

SEMESTER 5th

DEE501

ELECTRICAL MACHINES-II

L3:T0:P0

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

Unit-1

Synchronous Machines: 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

Unit-2

Alternators: 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 ,

Unit-3

Synchronous Motors; 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-4

Induction Motors: Salient constructional features of squirrel cage and slip ring 3-phase induction motors, Principle of operation, slip and its significance ,Locking of rotor and stator fields, 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 and unstable zones, Effect of rotor resistance upon the torque slip relationship, Double cage rotor motor and its applications, 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, Harmonics and its effects, cogging and crawling in Induction Motors.

Unit-5

Single Phase Motors: 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, Reluctance start motor, Alternating current series motor and universal motors, Single phase synchronous motor, Reluctance motor, Hysteresis motor, Comparison of 3 phase and 1 phase Induction motor, Application of 3 phase and Single phase Induction 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 polyphase alternators and load sharing
6. Determination 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;

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

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**Unit-1**

Power Generation: Main resources of energy, conventional and non-conventional 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. Importance of non-conventional sources of energy in the present scenario. Brief details of solar energy, bio-energy, wind energy

Unit-2

Economics of Generation: 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, Base load and peak load power stations, inter-connection of power stations and its advantages, concept of regional and national grid.

Unit-3

Transmission Systems: 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

Comparison of different systems: AC versus DC for power transmission, conductor material and sizes from standard tables, 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, Mechanical features of line: Importance of sag, calculation of sag, effects of wind and ice related problems; Indian electricity rules pertaining to clearance, 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

Transmission Losses

Unit-4

Distribution System: Layout 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 Preparation of estimates of HT and LT lines (OH and Cables), Constructional features of LT (400 V), HT (11 kV) underground cables, advantages and disadvantages of underground system with respect to overhead system, Calculation of losses in distribution system, Faults in underground cables-determine fault location by Murray Loop Test, Varley Loop Test

Unit-5

Substations & Power Factor: Brief idea about substations; out door grid sub-station 220/132 KV, 66/33 KV outdoor substations, pole mounted substations and indoor substation, Layout of 33/11 and kV/400V distribution substation and various auxiliaries and equipment associated with it. Power Factor: Concept of power factor, Reasons and disadvantages of low power factor, 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

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**Unit-1**

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

Unit-2

Controlled Rectifiers: 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 (Workshops only),Single phase full wave centre tapped rectifier (Workshops only)

Three phase full wave half controlled bridge rectifier (Workshops only),Three phase full wave fully controlled bridge rectifier (Workshops only)

Unit-3

Inverters: Inverter-introduction, working principles, voltage and current driven series and parallel inverters and applications

Unit-4

Choppers: Choppers-introduction, types of choppers and their working principles and applications

Unit-5

Dual converters & Cyclo-converters: Dual converters-introduction, working principles and applications. Cyclo-converters- introduction, types, working principles and applications

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. To observe the output wave shape on CRO of a Single phase half controlled full wave rectifier
7. Single phase controlled rectifier
8. 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

RATIONALE

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**Unit-1**

8085 pinout diagram, function of different pins, data bus, address bus, multiplexing and demultiplexing of address/data lines, control bus, control and status signals, internal architecture (ALU, Register Array, timing and Control Unit), flags, basic interfacing devices (buffers, tristate devices, decoders, encoders, latches).

Unit-2

Different addressing modes, instruction set, arithmetic and logic operations, 8085 assembly language programming, (addition, subtraction, multiplication, Division), timing diagrams, Instruction cycle.

Unit-3

Addressing techniques, memory mapped I/O and I/O mapped I/O scheme, Partial and absolute address decoding, Basic interfacing concepts, interfacing input devices, interfacing output devices, 8085 Interrupts, stack and subroutines.

Unit-4

Interfacing peripheral devices, Multi-purpose programmable device (8155), Interfacing of different Devices, and its interfacing with 8085, Direct memory access and DMA controller (8237).

