

5.1 AC MACHINES

L T P

Periods /week 5 - 4

RATIONALE

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

UNIT1: Synchronous Machines

(30 Periods)

Main constructional features of synchronous machine including commutator and brushless excitation system , Generation of three phase emf, Production of rotating magnetic field in a three phase winding , Concept of distribution factor and coil span factor and emf equation Armature reaction at unity, lag and lead power factor , Operation of single synchronous machine independently supplying a load - Voltage regulation by synchronous impedance method, Need and necessary conditions of parallel operation of alternators Synchronizing an alternator (Synchroscope method) with the bus bars , Operation of synchronous machine as a motor –its starting methods , Effect of change in excitation of a synchronous motor , Concept and Cause of hunting and its prevention, Rating and cooling of synchronous machines Applications of synchronous machines (as an alternator, as a synchronous condenser)

UNIT 2: :Induction Motors

(20 Periods)

Salient constructional features of squirrel cage and slip ring 3-phase induction motors , Principle of operation, slip and its significance ,Rotor resistance, inductance, emf and current ' Relationship between copper loss and the motor slip , Power flow diagram of an induction motor,Factors determining the torque ,Torque-slip curve, stable , Effect of rotor resistance upon the torque slip relationship , Starting of 3-phase induction motors, DOL, star-delta, auto transformer ,Causes of low power factor of induction motors ,Testing of 3-phase motor on no load and blocked rotor test and to find efficiency ,Speed control of induction motor .

UNIT 3: : Fractional Kilo Watt (FKW) Motors

(18 Periods)

Single phase induction motors; Construction characteristics and applications , Nature of field produced in single phase induction motor , Split phase induction motor , Capacitors start and run motor , Shaded pole motor ,universal motors , Single phase synchronous motor .

UNIT 4 : Special Purpose Machines

(12 Periods)

Construction and working principle, characteristics and applications of stepper motor, Servomotor, Submersible Motor

LIST OF PRACTICALS

1. Demonstration of revolving field set up by a 3-phase wound stator
2. To plot relationship between no load terminal voltage and excitation current in a synchronous generator at constant speed
3. Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant
4. Determination of the regulation and efficiency of alternator from the open circuit and short circuit test
5. Synchronization of poly phase alternators and load sharing
6. Determination of the effect of variation of excitation on performance of a synchronous motor
7. Study of ISI/BIS code for 3-phase induction motors
8. Perform at least two tests on a 3- phase induction motor as per BIS code
9. Determination of efficiency by
 - (a) no load test and blocked rotor test on an induction motor
 - (b) direct loading of an induction motor (refer BIS code)
10. Determination of effect of rotor resistance on torque speed curve of an induction motor
11. To study the effect of a capacitor on the starting and running of a single-phase induction motor by changing value of capacitor and also to reverse the direction of rotation of a single phase induction motor
12. Slip and slip measurement of three phased induction motor.

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles of operation and control of electrical machines. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each student to perform with his/her own hands and draw conclusions.

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi Electrical Engineering by JB Gupta, SK Kataria and sons, New Delhi
4. Electrical Machines by Samarjit Ghosh, Pearson Education (Singapore) Pvt., Ltd. 482, FIE Patparganj, Delhi 110092
5. Electrical Machines by DR Arora, Ishan Publications, Ambala City

SUGGESTED DISTRIBUTION OF MARKS

UNIT 1	Time Allotted (Period)	Marks Allocation (%)
1	30	40
2	20	25
3	18	25
4	12	10
total	80	100

5.2 SUB-STATION, SWITCHGEAR AND PROTECTION

L T P

Periods /weeks 4 - 2

RATIONALE

In view of the complexities associated with the modern interconnected power stations, the responsibilities and the job requirements of a diploma pass out have become more complex than what they used to be earlier. He is required to work with modern electrical equipment and maintain reliability of supply. The course is designed to understand the concepts, principles involved in the construction and working of generating stations and protective switch gear system so that one can handle, install, maintain them and also take decisions at his/her level in different situations. The teaching of this subject requires reinforcement in the form of visits to substations, power stations and well designed laboratory experiences. A practice-oriented approach to the teaching of this subject is suggested.

DETAILED CONTENTS

UNIT1 Substations

(08 Periods)

Brief idea about substations - outdoor grid sub-station 400, 220, 132 KV, and 66 and 33 KV;11 KV, outdoor pole and plinth mounted substations, Layout of 33/11 KV and 11KV/400V distribution substation and various auxiliaries and equipment associated with these.

