5.1 ELECTRICAL MACHINES-II

L P
4 3

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

DETAILED CONTENTS

1. Synchronous Machines (24 hrs)

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

2. Induction Motors (16 hrs)

- 2.1 Salient constructional features of squirrel cage and slip ring 3-phase induction motors
- 2.2 Principle of operation, slip and its significance
- 2.3 Locking of rotor and stator fields
- 2.4 Rotor resistance, inductance, emf and current
- 2.5 Relationship between copper loss and the motor slip
- 2.6 Power flow diagram of an induction motor
- 2.7 Factors determining the torque
- 2.8 Torque-slip curve, stable and unstable zones
- 2.9 Effect of rotor resistance upon the torque slip relationship
- 2.10 Double cage rotor motor and its applications
- 2.11 Starting of 3-phase induction motors, DOL, star-delta, auto transformer
- 2.12 Causes of low power factor of induction motors
- 2.13 Testing of 3-phase motor on no load and blocked rotor test and to find efficiency
- 2.14 Speed control of induction motor
- 2.15 Harmonics and its effects, cogging and crawling in Induction Motors.

3. Fractional Kilo Watt (FKW) Motors (16 hrs)

- 3.1 Single phase induction motors; Construction characteristics and applications
- 3.2 Nature of field produced in single phase induction motor
- 3.3 Split phase induction motor
  - 3.3.1 Capacitors start and run motor
  - 3.3.2 Shaded pole motor
  - 3.3.3 Reluctance start motor
- 3.4 Alternating current series motor and universal motors
- 3.5 Single phase synchronous motor
  - 3.5.1 Reluctance motor
  - 3.5.2 Hysteresis motor
- 3.6 Comparison of 3 phase and 1 phase Induction motor
- 3.7 Application of 3 phase and Single phase Induction motor

4. Special Purpose Machines (8 hrs)

Construction and working principle of linear induction motor, stepper motor, Servomotor, Submersible Motor, Introduction to Energy efficient Motors.

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 polyphase 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

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 should 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) Pte, Ltd. 482, FIE Patparganj, Delhi 110092
5. Electrical Machines by DR Arora, Ishan Publications, Ambala City.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Synchronous Machines	24	40
2	Induction Motors	16	25
3	Fractional Kilo Watt Motors	16	25
4	Special Purpose Machines	8	10
	Total	**64**	**100**

5.2 ELECTRICAL POWER –I

L P
4 -

RATIONALE

The majority of the polytechnic passouts who get employment in State Electricity Boards have to perform various activities in the field of Generation, Transmission and Distribution of Electrical power. The range of these activities vary from simple operation and maintenance of equipment, lines, fault location, planning and designing of simple distribution schemes, executive and supervisory control in power stations, transmission and distribution networks in addition to administrative jobs including public relations. They should also be made aware of recent developments, current practices in the electricity departments, corporations and boards to keep them abreast with modern techniques in Transmission and Distribution of Electrical Power.

DETAILED CONTENTS

1. Power Generation (10 hrs)

   1.1 Main resources of energy, conventional and non-conventional
   1.2 Different types of power stations, thermal, hydro, gas, diesel and nuclear power stations. Flow diagrams and brief details of their operation, comparison of the generating stations on the basis of running cost, site, starting, maintenance etc.
   1.3 Importance of non-conventional sources of energy in the present scenario. Brief details of solar energy, bio-energy, wind energy

2. Economics of Generation (08 hrs)

   2.1 Fixed and running cost, load estimation, load curves, demand factor, load factor, diversity factor, power factor and their effect on cost of generation, simple problems there on.
   2.2 Base load and peak load power stations, inter-connection of power stations and its advantages, concept of regional and national grid.