Unit-5

8086 architecture, addressing modes, Instruction set, Basic programming concepts, interrupts.

LIST OF PRACTICALS

1. To write a program to add two single byte numbers.
2. To write a program to subtract one 8-bit number from another 8-bit number.
3. To write a program to multiply two single byte numbers.
4. To write a program to divide one number by another.
5. Write a program to find the greatest of three numbers.

INSTRUCTIONAL STRATEGY

The 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), 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.

BOOKS RECOMMENDED:

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and Applications with 8085. PRI Publishing (India) Pvt. Ltd.
2. Gilmore, Microprocessors, TMH India.
3. K.L. Short, Microprocessors and Programming Logic
4. M. Rafiquzzaman, Microprocessors: Theory and Applications (Intel and Motorola)

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**Unit-1**

Energy Management: Overview of energy management, need for energy conservation, Environmental Aspects, Need for energy conservation with brief description of oil and coal crisis, Alternative sources of energy, Energy efficiency- its significance

Unit-2

Energy Conservation: Energy conservation in Domestic sector- Lighting, Home appliances, Energy conservation in Industrial sector-Industrial lighting, Distribution system, Motor Pumps, Fans, Blowers etc, Energy conservation in Agriculture sector Tube well pumps, Diesel-generating sets, Standby energy sources, Macro Level approach for energy conservation at design stage.

Unit-3

Energy Efficient Devices: Energy efficient technology an overview, Need for energy efficient devices Initial cost versus life cycle, cost analysis on life cycle basis Energy efficient motors as compared to standard motors, BIS standards for energy efficient motors, BIS salient design features, Efficiency as a function of load, safety margins, Energy efficient lighting system different sources, lumens/watt, LEDs, role of voltage on efficiency, Distribution system- Optimum cable size, amorphous core transformer, role of power factor, use of compensating capacitors-manual and automatic, location of capacitors.

Unit-4

Energy Audit :Energy audit methodology, Efficiency of energy conversion processes, monitoring system, Specific energy consumption –three pronged approach, fine tuning, technical up gradation, avoidable losses, Case studies of energy audit of distribution system, AC motors, Industries. audit activities.

Unit-5

Environmental Impact Assessment: Need for environmental impact assessment Standard format for assessment and its completion, 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

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 devices 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 (luminaries) 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,
8. 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 :

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

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 6 weeks duration to be organised during the semester break starting after second year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

Teachers and students are requested to see the footnote below the study and evaluation scheme of IV Semester for further details.

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

ELECTIVE-II

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**Unit-1**

Measurements & Transducers: Importance of measurement, Basic measuring systems, advantages and limitations of each measuring systems, generalized measurement system, signal conditioning and display devices, Transducers: Theory, construction and use of various transducers (resistance, inductance, capacitance, electromagnetic, piezo electric type)

Unit-2

Measurement of Displacement and Strain: 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.

Unit-3

Force and Torque Measurement: 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.

Unit-4

Pressure Measurement & Flow Measurement: Bourdon pressure gauges, electrical pressure pick ups and their principle, construction and applications. Use of pressure cells. Flow Measurement: Basic principles of magnetic and ultrasonic flow meters

Unit-5

Measurement of Temperature & other non electrical quantities: Bimetallic thermometer, Pressure thermometers, thermoelectric thermometers, resistance thermometers, Thermocouple, thermistors and pyrometer, errors in temperature measurements in rapidly moving fluids. Temperature recorders, Measurement of other non electrical quantities such as humidity, pH level and vibrations

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.