UNIT2. Faults

(06Periods)

Common type of faults in both overhead and underground systems, symmetrical/ unsymmetrical faults. Single line to ground fault, double line to ground fault, 3-phase to ground fault and open circuit. Simple problems relating to fault finding

UNIT 3. Switch Gears

(15 Periods)

Purpose of protective gear. Difference between switch, isolator and circuit breakers. Function of isolator and circuit breaker. Making capacity and breaking capacity of circuit breaker (only definition), Circuit breakers. Types of circuit breakers, construction and working of bulk and minimum oil circuit breakers, air blast circuit breakers, vacuum circuit breaker, SF6 circuit breaker and circuit breaker rating ,Principles of Arc extinction blast circuit breakers in OCB and ACB. Constructional features of OCB, ACB, and their working, Method of arc extinction , Portable circuit breakers - MCB, MCCB, ELCB, for distribution and transmission system description only

UNIT 4. Protection Devices

(15 Periods)

Fuses; function of fuse. Types of fuses, HV and LV fuses, rewire-able, cartridge, HRC Earthing: purpose of earthing, method of earthing, Equipment earthing, Substation earthing, system earthing as per Indian Electricity rules. Methods of reducing earth resistance ,

Relays :Introduction - types of relays. Electromagnetic and thermal relays, their construction and working Induction type over-current, earth fault relays, instantaneous over current relay Directional over-current, differential relays, their functions , Distance relays their functions , Idea of static relays and their applications.

UNIT5. Protection Scheme

(20 Periods)

Relays for generator protection , Relays for transformer, protection including Buchholtz relay protection,Protection of feeders and bus bars, over current and earth fault protection. Distance protection for transmission system, Relays for motor protection. Protection of system against over voltages, causes of over voltages, utility of ground wire, surge absorber ,Lightning arrestors, rod gap, horn gap, metal oxide type. Transmission Line and substation protection against over-voltages and lightning ,Transient over voltage protection.

Note: Students may be taken to various Sub-stations/ Grid Stations. Students must be familiarized with present tariff system employed by State Electricity Boards

LIST OF PRACTICALS

Visit to power station/substation for the conduct of following practical work:

1. Testing of the dielectric strength of transformer oil and air
2. Study of different types of circuit breakers and isolators
3. Plot the time current characteristics of over current relay
4. Perform the overload and short circuit test of MCB as per IS specifications
5. Plot the time-current characteristics of Kit-Kat fuse wire
6. Taking reading of current on any LT line with clip on meter

INSTRUCTIONAL STRATEGY

Since this is a descriptive and practice oriented subject, it is suggested that visits to different types of generating stations and substations be arranged and various equipment, accessories and components explained to the students. The protection schemes should be shown at the site and engineers from field may be invited for delivering expert lectures on these topics. Help of Video Films may be taken to explain the layout, construction and working of different power equipment.

RECOMMENDED BOOKS

1. Testing, Commissioning , Operation and Maintenance of Electrical Equipment by S Rao, Khanna Technical Publication, New Delhi

2. Electrical Power – II by SK Sahdev, Uneek Publications, Jalandhar (Pb)
3. Electrical Power Systems by CL Wadhwa, Wiley Eastern Ltd., New Delhi
4. Textbook of Electrical Technology by BL Theraja, S Chand and Co., New Delhi
5. Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi
6. A Course in Electrical Power by ML Soni, PV Gupta and Bhatnagar, Dhanpat Rai & Sons, New Delhi
7. Principles of Power Systems by VK Mehta, S Chand and Co., New Delhi
8. Preventive Maintenance of Electrical Apparatus by SK Sharotri, Katson Publishing House, Ludhiana

SUGGESTED DISTRIBUTION OF MARKS

UNIT 1	Time Allotted (Period)	Marks Allocation (%)
1	8	15
2	6	9
3	15	23
4	15	23
5	20	30
TOTAL	64	100

5.3 INSTALLATION AND MAINTENANCE OF ELECTRICAL EQUIPMENTS

L T P

Periods/week 6 - 4

RATIONALE

In his career as a supervisor, an electrical engineering technician will be called upon to inspect, test and modify the work done by skilled workers or artisans working under him. Many a times it will become necessary for him to demonstrate the correct method and procedure of doing certain operations. Normally manufacturers of heavy electrical equipment provide service manuals, instructions for installation, maintenance and fault location. Indian Electricity Rules and Indian Standard Specifications also provide enough guidelines. This syllabus has been designed to provide certain guidelines and broad principles regarding the above activities. Appropriate field trips will reinforce the learning by students.