3. Transmission Systems (20 hrs)

   3.1 Layout of transmission system, selection of voltage for H.T and L.T lines, advantages of high voltage for Transmission of power in both AC and DC

   3.2 Comparison of different systems: AC versus DC for power transmission, conductor material and sizes from standard tables

   3.3 Constructional features of transmission lines: Types of supports, types of insulators, Types of conductors, Selection of insulators, conductors, earth wire and their accessories, Transposition of conductors and string efficiency of suspension type insulators, Bundle Conductors.
   3.4 Mechanical features of line: Importance of sag, calculation of sag, effects of wind and ice related problems; Indian electricity rules pertaining to clearance

   3.5 Electrical features of line: Calculation of resistance, inductance and capacitance without derivation in a.c. transmission line, voltage regulation, and concept of corona. Effects of corona and remedial measures

   3.6 Transmission Losses

4. Distribution System (14 hrs)

   4.1 Lay out of HT and LT distribution system, constructional feature of distribution lines and their erection. LT feeders and service mains; Simple problems on AC radial distribution system, determination of size of conductor

   4.2 Preparation of estimates of HT and LT lines (OH and Cables).

   4.3 Constructional features of LT (400 V), HT (II kV) underground cables, advantages and disadvantages of underground system with respect to overhead system.

   4.4 Calculation of losses in distribution system

   4.5 Faults in underground cables-determine fault location by Murray Loop Test, Varley Loop Test

5. Substations: (08 hrs)

   5.1 Brief idea about substations; out door grid sub-station 220/132 KV, 66/33 KV outdoor substations, pole mounted substations and indoor substation

   5.2 Layout of 33/11 and kV/400V distribution substation and various auxiliaries and equipment associated with it.

6. Power Factor: (4 hrs)

   6.1 Concept of power factor
   6.2 Reasons and disadvantages of low power factor
   6.3 Methods for improvement of power factor using capacitor banks, VAR Static Compensator (SVC)

INSTRUCTIONAL STRATEGY

Since this is a descriptive and practice oriented subject, it is suggested that visits to different types of power generating stations and substations including grid stations be arranged and various equipment, accessories and components explained to the students before the actual class room teaching and make them familiar with the equipment and accessories installed over there. There should be at least 3 visits during the semester. The students may be asked to prepare notes while on visit and submit the report and give seminar. In addition, viva-voce be conducted to evaluate the knowledge gained during the field visit.

RECOMMENDED BOOKS

1. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi
2. Substation Design and Equipment by Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi
3. Electrical Power –I by SK Sahdev, Uneek Publications, Jalandhar
4. Electrical Power System by VK Mehta, S Chand and Co., New Delhi
5. Electrical Power System by JB Gupta, SK Kataria and Sons, New Delhi
6. Sub-Station Design by Satnam, Dhanpat Rai and Co., New Delhi
7. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi
8. Electrical Power System by S Channi Singh, Tata McGraw Publishing Co. New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Power Generation	10	15
2	Economics of Generation	8	10
3	Transmission Systems	20	35
4	Distribution System	14	20
5	Substations	8	10
6	Power Factor	4	10
	Total	**64**	**100**

5.3 INDUSTRIAL ELECTRONICS AND CONTROL OF DRIVES

L P
4 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 compare 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

1. Introduction to SCR (16 hrs)

   1.1. Construction and working principles of an SCR, two transistor analogy and characteristics of SCR
   1.2. SCR specifications and rating
   1.3. Construction, working principles and V-I characteristics of DIAC, TRIAC and Quadriac
   1.4. Basic idea about the selection of heat sinks for SCR and TRIACS
   1.5. Methods of triggering a Thyristor. Study of triggering circuits
   1.6. UJT, its Construction, working principles and V-I characteristics, UJT relaxation oscillator
   1.7. Commutation of Thyristors (Concept)
   1.8. Series and parallel operation of Thyristors
   1.9. Applications of SCR, TRIACS and Quadriac such as light intensity control, speed control of DC and universal motor, fan regulator, battery charger etc.
   1.10. dv/dt and di/dt protection of SCR.

2. Controlled Rectifiers (10 hrs)

   2.1 Single phase half wave controlled rectifier with resistive load and inductive load, concept of free wheeling diode.
   2.2 Single phase half controlled full wave rectifier (No mathematical derivation)
   2.3 Single phase fully controlled full wave rectifier bridge (Workshops only)
   2.4 Single phase full wave centre tapped rectifier (Workshops only)
   2.5 Three phase full wave half controlled bridge rectifier (Workshops only)
   2.6 Three phase full wave fully controlled bridge rectifier (Workshops only)

3. Inverters, Choppers, Dual Converters and Cyclo Converters (18 hrs)

   3.1 Inverter-introduction, working principles, voltage and current driven series and parallel inverters and applications
   3.2 Choppers-introduction, types of choppers and their working principles and applications
   3.3 Dual converters-introduction, working principles and applications
   3.4 Cyclo-converters- introduction, types, working principles and applications

4. Thyristor Control of Electric Drives (15 hrs)

   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

5 Uninterrupted Power Supplies (5 hrs)

   5.1 UPS, Stabilizers, SMPS
   5.2 UPS online, off line
   5.3 Storage devices (batteries)

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 Quadriac (fabrication of this circuit)
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.