RECOMMENDED BOOKS

Electronic Measurement and Instrumentation by Dr Rajendra Prasad
Electronic Measurement and Instrumentation by JB Gupta, SK Kataria and Sons, New Delhi
Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi
Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi

Unit 1

Introduction: World energy scenario, Energy crisis, **Renewable** energy resources

□ Solar energy, Hydro electricity, Biomass, Wind energy, Geothermal energy, Tidal energy
Wave energy

Unit 2

Solar Energy : Solar radiation, Electromagnetic spectrum, Prediction of solar radiation, Solar thermal energy, Domestic hot water system, Solar dryer, Solar distillation
Solar ponds, Swimming pool heating, Concentrating collectors, Flat plate collectors, Solar-electricity, Fundamental principle of photovoltaic conversion, Types of photovoltaic cells (mono-crystalline, poly-crystalline, thin film or amorphous cells), Solar module, energy storage battery, charge controller, Solar home system and solar water pumping

Unit 3

Hydro-electricity: Water head, flow and power from water, Types of hydropower plants, Large hydro, medium hydro, small hydro, micro hydro, Pelitic set, Micro-hydro power
Feasibility study and evaluation of potential of hydro power, Demand survey and calculation of micro-hydro size, Hydraulic structures, Electromechanical equipment- turbine- generator- governor- automatic voltage regulator- electronic load controller- ancillary equipments

Unit 4

Biomass : Biomass as a fuel, Direct combustion, Gasification, Pyrolysis, Anaerobic digestion – Biogas, Role of biogas in Nepal, Components of Biogas system, Biogas constituents, Biodigester, Biogas inputs (feeds), Digestion, Slurry, Use of Biogas (cooking, lighting etc), Presentation Package: Microsoft PowerPoint

Unit 5

Wind Energy : Power from the winds, Wind turbines, Horizontal axis turbines, Vertical axis turbines, Electricity generation from wind turbines, Wind farm

References:

1. Renewable Energy, Power for a sustainable future by Godfrey Boyle, Oxford University Press.

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

RATIONALE

Civil Engineering diploma holders must have the knowledge of different types of environmental aspects related to development activities so that they may help in maintaining the ecological balance and control pollution. They should also be aware of the related environmental laws for effectively combating environmental pollution. The class room instructions should be supplemented by field visits to show the pollution caused by urbanization and the combatment measures being adopted at site. Extension lectures by experts may be encouraged.

DETAILED CONTENTS

Unit-1

Study of Importance of Environmental Engineering .Importance of clean environment, control of environmental pollution with respect to air, land and water. Conservation of natural resources, environmental education and awareness, sustainable development.

Environments and Ecology.Definition and understanding of environment and ecology concept, ecosystem and types of ecosystems, energy flow in an ecosystem, food chain, ecological pyramids, consortium and ecological balance

Unit-2

Water Pollution,Causes of pollution in surface and underground water eutrophication of lakes and its preventing measure; BIS standards for water quality.

Air Pollution :Definition, principal air pollutants, atmospheric parameters influencing air pollution, types of air contaminants and their sources, effects of air pollution on human beings, plants, animals, automobile pollution, BIS ambient air quality standards and measures to combat air pollution.Noise

Pollution :Definition, unit of measurement of noise, sources and effects of noise pollution and control of noise pollution

Unit-3

Effects of mining, blasting and deforestation ,Ill effects of mining, blasting and deforestation on the environment human life and wild life.Land Use: Effect of land use on environmental quality, land use and natural disasters,(land slides etc) soil degradation problems - erosion, water logging, soil pollution etc

Unit-4

Environmental Impact Assessment:Definition and requirements, environmental impact assessment. Flour chart of environmental impact assessment methodology. Describe the need and importance of EIA. Legislation to Control Environmental Pollution (idea), Indian legislative acts for water, land and air pollution control – provisions, scope and implementation

Unit-5

Global Issues of Environmental Engineering, Global warming, ozone depletion, acid rain, oil pollution; radiation hazards and their control, concept of clean technology and carbon credits. Renewable Source of Energy :Role of non-conventional sources of energy (biogas, solar, wind etc) in environmental protection. Conservation of energy resources like coal, oil etc., alternative fuels, bio-diesel etc.

