewis, “Managerial Economics” Prentice Hall. 3. G.S. Gupta, “Managerial Economics” T M H, New Delhi. | | | |

| Course No | Title of the Course | Course Structure | Pre-Requisite |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------|---------------|
| EO015 | Global Strategies and Technology | L-T-P: 3-1-0 | None |
| COURSE OUT COMES (CO) This subject focuses on the specifics of strategy and organization of the multinational company, and provides a framework for formulating successful and adaptive strategies in an increasingly complex world economy. | | | |
| COURSE CONTENT Globalization of industries, the continuing role of country factors in competition, organization of multinational enterprises, and building global networks, Analysis of competitive situations from the general management point of view, including fit between key environmental forces and the firm's resources, and changes in these over time. Formulating and implementing strategy based on that analysis. Developing and leveraging a firm's core competencies to gain long-term sustainable advantage. | | | |
| SUGGESTED READINGS: 1. Mike W. Peng, "Global strategy" Cengage Learning. 2. Pankaj Ghemawat, "Redefining Global Strategy" Harvard Business Press. | | | |

| Course No | Title of the Course | Course Structure | Pre-Requisite |
|-----------|----------------------------------------|------------------|---------------|
| EO016 | Engineering System analysis and Design | L-T-P: 3-1-0 | None |

COURSE OUT COMES (CO)

The students will learn about system definitions and role of system analyst. They will learn about system modeling and design. They will be exposed to System Implementation and Maintenance issues.

COURSE CONTENT

Unit 1

System definition and concepts: Characteristics and types of system, Manual and automated systems

Real-life Business sub-systems: Production, Marketing, Personal, Material, finance Systems models types of models: Systems environment and boundaries, Real time and distributed systems, Basic principles of successful systems

Unit 2

Systems analyst: Role and need of systems analyst, Qualifications and responsibilities, Systems Analyst, agent of change.

Various phases of systems development life cycle: Analysis, Design, Development, Implementation, Maintenance

Unit3

Systems Design and modeling:Process modeling, Logical and physical design, Design representation, Systems flowcharts and structured charts, Data flow diagrams, Common diagramming conventions and guidelines using DFD and ERD diagrams. Data Modeling and systems analysis, designing the internals: Program and Process design, Designing Distributed Systems

Unit 4

User Interfaces – Relational Analysis – Database design – program design– structure chart – HIPO – SSADM – Alternate Life cycles – Prototypes.

Unit 5

System Implementation and Maintenance:Planning considerations, Conversion methods, producers and controls, System acceptance Criteria, System evaluation and performance, Testing and validation, Systems qualify Control and assurance, Maintenance activities and issues.

SUGGESTED READINGS:

1. Haryszkiewicz, “Introduction to Systems Analysis and Design” PHI.

2. James A Senn, "Analysis and Design of Information Systems" McGraw Hill.

| Course No | Title of the Course | Course Structure | Pre-Requisite |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------|---------------|
| EO017 | BIOLOGY FOR ENGINEERS | L-T-P: 3-1-0 | None |
| COURSE OUT COMES (CO) <ol style="list-style-type: none">1. General understanding of organization in biological systems2. Conceptual knowledge of functioning in biological systems3. Clarity about relevance of Biology to engineering graduates4. Understanding human body or any other suitable organism as a study-model for engineering students.5. Understanding electrical, chemical and magnetic forces, and communication networks in bio system. | | | |
| COURSE CONTENT <p>The Biological system – An Introduction; Biomolecules & self-assemblies; Molecular recognition; Bioenergetics; Communication network in biosystem; Mechanics in biology; Storage, preservation and propagation of biological information; Biomaterials in engineering applications; Organisms as factories for biomaterials; Engineering organisms for novel applications</p> | | | |
| SUGGESTED READINGS: <ol style="list-style-type: none">1. T. Johnson, “Biology for Engineers” CRC Press.2. Michael Small, “Dynamics of Biological system” CRC Press.3. Johnny T. Ottesen, MS Olufsen, JK Larsen, “Applied Mathematical Models and Human Physiology” Society for Industrial and Applied Mathematics. | | | |

| Course No | Title of the Course | Course Structure | Pre-Requisite |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------|---------------|
| EO018 | Energy, Environment and Society | L-T-P: 3-1-0 | None |
| COURSE OUT COMES (CO) | | | |
| 1. To be able to assess the energy resources available worldwide | | | |
| 2. To understand the negative impact of conventional energy resource utilization on ecosystem | | | |
| 3. To learn about various types of pollutions and their control strategies | | | |
| 4. To understand renewable energy resources and their socio-economic impact. | | | |
| COURSE CONTENT | | | |
| Introduction to Environment, Energy and its impact on society | | | |
| Universe, Environment and Ecosystem: Origin of earth, atmosphere, Origin of Life, Ecosystem, Biotic and abiotic components, Ecological pyramids, Food chain, Food web, Habitat and Niche, Major ecosystems, Atmosphere, Biodiversity | | | |
| Pollution: Air Pollution, Water Pollution, Soil Pollution, Noise Pollution | | | |
| Energy: Different sources of Energy, Renewable sources of energy, Non renewable energy, Bioenergy, Bioethanol and Biodiesel | | | |
| Biofertilizers, Biopesticides and Biopolymers | | | |
| Environmental Ethics and Morals | | | |
| SUGGESTED READINGS: | | | |
| 1. Kishore V V N, "Renewable Energy Engineering and Technology Principles and Practice" The Energy and Resources Institute (TERI). | | | |
| 2. G. N. Tiwari and M. K. Ghosal, "Fundamentals of Renewable Energy Sources" Narosa Publishing House. | | | |
| 3. Mital K. M, "Biogas Systems: Principles and Applications" New Age International publishers (P) Ltd. | | | |

| Course No | Title of the Course | Course Structure | Pre-Requisite |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------|---------------|
| EO019 | Public Policy and Governance | L-T-P: 3-1-0 | None |
| COURSE OUTCOMES (COs) Students will be introduced to Public Policy and Administrative governance. They will also learn about Administrative Governance. | | | |
| COURSE CONTENT Unit 1 Introduction to Public Policy and Administrative Governance: Introduction to public policy, econometrics for policy research, policy analysis, economics for public decision making. Unit 2 Public Bureaucracy in Theory and Practice: Benefit cost analysis, public budgeting, revenue and expenditures, managing and leading public service organisations. Unit 3 Administrative Governance: The Challenge of Policy Implementation, public and non-profit programme evaluation. Unit 4 Non-state Actors in Policy-making and Administrative Governance: governance in twenty-first century, Social Diversity and the Question of “Difference” in Policy-making and administrative Governance | | | |
| SUGGESTED READINGS: 1. John Shields and B. Mitchell Evans, “Globalization and Public administration Reform” Halifax: Fernwood. 2. Beryl Radin, “Beyond Machiavelli: Policy Analysis Reaches Midlife” Georgetown University Press. 3. Frank R. Baumgartner, Jeffrey M. Berry, Marie Hojnacki, and David C. Kimball), “Lobbying and Policy Change: Who Wins, Who Loses, and Why. Chicago IL” University of Chicago Press. 4. Timothy Conlan, Paul Posner, and David Beam, “Pathways of Power: The dynamics of National Policymaking” Georgetown University press. | | | |