BOOKS RECOMMENDED

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 FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Introduction of SCR	16	25
2	Controlled Rectifiers	10	15
3	Inverters, Choppers, Dual Converters and cyclo converters	18	30
4	Thyristor Control of Electric Drives	15	20
5	Uninterrupted power supplies	5	10
	Total	**64**	**100**

5.4 Elective - I
5.4 (a) INSTRUMENTATION

L P
4 -

RATIONALE

This subject deals with the various instruments, their construction and working which control the various parameters and operations in any industry. Electrical supervisor employed for maintenance of electrical equipment/ machinery is required to diagnose faults, rectify them and test the total system for good performance. Thus there is a need of introducing diploma holders to the basics of Instrumentation. Basics of instrumentation has been dealt with in this subject

DETAILED CONTENTS

1. Measurements: (4 hrs)

   Importance of measurement, Basic measuring systems, advantages and limitations of each measuring systems, generalized measurement system, signal conditioning and display devices

2. Transducers: (8 hrs)

   Theory, construction and use of various transducers (resistance, inductance, capacitance, electromagnetic, piezo electric type)

3. Measurement of Displacement and Strain: (10 hrs)

   Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges and their different types such as inductance type, resistive type, wire and foil type etc. Gauge factor, gauge materials, and their selections, sources of errors and its compensations. Use of electrical strain gauges, strain gauge bridges and amplifiers.

4. Force and Torque Measurement: (10 hrs)

   Different types of force measuring devices and their principles, load measurements by using elastic Transducers and electrical strain gauges. Load cells, proving rings. Measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements; different methods, devices.

5. Pressure Measurement: (8 hrs)

   Bourdon pressure gauges, electrical pressure pick ups and their principle, construction and applications. Use of pressure cells.

6. Flow Measurement: (6 hrs)
   Basic principles of magnetic and ultrasonic flow meters

7. Measurement of Temperature: (10 hrs)

   Bimetallic thermometer, pressure thermometers, thermoelectric thermometers, resistance thermometers, thermocouple, thermisters and pyrometer, errors in temperature measurements in rapidly moving fluids. Temperature recorders

8. Measurement of other non electrical quantities such as humidity, pH level and vibrations
   (8 hrs)

INSTRUCTIONAL STRATEGY

The teacher should explain the scope of various measuring devices and their practical applications in the field. The transducers and measuring devices must be shown to the students and they should be trained in the reaction, operation, maintenance and calibrations. Frequent visits to nearby process industries will be of immense help to the students.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Measurements	4	5
2	Transducers	8	15
3	Measurement of Displacement and Strain	10	15
4	Force and Torque Measurement	10	15
5	Pressure Measurement	8	10
6	Flow Measurement	6	10
7	Measurement of Temperature	10	15
8	Measurement of other non electrical quantities	8	15
	Total	**64**	**100**

RECOMMENDED BOOKS

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
2. Electronic Measurement and Instrumentation by JB Gupta, SK Kataria and Sons, New Delhi
3. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi

4. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi

5. Industrial Instrumentation by Umesh Rathore, SK Kataria and Sons, New Delhi

Elective-I
5.4(b) INSTALLATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT

L	P
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.

DETAILED CONTENTS

1. Tools and Accessories (4 hrs)

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

2. Installation (24 hrs)

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

2.2 Installation of transmission and Distribution Lines:

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

3. Maintenance (36 hrs)

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 Meggar, 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

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

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 FOR FACILITATING THE PAPERSETTER

Sr. No	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Tools and Accessories	4	5
2	Installation	24	40
3	Maintenance	36	55
	Total	**64**	**100**

5.5 DIGITAL ELECTRONICS AND MICROPROCESSORS

L P
4 3

RATIONALE

Digital electronics has made extremely rapid advances in the last five decades. It has important applications in communication entertainment, instrumentation, control, automation etc. Thus it appears that there is no end to its usefulness. In fact, the light and the new world belongs to it. So it is necessary to give the knowledge of digital electronics to the electrical students. Microprocessor is one of the most exciting technological advancement among the semiconductor devices in recent times. It has a tremendous impact on the Industrial processes due to its high reliability, flexibility and control capacity both at the design and the Implementation stages. The decreasing cost with increasing facilities act as catalysts in widening their scope of applications.