DETAILED CONTENTS

UNIT1. Tools and Accessories

(11 Periods)

Tools, accessories and instruments required for installation, maintenance and repair work Knowledge of Indian Electricity rules, safety codes, causes and prevention of accidents, artificial respiration of an electrocuted person, workmen's safety devices

UNIT2. Installation

(35 Periods)

2.1 Domestic Installation

Introduction, testing of electrical installation of a building, testing of insulation resistance to earth, testing of insulation and resistance between conductors continuity or open circuit test, short circuit test, testing of earthing, continuity, location of faults.

2.2 Installation of transmission and Distribution Line

Erection of steel structures, connecting jumpers, tee-off points, joints and dead ends; crossing of roads, streets, power/telecommunication lines and railway line, clearances; earthing of transmission lines and guarding, spacing and configuration of conductors: Types of arrangement for suspension and strain insulators, bird guards, anti-climbing devices and danger plates; sizes of conductor, earthwire and guy wires, Testing and Commissioning. Laying of service lines, earthing, provision of service fuses, installation of energy meters

2.3 Laying of Underground Cables

Inspection, storage, transportation and handling of cables, cable handling equipment, cable laying depths and clearances from other services such as: water pipes, sewerage, gas pipes, power and telecommunication cables and coordination with these services, excavation of trenches, direct cable

laying, laying of cable from the drum, laying of cable in the trenches, back filling of trenches with earth or sand, laying protective layer of bricks etc, laying of cables into pipes and conduits and within buildings, introduction to cable filling compounds, epoxy resins and hardeners, cable jointing and terminations, testing and commissioning.

2.4 Elementary idea regarding, inspection and handling of transformers; pole mounted substations, plinth mounted substations and grid substation, busbars, isolators, voltage and current transformers, lightning arrestors, control and relay panels, HT/LT circuit breakers, LT switches, installation of power/distribution transformers, dehydration. Earthing system, fencing of yard, equipment foundations and trenches etc..

2.5 Handling and inspection of electric motors and generators (AC and DC), drying out medium voltage distribution panels, testing and commissioning

UNIT3. Maintenance Preventive, Predictive, Breakdown maintenance (50 Periods)

3.1 Types of maintenance, maintenance schedules, procedures

3.2 Maintenance of Transmission and Distribution System Authorized persons, danger notice, caution notice, permit to work, arranging of shutdowns personally and temporary earths, cancellation of permit and restoration of supply Patrolling and visual inspection of lines - points to be noted during patrolling from ground; special inspections and night inspections Location of faults using Magger, effect of open or loose neutral connections, provision of proper fuses on service lines and their effect on system, causes of dim and flickering lights

3.3 Maintenance of Distribution Transformers Transformer maintenance and points to be attended to in respect of various items of equipment Checking of insulation resistance, transformer oil level BDV test of oil and measurement of earth resistance, maintenance of breathers and oil level indicators

3.4 Maintenance of Grid Substations Checking and maintenance of busbars, isolating switches, HT/LT circuit breakers, LT switches. Power transformers

3.5 Maintenance of Motors Over hauling of motors, preventive maintenance, trouble shooting of electric motors.

LIST OF PRACTICALS

1. Preventive maintenance of different electrical equipments available in electrical laboratories
2. Corrective maintenance of different equipments which may occur faulty during experiments/use
3. Trouble shooting of Water Boiler Geyser Generator set Pumping set Heating ovens

4. Patrolling inspection and fault finding of lines
5. Open circuit/Short circuit/earth fault finding of machines
6. Installation of motors, Diesel Generating set
7. Laying of underground cables
8. Detecting of faults in underground cables
9. Case study of maintenance department of industry/electricity board

INSTRUCTIONAL STRATEGY This subject needs theoretical and practical inputs. Demonstration at actual site may be arranged for conceptual understanding. The subject teacher should plan in advance about the visits to the actual sites and establish liaison with the appropriate authorities/ persons with the help of HOD and Principal of the institution. The students be taken to actual workplace and explained various test procedures.