INSTRUCTIONAL STRATEGY

Students should be encouraged to undertake project work related to environmental problems. They should visit industrial effluent treatment plant, water treatment plant and environmental engineering laboratory and study the impact of utilization of reclaimed by products.

RECOMMENDED BOOKS

1. Deswal DS and Deswal SS “Environmental Engineering” Dhanpat Rai and Company (P) Ltd., Delhi
2. Odum EP, “Fundamentals of Ecology”, Amarind Publication Co., Delhi
3. DhamijaSK “Environmental Engineering and Management ; SK Kataria and Sons, Delhi
4. DeAK, “Engineers Chemistry”, New Age Publication, Delhi
5. KendeighSC, “Ecology”, Prentice Hall of India, Delhi
6. Khitoliya, RK, “Environmental Pollution’, S Chand & Co. Ltd., New Delhi
7. Bhatia, HS, “A text book of Environmental Pollution and Control”, Galgotia. Publishers, Delhi

Unit-1

Plumbing: Elements of plumbing, Objectives of plumbing, purpose of plumbing, role of plumber, licensing of plumbers their functions, sewer Air, supply pipes, drainage & vent pipes application for obtaining supply connection.

Unit-2

Pipes joints & fittings.Introduction. Types of Pipe – G.I. Pipes, PVC Pipes, Copper pipes, C.I. Pipes, A.C. Pipes, prestressed concrete pipes, joints in pipes, method of fixing pipes such as G.I. fitting C.I. fitting.

Unit-3

Valves & Terminal Fittings.Types of valves & its purpose, sluice valve, reflux valve, scour valve, Air relief valve, pressure relief valve, gate valves, Bio-taps & stop valve self closing valve. Flush valve, mixing valve.

Unit-4

Sanitary fixture & Building drainage system.Building sanitary fittings – water closet, flushing appliances, urinals, washbasins, flushing cisterns, principles of building drainage siphonic action, traps & its types. Capacity & sizing of pipe, soil pipe, waste pipe, rain water pipe, system of plumbing. Installation of pipes, testing of pipes.

Unit-5

Water Proofing Treatment: Introduction, material required for water proofing and its specification.

Water proofing of water closet and bath room procedure & Cross section.

Terrace and basement water proofing, Precautions to be taken while water proofing.

RATIOANLE

A diploma holder in this course is supposed to maintain steam generators, turbines, compressors and other power plant equipment. Therefore, it is essential to impart him basic concepts of thermodynamics, steam generators, steam turbines, and compressors and about IC engines.

DETAILED CONTENTS**Unit-1**

Thermodynamic state and system, boundary, surrounding, universe, thermodynamic systems – closed, open, isolated, adiabatic, homogeneous and heterogeneous, properties of system – intensive and extensive, thermodynamic equilibrium, quasi – static process, reversible and irreversible processes, Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy, internal energy.

Definition of gases, explanation of perfect gas laws – Boyle's law, Charle's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gas constants, derivation

Specific heat at constant pressure and constant volume of gas, derivation of an expression for specific heats with characteristics, simple problems on gas equation

Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes

Derivation of work done, change in internal energy, change in entropy, rate of heat transfer for the above processes

Unit-2

Laws of conservation of energy, first law of thermodynamics (Joule's experiment), Application of first law of thermodynamics to non-flow systems – Constant volume, constant pressure, Adiabatic and polytropic processes, steady flow energy equation, Application of steady flow energy to equation, turbines, pump, boilers, compressors, nozzles, evaporators, limitations.

Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Classius statement, equivalence of statements, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy.

Concept of ideal gas, enthalpy and specific heat capacities of an ideal gas,

P – V – T surface of an ideal gas, triple point, real gases, Vander-Wall's equation

Unit-3

Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of steam, entropy of water, entropy of steam, T- S diagrams, Mollier diagram (H – S Chart), Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes

Quality of steam (dryness fraction), finding dryness fraction using separating and throttling calorimeter, Rankine cycle

Uses of steam, classification of boilers, comparison of fire tube and water tube boilers. Construction features of Lancashire boiler, nestler boiler, Babcock & Wilcox Boiler. Introduction to modern boilers.

Unit-4

Meaning of air standard cycle – its use, condition of reversibility of a cycle

Description of Carnot cycle, Otto cycle, Diesel cycle, simple problems on efficiency, calculation for different cycles

Comparison of Otto, Diesel cycles for same compression ratio or same peak pressure developed

Reasons for highest efficiency of Carnot cycle and all other cycles working between same temperature limits

Unit-5

Functions of air compressor – uses of compressed air, type of air compressors

Single stage reciprocating air compressor, its construction and working, representation of processes involved on P – V diagram, calculation of work done.

Multistage compressors – advantages over single stage compressors, use of air cooler – condition of minimum work in two stage compressor (without proof), simple problems

Rotary compressors – types, descriptive treatment of centrifugal compressor, axial flow compressor, vane type compressor

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Plan assignment so as to promote problem solving abilities.

RECOMMENDED BOOKS

1. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi.
2. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi.
3. Engineering Thermodynamics by CP Arora; Tata McGraw Hill, Delhi.
4. A Treatise on Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Company.

RATIONALE

The mechatronics, the integration of electronic, of electrical engineering, computer technology and control engineering with mechanical engineering is increasingly forming a crucial part in design, manufacture and maintenance of wide range of engineering products and processes. The diploma holders need skills and knowledge that are not confined to a single subject area. They need to be capable of operating and communicating across a range of engineering disciplines and linking those having more specialized skills. So it is important to introduce this subject.

DETAILED CONTENTS**UNIT 1****Introduction**

- 1.1 Introduction to Mechatronics
- 1.2 Mechatronic system
- 1.3 Measurement systems
- 1.4 Control system-open Loop, Close loop and sequential
- 1.5 Microprocessor based controllers
- 1.6 The Mechatronics approach

UNIT 2**Sensors and Transducers**

- 1.7 Sensors and transducers
- 1.8 Performance terminology
- 1.9 Displacement, position and motion sensors
- 1.10 Electromechanical sensors and transducers
- 1.11 Force sensors
- 1.12 Liquid flow sensors
- 1.13 Liquid level sensors
- 1.14 Temperature sensors
- 1.15 Light sensors
- 1.16 Selection of sensors
- 1.17 Simple problems

UNIT 3**Data Presentation Systems**

- 1.18 Displays
- 1.19 Data presentation elements
- 1.20 Magnetic recording
- 1.21 Data acquisition systems
- 1.22 Measurement systems
- 1.23 Testing and calibration
- 1.24 Simple problems

UNIT 4**Pneumatic and Hydraulic Systems**

- 1.25 Actuation systems
- 1.26 Pneumatic and hydraulic systems
- 1.27 Directional control valves
- 1.28 Pressure control valves
- 1.29 Cylinders
- 1.30 Process control valves
- 1.31 Rotary actuators
- 1.32 Simple problems

UNIT 5

Mechanical Actuation Systems

- 1.33 Mechanical systems
- 1.34 Types of motion
- 1.35 Kinematic chains
- 1.36 Cams
- 1.37 Gear trains
- 1.38 Ratchet and pawl
- 1.39 Belt and chain drives
- 1.40 Bearing
- 1.41 Mechanical aspects of motor selection
- 1.42 Simple problems

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching learning.
2. Students should be taken to various industrial units for clear conception of various topics.
3. Efforts should be made to relate the process of teaching with direct experiences in the industry.

RECOMMENDED BOOKS

1. Mechatronics by HMT, Tata McGraw Hill, New Delhi
2. Mechatronics: Electronic Control System in Mechanical Engineering by W. Bolton; Pearson Education, Singapore.
3. Fundamentals of Electrical Engineering and Electronics by BL Thareja; S. Chand and Company, New Delhi.
4. Basic Electronics by Gupta, NN Bhargava, Kulshreshtha, TTTI, Chandigarh.