DETAILED CONTENTS

Note: **Question paper will be set 70% from Part-A and 30% from Part-B.**

(Part-A)

1. Number Systems (8 hrs)
   - 1.1 Decimal, binary, octal, hexa-decimal BCD and ASCII code number systems and their inter-conversion
   - 1.2 Binary and Hexadecimal addition, subtraction and multiplication
   - 1.3 1's and 2's complement methods of addition/subtraction

2. Gates (5 hrs)
   Definition, symbol and truth tables for inverter, OR, AND, NAND, NOR and X-OR exclusive-AND gates

3. Boolean Algebra (8 hrs)
   - 3.1 Boolean Relations and their applications
   - 3.2 DeMorgan's Theorems
   - 3.3 K-Map upto four variables

4. Combinational Circuits (8 hrs)
   - 4.1 Half adder, Full adder
   - 4.2 Encoder, Decorder
   - 4.3 Multiplexer/Demultiplexer
   - 4.4 Display Devices (LED, LCD and 7-segment display)

5. Flip-Flops (6 hrs)
   - 5.1 J-K Flip-Flop
   - 5.2 R-S Flip-Flop
   - 5.3 D-Type Flip-Flop
   - 5.4 T-Type Flip-Flop
   - 5.5 Applications of Flip-Flops

6. Introduction of Shift Registers and Counters (6 hrs)

7. A/D and D/A Converters (4 hrs)
   - 7.1 A/D converter (Counter ramp, successive approximation method of A/D Conversion)
   - 7.2 D/A converters (Binary weighted, R-2R D/A Converter)

8. Semi-conductor Memories (4 hrs)
   Types, merits, demerits, and applications

(PART-B)

9. Microprocessor (16 hrs)
   - 9.1 Study of 8085 microprocessor architecture, pin configuration, bus organisation, registers flags, interrupts
   - 9.2 Instruction set of 8085 microprocessor, addressing modes, instruction format. Writing some simple assembly language programmes including debugging. Use of stacks and sub-routines in programming
   - 9.3 Interfacing and data transfer between peripheral, I/O and microprocessor
   - 9.4 Study of peripheral chips – 8251, 8155, 8051, 8257, 8259
   - 9.5 Introduction of 16-bit, 32-bit microprocessor, their advantages over 8-bit microprocessor

LIST OF PRACTICALS

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, X-OR gates
2. Construction of Half Adder/Full Adder using gates
3. To verify the truth table for R-S and JK flipflop
4. Construction and testing of any counter
5. Verification of operation of a 8-bit D/A Converter
6. Writing assembly language programme using numemoanics and test them on μP Kit (any three)
   a) Addition of two 8-bit numbers
   b) Subtraction of two 8-bit numbers
   c) Multiplication of two 8-bit numbers

d) Division of two 8-bit numbers

e) Finding average of N given integer

f) Finding maximum number out of three given numeric

7. Assembly language programming for different applications on 8051 microcontroller

INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing), A/D, D/A converters and other Topics. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. More emphasis while teaching this subject should be given on practical aspects along with the theory input. Lots of programming exercises may be given to the students. Mini projects based on microprocessor operations may be identified and given to students as assignments.