RECOMMENDED BOOKS

1. Testing, Commissioning, Operation and Maintenance of Electrical Equipment by S Rao, Khanna Technical Publication, New Delhi
2. Preventive Maintenance of Electrical Apparatus by SK Sharotri, Katson Publishing House, Ludhiana

SUGGESTED DISTRIBUTION OF MARKS

UNIT 1	Time Allotted (Period)	Marks Allocation (%)
1	11	10
2	35	40
3	50	50
TOTAL	84	100

5.4 ENERGY MANAGEMENT

L T P

Periods/week 6 - -

RATIONALE

One of the reasons for India not been able to catch up with the desired extent of modernization of industrial processes in light of challenges posed by multinationals is the non-availability of required energy supply. The solution primarily lies in tapping all possible energy generation sources and efficient use of available energy important. Energy management focuses on these aspects. This course will develop awareness amongst the diploma engineers and will enable them to practice the energy management techniques in whatever field they are engaged in.

DETAILED CONTENTS

- Unit1.** Energy Management (12 Periods)
- 1.1 Overview of energy management, need for energy conservation, Environmental Aspects
 - 1.2 Need for energy conservation with brief description of oil and coal crisis
 - 1.3 Alternative sources of energy
 - 1.4 Energy efficiency- its significance.
- Unit2.** Energy Conservation (24 Periods)
- 2.1 Energy conservation opportunity and measures
 - 2.2 Energy conservation in Domestic sector- Lighting, Home appliances
 - 2.3 Energy conservation in Industrial sector-Industrial lighting, Distribution system, Motor Pumps, Fans, Blowers etc
 - 2.4 Energy conservation in Agriculture sector Tubewell pumps, Diesel-generating sets, Standby energy sources
 - 2.5 Macro Level approach for energy conservation at design stage
- Unit3.** Energy Efficient Devices (30 Periods)
- 3.1 Energy efficient technology an overview
 - 3.2 Need for energy efficient devices
 - 3.2 Initial cost versus life cycle, cost analysis on life cycle basis 3.3 Energy efficient motors as compared to standard motors.
 - 3.4 BIS standards for energy efficient motors, BIS salient design features, 3.5 Efficiency as a function of load, safety margins
 - 3.6 Energy efficient lighting system different sources, lumens/watt, LEDs, role of voltage on efficiency
 - 3.7 Distribution system- Optimum cable size, amorphous core transformer, role of power factor, use of compensating capacitors-manual and automatic, location of capacitors
- Unit4.** Energy Audit (20 Periods)
- 4.1 Energy audit methodology
 - 4.2 Efficiency of energy conversion processes, monitoring system
 - 4.3 Specific energy consumption –three pronged approach, fine tuning, technical up gradation, avoidable losses.

4.4 Case studies of energy audit of distribution system, AC motors, Industries, audit activities.

Unit5. Environmental Impact Assessment (10 Periods)

- 5.1 Need for environmental impact assessment
- 5.2 Standard format for assessment and its completion
- 5.3 Evaluation of the assessment

INSTRUCTIONAL STRATEGY

While explaining the need and energy management, the teacher should give students home assignments based on energy conservation. The students should be made familiar with the energy efficient devices, various approaches to conserve energy and energy auditing procedure etc. Best learning will take place if students are given real life problems on energy audit.

RECOMMENDED BOOKS

- 1. Manual on Energy Efficiency at Design Stage, CII Energy Management Cell
- 2. Manual on Energy Efficiency in Pumping System, CII Energy Management Cell
- 3. Manual on Variable Speed Drives for Energy Efficiency CII Energy Management Cell
- 4. Energy Conservation-case studies in ceramic industry, sugar industry, fertilizer industry, cement industry. CII, Energy Management Cell etc.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time (PERIODS)	Allotted Marks Allocation (%)
1	12	14
2	24	25
3	30	31
4	20	20
5	10	10
Total	80	100

5.5 INDUSTRIAL ELECTRONICS AND CONTROL OF DRIVES

L T P

Periods/week 5- 3

RATIONALE

Industrial electronics plays a very vital role in the field of control engineering specifically in the modern industries as they mostly use electronic controls, which are more efficient, effective and precise as compared to the conventional methods. The old magnetic and electrical control schemes have all become obsolete. Electrical diploma holder many times has to maintain the panels used in the modern control process. Therefore, the knowledge of components like thyristors and other semiconductor devices used in such control panels is must for them in order to supervise the work efficiently and effectively. Looking in to usefulness and importance of the subject this has been incorporated in the curriculum.

DETAILED CONTENTS

UNIT 1. Silicon Controlled Rectifiers & Thyristor family (20 Periods)

- 1.1-Introduction, Construction and working principles of an SCR, two transistor analogy and characteristics, specifications and rating, Methods of triggering a Thyristor, Commutation of Thyristors (Concept), Series and parallel operation of Thyristors, Protection of SCR, Snubber Circuit
- 1.2-Construction, working principles and V-I characteristics of DIAC, TRIAC, Basic idea about the selection of heat sinks for SCR and TRIACS
- 1.3- UJT, its Construction, working principles and V-I characteristics, UJT relaxation o scillator
- 1.4- Applications of SCR, TRIACS such as light intensity control, speed control of DC and universal motor, fan regulator, battery charger, temperature control

UNIT 2 Controlled Rectifiers (13 Periods)

Single phase half wave controlled rectifier with resistive load and inductive load, concept of freewheeling diode, Single phase half controlled full wave rectifier (No mathematical derivation), Single phase fully controlled full wave rectifier bridge, Single phase full wave centre tapped rectifier, Three phase full wave half controlled bridge rectifier, Three phase full wave fully controlled bridge rectifier

UNIT 3 Choppers, Dual Converters and Cyclo Converters (16 Periods)

- 3.1 Choppers-introduction, types of choppers and their working principles, Quadrant operation and applications
- 3.2-Dual converters-introduction, working principles and applications
- 3.3Cyclo-converters- introduction, types, working principles of simultaneous and non simultaneous control and applications

UNIT 4. Thyristor Control of Electric Drives

(18 Periods)

- 4.1 DC drives control (Basic Concept)
- 4.2 Half wave drives
- 4.3 Full wave drives
- 4.4 Chopper drives
- 4.5 AC drives control
- 4.6 Phase control
- 4.7 Variable frequency a.c. drives
- 4.8 Constant V/F application
- 4.9 Voltage controlled inverter drives
- 4.10 Constant current inverter drives
- 4.11 Cyclo convertors controlled AC drives
- 4.12 Slip control AC drives

UNIT 5. Inverters & Uninterrupted Power Supplies

(13 Periods)

- 5.1 Inverter-introduction, working principles, voltage and current driven series and parallel inverters and applications
- 5.2 UPS, Stabilizers, SMPS, UPS online, off line, Storage devices (batteries)
- 5.3 Power Conditioners

LIST OF PRACTICALS

1. To draw V-I characteristics of an SCR
2. To draw V-I characteristics of a TRIAC
3. To draw V-I characteristics of a DIAC
4. To draw uni-junction transistor characteristics
5. Observe the output wave of an UJT relaxation oscillator
6. Observe the wave shape across SCR and load of an illumination control circuit
7. Fan speed regulator using TRIAC
8. Speed-control of a DC shunt motor or universal motor
9. To observe the output wave shape on CRO of a Single phase half controlled full wave rectifier
10. Single phase controlled rectifier
11. Use of Variable Frequency Drive for running a 3 phase Induction motor

INSTRUCTIONAL STRATEGY

The teachers may encourage students to perform practical simultaneously for better understanding of the subjects and verification of theoretical concepts. The various components must be shown to the students for identification and also tested. Practical applications of the various circuits and devices should be discussed in the class. The available video films on the subject must be shown to the students.

RECOMMENDED BOOKS

1. Industrial Control Electronics. John Webb, Kevin Greshock, Maxwell, Macmillan International editions
2. Fundamentals of Power Electronics by S Rama Reddi, Narosa Publishing House Pvt. Ltd, New Delhi
3. Power Electronics, Circuits Devices and Applications by Mohammad H. Rashid
4. Power Electronics by PC Sen
5. Power Electronics by Dr. PS Bhimbra, Khanna Publishers, New Delhi

6. Industrial Electronics & Control by SK Bhattacharya & S Chatterji, New Age international Publications(P) Ltd, New Delhi
7. Industrial Electronics and Control of Drives by SK Sahdev, Uneek Publication, Jalandhar
8. Industrial Power Electronics by JC Karhava, King India Publication,
9. Fundamentals of Electrical Drives by Gopal K Dubey, Narosa Publishing House Pvt. Ltd, New Delhi
10. Power Electronics and Controls by Samir K Datta, Prentice Hall of India, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

UNIT	Time Allotted (Period)	Marks Allocation (%)
1	20	25
2	13	16
3	16	20
4	18	22
5	13	17
Total	80	100

5.6 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

L T P

Periods/week 5 - -

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

DETAILED CONTENTS

A **ENTREPRENEURSHIP** (30 Periods)

1. Introduction

Concept /Meaning and its need

- Qualities and functions of entrepreneur and barriers in entrepreneurship
- Sole proprietorship and partnership forms of business organisations
- Schemes of assistance by entrepreneurial support agencies at National, State,

• District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP)

2. Market Survey and Opportunity Identification

Scanning of business environment

- Salient features of National and State industrial policies and resultant business opportunities
- Types and conduct of market survey
- Assessment of demand and supply in potential areas of growth
- Identifying business opportunity
- Considerations in product selection
-

3. Project report Preparation

Preliminary project report

- Detailed project report including technical, economic and market feasibility
- Common errors in project report preparations
- Exercises on preparation of project report

B MANAGEMENT

(30Periods)

4. Introduction to Management
Definitions and importance of management
 - Functions of management: Importance and Process of planning, organising, staffing, directing and controlling Principles of management (Henri Fayol, F.W. Taylor)
 - Concept and structure of an organisation
 - Types of industrial organisations
 - a) Line organisation b) Line and staff organisation c) Functional Organisation

5. Leadership and Motivation
 - a) Leadership Definition and Need
 - Qualities and functions of a leader
 - Manager Vs leader
 - Types of leadership
 - b) Motivation Definitions and characteristics
 - Factors affecting motivation
 - Theories of motivation (Maslow, Herzberg, McGregor)

6. Management Scope in Different Areas
 - a) Human Resource Management Introduction and objective
 - Introduction to Man power planning, recruitment and selection
 - Introduction to performance appraisal methods
 - b) Material and Store Management Introduction functions, and objectives
 - ABC Analysis and EOQ
 - c) Marketing and sales Introduction, importance, and its functions
 - Physical distribution
 - Introduction to promotion mix
 - Sales promotion
 - d) Financial Management Introductions, importance and its functions
 - Elementary knowledge of income tax, sales tax, excise duty, custom duty and VAT

7. Miscellaneous Topics
 - a) Customer Relation Management (CRM) Definition and need
 - Types of CRM
 - b) Total Quality Management (TQM) Statistical process control
 - Total employees Involvement
 - Just in time (JIT)

- c) Intellectual Property Right (IPR) Introductions, definition and its importance, Infringement related to patents, copy right, trade mark.

C EMPLOYABLE SKILLS

(20 Periods)

8. Industrial Scenario Engineering Education and expectations of competences from an engineer by employer, Personality types, characteristic and features for a successful engineer. Professional Engineer desirable values and ethics and their development. Relation between engineering profession, society and environment.

9. Preparing for Employment

Searching for job/job hunting

- Resume Writing
- Interview technique in personal interview telephonic interview, panel interview, group interview, video conference.

Effective Communication Listening

- Speaking
- Writing
- Presentation Technique/Seminar
- Group discussion

Managing Self: Managers body, mind, emotion and spirit

- Stress Management
- Conflict resolution

10. Creativity, Innovation and Intellectual property right, Concept and need in present time for an engineer, Basic rules, laws and norms to be adhered by engineers during their working .

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment or seminar method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided.

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development published by Tata McGraw Hill Publishing Company Ltd., New Delhi
3. Entrepreneurship Development in India by CB Gupta and P Srinivasan; Sultan Chand and Sons, New Delhi
4. Entrepreneurship Development - Small Business Enterprises by Poornima M Charantimath; Pearson Education, New Delhi
5. Entrepreneurship : New Venture Creation by David H Holt; Prentice Hall of India Pvt. Ltd., New Delhi
6. Handbook of Small Scale Industry by PM Bhandari
7. Principles and Practice of Management by L M Prasad; Sultan Chand & Sons, New Delhi.
8. Entrepreneurship by Alpana Trehan; Dream Tech. Press.
9. Entrepreneurship by Manimali; Viz Tantra Publications.
10. Patterns of Entrepreneurship by Kalpana; Wiley India Publications.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (PERIODS)	Marks Allocation (%)
1	30	37
2	30	37
3	20	26
total	80	100