RECOMMENDED BOOKS

1. Modern Digital Electronics by RP Jain, Tata McGraw Hill, Education Pvt. Ltd. New Delhi
2. Digital Principles and Electronics by Malvino and Leach, Tata McGraw Hill, New Delhi
3. Digital Electronics by SN Ali
4. Digital Electronics by Rajive Sapra, Eshan Publications, Ambala City
5. Digital Fundamentals by Floyd and Jain , Pearsons Education (Singapore) Pte Ltd Patparganj, Delhi 110092
6. Digital Electronics by Jamwal, Dhanpat Rai and Co. New Delhi
7. Microprocessors Architecture, Programming and Application with 8085/8080A, Ramesh S Gaonkar, Wiley Eastern Ltd. New Delhi
8. Introduction to Microporcessors by Aditya Mathur, TMH Publishing Co., New Delhi
9. Microprocessors and Microcontrollers by BP Singh, Galgotia Publications, New Delhi
10. Digital Systems by Sanjay K Bose, Wiley Eatern(P) Ltd. New Delhi
11. Digital Systems : principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
12. Digital Integrated Circuits by AK Gautam, SK Kataria and Sons, New Delhi
13. Microprocessors(The 8086 and 8088) by AK Gautam and A Jaiswal; SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Number Systems	8	10
2	Gates	5	5
3	Boolean Algebra	8	10
4	Combinational Circuits	8	10
5	Flip-Flops	6	10
6	Shift Registers and Counters	6	10
7	A/D and D/A Converters	4	5
8	Semi-conductor Memories	4	5
9	Microprocessor	16	35
	Total	**64**	**100**

5.6 ENERGY MANAGEMENT

L P
4 -

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 but efficient use of available energy is also 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

1. Energy Management (8 hrs)

   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

2. Energy Conservation (14 hrs)

   2.1 Energy conservation in Domestic sector- Lighting, Home appliances
   2.2 Energy conservation in Industrial sector-Industrial lighting, Distribution system, Motor Pumps, Fans, Blowers etc.,
   2.3 Energy conservation in Agriculture sector Tubewell pumps, Diesel-generating sets, Standby energy sources.
   2.4 Macro Level approach for energy conservation at design stage.

3. Energy Efficient Devices (20 hrs)

   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.

4. Energy Audit (16 hrs)

   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.

5. Environmental Impact Assessment (6 hrs)

   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 bases on energy conservation. The students should be made familiar with the energy efficient devices, various approaches to conserve energy, energy auditing procedure etc. Beet 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, fertiliser industry, cement industry. CII, Energy Management Cell etc

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Energy Management	08	15
2.	Energy Conservation	14	25
3.	Energy Efficient Devices	20	30
4.	Energy Audit	16	25
5.	Environmental Impact Assessment	06	5

Total	**64**	**100**

5.7 MINOR PROJECT WORK

L	P
-	4

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the students will be able to comprehend concepts, principles and practices taught in the classroom and their application in solving field/industrial problems. The work done in minor project work will also prepare them in taking up problem solving at latter stage under major project work.

Depending upon the interests of the students and location of the organization the student may be asked to do Market study in the following cases:

1. Various types of cables available in the market, their current rating/specifications, different makes/manufacturing companies (minimum three), comparison of cost between different makes.
2. Various types of domestic/wiring components such as switches, sockets, holders etc., their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes.
3. Various types of protective devises used in domestic and industrial wiring such as MCBs, ELCB/RCCB, fuses etc. their specifications, make (minimum three), and comparison of cost between different makes.
4. Various types of electric lamps (lumeneries) available in the market, their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes.
5. Various types of Electrical Appliances (domestic and commercial) available in the market, their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes. (compare any one type)
6. Survey and study of house wiring accessories, manufacturers, rates, specifications, their literature collection for their design
7. Study of LT/HT components, detailed specifications from catalogues of manufacturers, drawings, rates, availability in local market

Minor project assignments may also include following studies:

1. Study of different types of sources of light, their connections, and to measure intensity of light with lux-meter:

    1.1 Fluorescent lamp/ tube
    1.2 HP mercury vapour lamp
    1.3 HP sodium vapour lamp
    1.4 Compact Fluorescent lamp (CFL)

1. Study of induction furnace by visiting a factory and to prepare a report
2. Study of welding equipment along with its accessories
3. Study of the electroplating plant by visiting an industry and preparing a report
5. Study of refrigerator/air conditioner and to prepare a report of its electrical circuit
6. Study of an electric locomotive by visiting any locomotive repair shop at a nearby station

NOTE: The students of the class may be divided into five groups and work may be assigned to each group as per their interest.

The components of evaluation will include the following :

	Component		**Weightage**
a)	Punctuality and regularity		15%
b)	Initiative in learning new things		15%
c)	Relationship with others/workers	15%	
d)	Project Report/ Technical report		55%

PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person interviews; telephonic interviews, panel interviews; group interviews and video conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene