



**DR. A P J ABDUL KALAM UNIVERSITY,  
INDORE**

## **SYLLABUS**

**For**

**DIPLOMA ELECTRICAL ENGINEERING  
(THIRD YEAR, 5<sup>TH</sup> and 6<sup>TH</sup> SEMESTER)**

**Dr. A P J Abdul Kalam University, Indore**

# **DR. A P J ABDUL KALAM UNIVERSITY, INDORE**

## **Syllabus for Diploma Electrical Engineering**

### **List of Subject (Second Year- 3<sup>rd</sup> and 4<sup>th</sup> Semester)**

<b>S. No.</b>	<b>Subject Code</b>	<b>Subject name</b>	<b>Page No.</b>
<b>1</b>	EED 501	INSTRUMENTATION	<b>3-4</b>
<b>2</b>	EED 502	POWER SYSTEM OPERATION & PROTECTION	<b>5-6</b>
<b>3</b>	EED 503	POWER ELECTRONICS & APPLICATION	<b>7-8</b>
<b>4</b>	EED 504	UTILIZATION OF ELECTRICAL POWER	<b>9-10</b>
<b>5</b>	EED 505	ESTIMATING & COSTING	<b>11</b>
<b>6</b>	DE9999	PROFESSIONAL ACTIVITIES	<b>12</b>
<b>7</b>	EED 601	ENERGY CONSERVATION AND MANAGEMENT	<b>13</b>
<b>8</b>	EED 602	INSTALLATION, MAINTENANCE AND TESTING	<b>14-15</b>
<b>9</b>	EED 611	ELECTRIC TRACTION	<b>16-17</b>
<b>10</b>	EED 612	PROGRAMMABLE LOGIC CONTROLLER	<b>18-19</b>
<b>11</b>	EED 604	PROJECT	<b>20-21</b>
<b>12</b>	DE9999	PROFESSIONAL ACTIVITIES	<b>22-23</b>

**UNIT 1 - Measuring System**

Elements of a measuring system, Block diagram of system configuration, performance, standards, time lag, error, distortion and distortion meters, noise and noise factor.

**UNIT 2- Transducers**

Transducers definition and classification, mechanical devices as primary detectors, Characteristic & choice of Transducers, Electrical transducers, Advantages of electric transducers, Active and passive transducers, Classification, Resistive, inductive and capacitive transducers, Potentiometer, Metallic and semiconductor strain gauges, Gauge factor, types, material used and applications. Thermistor, RTD, Inductive, LVDT, RVDT and Capacitive transducers and their application. Thermocouples, Piezo-Electric transducers, principle, materials used, mode of operation and application. Frequency generating transducers. Hall effect transducers, Opto-electronic transducers such as photo voltaic, Photo conductive, and photo conductive cells, constructional details, characteristics and applications. Photo diodes and transistors, characteristics and applications. Digital transducers, Optical encoders for linear and angular displacement measurement.

**UNIT 3 Signal Conditioners**

Purpose of signal conditioning, Classification, Input modifier, Operational amplifiers circuits used in instrumentation, D.C. amplifier, chopper amplifier. Instrumentation amplifier, characteristics, three amplifier configuration. A/D and D/A converters.

**UNIT 4 Measurement of Physical Quantities:**

Measurement of Pressure-Types of pressure measurement devices, Force summing devices, Secondary transducers, Low pressure measurement, Pirani gauge and thermocouple gauge. Resistive, Inductive and Capacitive pressure measuring devices.

Measurement of speed: Measurement of speed by stroboscope, photoelectric and reluctance pick-up devices for speed measurement. Measurement of Vibration-Necessity for Vibration Measurement, Seismic Transducer, Piezo-electric and LVDT Accelerometers. Measurement of Temperature-Temperature measuring devices, Resistance thermometers, Radiation and Optical Pyrometers. Measurement of Flow-Turbine and electromagnetic flow meters, Ultrasonic flow meter, Thermal flow meters. Measurement of Humidity-Humidity, absolute and relative humidity, Resistive and Capacitive hygrometers. Measurement of pH Value-Concept, pH scale, pH cell, pH meter. Measurement of Thermal Conductivity (gas analyzer). Measurement of level: Float and potentiometer method of flow measurement, Resistive and Capacitive methods, Ultrasonic and Gamma rays methods. Measurement of Force and Torque- Electronic weighing system, Hydraulic load cell. Torque measurement, concept, Stress and Deflection type torque measurement methods.

**UNIT 5 Telemetry**

Necessity, Principle, classification, current and voltage telemetry, Position telemetry, synchros. Frequency and pulse telemetry, Principle of frequency and pulse modulation, PAM, PPM and PCM. Idea about landline and R.F. telemetry and multiplexing. Pulse code format, Modulation techniques of digital data transmission, Digital multiplexers.

## **UNIT 6 Data Acquisition System**

Introduction data acquisition system, generalized DAS, Single and multi channel DAS, Data loggers, Special encoders.

## **UNIT 7 Display Devices and Recorders:**

Digital display system and indicators like CRT, Seven Segment LED , LED, LCD. Analog and digital recorders, Strip and circular chart recorder and Magnetic tape recorder, X-Y recorders. Ultraviolet recorders, Frequency modulated (FM) recording. Digital tape recorders.

## **References:-**

- (1) Electrical and Electronic Measurement and Instrumentation by A.K. Sawhney
- (2) Instrumentation Devices and Systems by C S Rangan, G R Sharma and V S V Mani
- (3) Digital Electronics By Malvino Leach
- (4) Instrumentation By Cooper

## **List of Experiments:**

- [1] Measurement of Distortion using wave distortion meter.
- [2] Measurement of load/weight using strain gauge and cantilever.
- [3] Measurement of linear displacement by LVDT and draw its characteristics.
- [4] Measurement of temperature by-
  - (a) Thermocouple (b) Resistance Thermometer
- [5] Measurement of pressure using LVDT and diaphragm gauge.
- [6] Study and use of data conversion using ADC and DAC.
- [7] Measurement of pH value using pH meter.
- [8] Measurement of Humidity by hygrometer.
- [9] Study and use of synchros in position telemetry system.
- [10] Measurement of Vibration using piezoelectric/LVDT transducer.
- [11] Study and flow measurement using electromagnetic flow meter.
- [12] Study of time division and frequency division multiplexing.
- [13] Measurement of liquid level by resistive/capacitive transducer.
- [14] Study and measurement of temperature using optical and radiation pyrometer.
- [15] Study of strip chart recorder and magnetic tape recorder.

**UNIT 1 Introduction to power system -**

Growth of power system in India, future schemes, various elements of power system. Interconnection, its necessity and advantages, planning, operation and improvement of power system. Load study, type of faults. AC/DC calculating board/digital computers.

**UNIT 2 Representation of power system -**

Single line diagram, use of standard symbol. Per unit quantity - definition and advantages, base impedance conversion of per unit values from one base values to other base values. Generalized ABCD constants, their values in terms of circuit parameters. To prove  $AD-BC=1$  characteristics of ABCD constants. The relations of  $Z_{so}, Z_{ro}, Z_{rs}$  in terms of generalized constants.

**UNIT 3 Fault analysis -**

Type of faults - symmetrical and unsymmetrical.

Phase sequence impedance, phase sequence networks, analysis of symmetrical faults. Analysis of L-G, L-L and L-L-G fault by symmetrical components, simple numerical problems.

**UNIT 4 Modern trends -**

E.H.T Lines, bundled conductors, HVDC system, block diagram, advantages and disadvantages. Block diagram of Power Line Carrier communication.

**UNIT 5 Introduction to protection -**

Purpose of protective system, requirement and selection. Abnormalities in a power system and their effects. Reasons for failure. Self and non self clearing faults. Use of CT/PT in protective scheme. Definition of terms regarding CT/PT. Advantages of CT/PT. Neutral earthing, their methods and advantages.

**UNIT 6 Protective relay -**

Type of relays- induction, electromagnetic, thermal. Primary and back up relaying. Types of back up relays, causes of failure of primary relaying. Explanation of terms used in relaying. Principle and working of different types of relays- electromagnetic and induction type. Induction type over current relay, reverse power relay, time and current settings. Differential relays., distance relays, thermal relays, inverse current characteristics.

**UNIT 7 Circuit interruption devices -**

Function of fuse. fusing factor, fusing characteristic. Application of isolator and circuit breakers. Circuit breaker capacities. Arc formation in C.B. and methods of arc extinction. Definition of various terms with reference to circuit interruption wave form. working principle and operation of Bulk Oil/Minimum oil/air blast/SF CB. Merits and Demerits of different types of C.B.

**UNIT 8 Protection against over voltages** - Causes and effects of over voltage. Traveling wave. Over-voltage protection, earth wire, lightning arresters- Multiple gap type, horn gap type, line type, station type and distribution type. Surge absorber.

**UNIT 9 Protective schemes** -

Protection of alternator- various abnormalities, Merz price differential protection, over current and earth fault protection.

Protection of transformer - various abnormalities, differential protection, Buchholz relay.

Feeder and transmission line protection - time graded and over current protection, current graded system, differential protection. Protection of Induction motors, use of thermal relays and under voltage protection

**References**

1. William Stevenson, Elements of Power System Analysis, McGraw Hill.
2. C.L. Wadhwa, Electrical Power System Analysis, New Age International.
3. D.P. Kothari, I.J. Nagrath, Modern Power System Analysis TMH, III Ed. Reprint 2008.
4. D.P. Kothari, I.J. Nagrath, Power System Engineering TMH II Ed. Reprint 2009.
5. Ashfaq Husain, Electrical Power Systems, Vikas Publishing House.
6. C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy”, New Age International.

**List of Experiments:-**

- [1]To determine the ABCD constants of a given / T network.
- [2]To determine  $Z_{so}$ ,  $Z_{ss}$ ,  $Z_{ro}$ ,  $Z_{rs}$  for a given / T network.
- [3]Study of a HVDC system.
- [4]Study and use of CT/PT employed for protection and determine their ratio error.
- [5]Study of an Induction type O/C relay and plot the inverse characteristic.
- [6]To plot the inverse characteristic (current/time) of a given fuse wire.
- [7]To determine the fusing factor of different fuse wire.
- [8] To study the differential protection of transformer/alternator.
- [9]Visit to power station Study of different protective elements/schemes- ground

**UNIT 1 - Thyristor -**

SCR - Structure, Two transistor model, characteristics, turn-on methods, factor responsible for temperature rise, circuit for over voltage, over current, voltage surge & high dv/dt, Gate production. Modes of heat transfer.

Triggering circuits - Resistance phase shift, UJT, Schmitt trigger. Turn-off types of commutation, methods of commutation. SCR rating, series and parallel connection. Thyristor family and other devices, DIAC, TRIAC, SCS, SUS, LASCR, MOSFET, IGRT, GTO, MCT.

**UNIT 2 Rectification -**

Single phase HW and FW converters. Mathematical relations of  $I_{dc}$  and  $I_{rms}$ . Applications Advantages of poly phase rectification.

**UNIT 3 Inverter -**

Series and parallel inverter, current and voltage source inverter, emergency tube light, comparison of inverters using different types of (transistor, MOSFET, IGRT) devices, block diagram of UPS (on load / off load). Applications of Inverter

**UNIT 4 Converter -**

Block diagram of DC to DC converter. Converter duty cycle, 4-quadrant operation of choppers, applications. Working of single phase cyclo-converter, basic concept of three phase cyclo-converter, application of cyclo-converters.

**UNIT 5 Speed control of Motors -**

Advantages of electronic speed control, 4-quadrant operation of DC motors, constant torque and constant horse power operation, speed control of separately excited DC motor, single and 3 phase controlled rectifiers, field failure protection and armature current limiter, speed control using chopper, dual converter.

Speed control of induction motor using rectifier, inverter and cyclo-convector (block diagram only).

Speed control of slip ring induction motor using SCRS in rotor circuit.

**UNIT 6 Applications -**

High frequency heating - induction and dielectric, principle, applications.

Resistance welding, electronic line contactor, heat control circuit. Static AC & DC switch, over voltage protection, time delay circuits, reversing switch with plugging logic and digit circuits, PF corrections

**Reference**

1. Power electrics : Circuits, devices & applications, M. H. Rashid, PHI
2. Power Electronics, P.C. Jain, TMH

### **List of Experiments**

- [1] Study of Characteristics of SCR.
- [2] Study of Characteristics of MOSFET.
- [3] Study of Characteristics of IGBT.
- [4] Study of single phase controlled rectifiers.
- [5] Study of emergency tube light
- [6] Study of SCR triggering circuits
- [7] Study of commutation circuits
- [8] Electronic speed control of d.c.motor
- [9] Electronic speed control of induction motor
- [10] Study of UPS
- [11] Study of chopper



**UNIT 1 Electric drives**

Merits and demerits of electric drives, factors governing selection of motors, drive requirements. Group and individual drive, starting and running characteristics of various motors. Selection of starters, hand operated and contactor type starters, liquid resistor type starter. Speed control of motors, load equalization, use of fly wheel. Motor enclosures, selection of motors for particular service, size and rating of motors.

**UNIT 2 Electric heating**

Advantages and disadvantages of electric heating, methods of electric heating. Principle of electric heating. Resistance heating, heating elements and alloys. Causes of failures of heating elements. Arc furnaces, principle, construction, working and uses. Induction heating principle, construction and use of Ajax Wyatt (core type) and coreless type. L.F. and H.F. induction furnaces. Dielectric heating principles and uses.

**UNIT 3 Electric welding**

Definition, classification of electrical welding, principle of arc welding. Qualities of a good weld. Welding defects. Resistance welding, advantages, classification, principle and working, comparison of resistance and arc welding process, A.C. & D.C. arc welding.

**UNIT 4 Illumination**

Electromagnetic wave spectrum, solid and plane angle, definition of electrical terms in use, sensitivity of human eye. Luminous efficiency, horizontal and vertical laws of illumination, definition of terms used in lighting, lighting scheme, various types of lamps, their use and fittings.

**UNIT 5 Power factor improvements**

Causes of low P.F., effects of low P.F., methods of improvement of P.F. and its economics.

**UNIT 6 Electro-chemical processes and storage batteries**

Electro deposition and faraday's laws of electrolysis, various electro-chemical processes like electroplating, electro-extraction, regions. Storage batteries, classification, construction. Battery maintenance, battery charging, circuit diagram. Application of storage batteries.

**Reference**

1. Gupta, J.B., Utilization of Elect. Energy ,Katariya and sons, New Delhi.
2. Garg, G.C., Utilization of Elect. Power and Elect. Traction.
3. N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect. Traction, New Age International.
4. Mehrdad,Ehsani,Yimin Gao,Sabastien.E. Gay,Ali Emadi, "Modern electric, hybrid electric and fuel cell vehicles", CRC Press.

## List of Experiments

- [1]Speed control of slip ring induction motor by variation of rotor resistance.
- [2]To verify the change in power factor by changing load parameters and its improvement using capacitance.
- [3]To draw 'V' curves of synchronous motor.
- [4]Study and operation of resistance oven and to control its temperature.
- [5]Study of dielectric / induction heating.
- [6]Measurement of luminous efficiency of lamps by Flux meter.
- [7]Study and operation of various types of lamps.
- [8]Study of arc welding.
- [9]Report on visit/ video demonstration on heating system. Report on visit/video film on welding system

**UNIT 1 Elements of Estimating**

Principles of estimating, purchase procedure, cost of materials, various charges like labor, stores, overhead tools, contingency etc.

**UNIT 2 Domestic and Industrial Wiring**

Various types of wiring systems including P.V.C. pipe, their merits and demerits. Calculation of total load & selection of wire, preparation of estimates for a small residential building, big institution or office building. Estimate for single store yard, multistory building. Estimate for a small workshop and industrial installation, agricultural pump, domestic pump, floor mills etc. Estimation of total cost.

**UNIT 3 Service connections**

For a single storey and multistoried building, single phase and three phase service connections, various methods of service connections. Distribution of circuits for light and power load. (Guidance may be taken by the M.P. Electricity Boards estimates).

**UNIT 4 Substations**

Various types of sub-stations, pole-mounted in-door and out-door substations. Estimating quantity and cost for a substation of a given specification.

**UNIT 5 Overhead lines : H.T. & H.T. lines**

Preparation of estimate and costing of 11KV or 33KV line. Selection of routes. Estimates for distribution lines- Location of poles for a given situation or locality. Providing street lights, necessary hardware, stay arrangements, underground cables, providing services lines using underground cables

**UNIT 6 Estimating and costing for repair/maintenance of electrical devices/equipments**

Estimates for repairing electrical equipment e.g. Rewinding, assembling and testing of polyphase induction motor. Repairing of 3 phase starters. Repairing of single phase transformers. Repairing of devices like hot plate, press, mixer fan etc.

**Objectives:**

To allow for professional development of students as per the demand of engineering profession.

**THE STUDENTS WILL BE ABLE TO:**

1. Developing working in teams
2. Apply problem solving skills for a given situation
3. Use effective presentation techniques
4. Apply techniques of effective time management
5. Apply task management techniques for given projects
6. Enhance leadership traits
7. Resolve conflict by appropriate method
8. Survive self in today's competitive world
9. Face interview without fear
10. Follow moral and ethics
11. Convince people to avoid frustration
12. To provide time for visiting library or using Internet.
13. To provide time for group discussion or solving case studies.
14. To provide time for personality development of students.
15. To allow for development of abilities in students for leadership and public speaking through organization of student's seminar etc.

**UNIT-1** Energy Scenario- Various types of renewable and non-renewable energy, energy consumption and use pattern, energy consumption and environment. Energy Management and audit-Energy Management and its objectives, energy audit, need of energy audit, types of energy audit, energy auditing instruments.

**UNIT-2** Waste heat recovery-Sources of waste heat, advantages of waste heat recovery, commercial waste heat recovery devices-Recuperators, Heat regenerators, heat pumps etc. Agricultural use of waste heat. Role of maintenance in energy conservation-Types of maintenance breakdown, predictive & preventive, maintenance and energy conservation.

**UNIT-3** Heating ventilation and air conditioning-Definition of Heating, ventilation and air conditioning, Energy saving opportunities in Heating ventilation and air conditioning, Conducting Audit in Heating ventilation and air conditioning.

**UNIT-4** Demand side management –Benefits, Demand side management Techniques, implementation of Demand side management programme, Tariff options of Demand side management.

**UNIT-5** Energy efficient motor and drives-Motor efficiency, energy efficient motors, energy efficient electric drives, use of variable speed drives. Power factor improvement-Causes of low power factor, advantages of power factor improvement, methods of power factor improvement.

**UNIT-6** Energy conservation in various sectors-For residential and commercial sector, in transportation, in energy intensive industries. Co-Generation benefits, types of co-generation. Economic Analysis of energy conservation-Economic analysis of investment, Economic analysis techniques, Risk analysis.

### **References**

- [1]Energy Conservation and Management by S. K. Soni and Manoj Nair, Satya Prakashan, New Delhi
- [2]Energy management- W.R.Murphy & G.M. ckey, Butter worths
- [3]Electrical Energy utilization & conservation – Dr. S.C.Tripathi
- [4]Four books published by BEE (Bureau of Energy Efficiency) Govt. of India

**UNIT-1 Installation testing and maintenance** - Types of heavy Electrical equipment, unloading accessories precautions for unloading, installation of small and large machines of both static and rotating type. Installation of pole mounted transformer. Instruments used for measuring insulation resistance, reasons for deterioration of insulation resistance, improving insulation resistance, drying of insulation, Measurement of internal temperature of winding, vacuum impregnation / filtering of insulating oil, testing of insulating oil.

**UNIT-2 Commissioning** - Tests required before commissioning procedure to be adopted for commissioning the electrical equipment in respect of -Mechanical fixture and alignment. Electrical tests. Initial precautions for starting.

**UNIT-3 Earthing** - Reasons of earthing, earthing system, earth lead and its size, permissible earth resistance for different installations, improvement of earth resistance, double earthing, earth resistance measurement, rules for earthing.

**UNIT-4 Preventive maintenance and environmental pollution prevention** – Concepts of preventive maintenance, advantages, preventive maintenance schedule for transformer, induction motor, transmission line, circuit breaker and underground cable. Preventive measures to control environmental pollution results due to production of smokes gases flow of waste material and automatic reactions in research stations, plants, electrical and electronic equipments and accessories.

**UNIT-5 Trouble Shooting** - Normal performance of equipment, trouble shooting internal and external faults, instruments and accessories for trouble shooting, trouble shooting charts. **Electrical Accidents and Safety Measures** - Electrical accidents, Safety regulations, treatment of shock, fire extinguishers.

**UNIT-6 Testing and maintenance of Relays and Circuit Breakers** - Testing of Relays Factory test, commissioning test and preventive periodic maintenance test. Testing of circuit breakers, voltage test, type test, preventive maintenance of circuit breaker.

**Hot Line Maintenance** - Meaning and advantages, special types of non-conducting Materials used for tools for hot line maintenance.

**References:-**

1. Electrical Installations work by T.G. Ffancist. E.L.B.S (Vth metric edition)
2. Electrical Installations Maintenance & fault location work book by T.T.T.I.(W.R.) Bhopal
3. Preventive maintenance Electrical equipment by Charies J Hurburt.
4. Commission of Electrical plant by RCH Richardson.

5. Operation and maintenance of Electrical Equipments Vol. I & Vol.I by B.V.S. Rao, Asia Publishing or Media Promoter Publishers Pvt. Bombay.
6. Electrical Maintenance & Repair by J.I. Watts. Mc Millars London.
7. Troubles in Electrical Equipments by N.E. Stafford. McGraw Hills Pub.
8. A Text Book of Electrical installation work Vol.2. by R.A. Mee., Macdonald London.
9. Electrical Maintenance & Repairs by P.P.Gupta., Dhanpat Rai & Sons Pub.
10. Estimating Commissioning and maintenance of Electrical equipment by S. Rao, Khanna Pub.
11. Fundamentals of maintenance of Electrical Equipment by Bhatia Khanna Pub.

### **List of Experiments**

- [1]To Study and Maintenance of Overhead Lines.
- [2] To Study and Maintenance of switchgear OCB.
- [3] To Study and Maintenance of distribution transformer in distribution system.
- [4] To Study and Routine / Preventive maintenance of induction motor in textile mills / industrial establishments.
- 5( a) Shut down and energizing procedure.
  - (b) Accident report writing.
  - (c) Permit to work.
  - (d) Fire extinguisher.
- [6] Insulation oil testing.
- [7] To Study of Earth resistance testing.
- [8] To Study of Test report of electrical installation.
- [9] To Study of Maintenance schedule.
- [10] To Study and analysis of Trouble shooting.
- [11]Report on hot line maintenance.

**UNIT-1** General Description of Electric Traction system in India- Electric Traction, advantage and disadvantages. Choice of traction system in India.

**UNIT-2** System of Track Electrification- Description of various systems - D.C., 1-Phase low frequency A.C., 1-Phase high frequency, 3-Phase A.C. and Composite system. 25 K.V. A.C., 50 Hz System-Advantages and disadvantages. Problems associated with A.C traction system, current and voltage unbalance, production of harmonics and induction effects, comparison between A.C. and D.C. system

**UNIT-3** Power Supply Arrangements-High Voltage Supply. Constituents of supply system substation, feeding post, feeding and sectioning arrangements, sectioning post, elementary section. Miscellaneous equipment at control posts and switching station. Major equipment at substation, transformer, circuit breaker, interrupters. Protection system for A.C. Traction.

**UNIT-4** A.C. Electric Locomotive- Block diagram of A.C. electric locomotive. Overhead equipment (O.H.E.). Pentagonal O.H.E.- catenary construction. OHE Supporting structure Current collection system, current collection gear for OHE, pole collection bow collection, pantograph collector. Air blast C.B.Tap Changer (on load). Transformer. Rectifier connection. Traction motor connection. Smoothing reactor. Desirable characteristics of traction motors. Traction motors-suitability of motors for traction, D.C. Series motors, A.C. Series single phase, repulsion motor, 3-phase I.M. linear I.M. Control of D.C. traction motor, series parallel control, energy saving with series parallel starting, metadyne control, multiple unit control. Requirements of breaking systems, types of electric breaking Conditions necessary to achieve regenerative breaking, suitability of motor.

**UNIT-5** Train signaling-System of train lighting, special requirements of train lighting, methods of obtaining unidirectional polarity and constant output. Battery System. Failure of under frame generating equipment. Requirements. Track circuits. Uses of Different signaling system.

**UNIT-6** Traction Mechanics-Types of services. Speed time curve. Simplified speed time curve. Average speed and schedule speed. Tractive effort. Power of traction motor. Specific energy consumption, factors affecting specific energy consumption. Mechanics of train movement. Coefficient of adhesion, factors affecting the coefficient of adhesion.

### References

1. Electric Traction A.T. Dover Pitmin & Sons
2. Electric Traction System Equipment D.W. Hingle Pergamo Press
3. Electric Traction Hand Book. R. Books Pitman & Sons.
4. Modern Electric Traction. H. Pratap Pritam Burai & Bros.



## **List of Experiments**

- [1] Draw Speed Current Characteristic of D.C. Series Motor.
- [2] Draw Speed Torque Characteristic of D.C. Series Motor.
- [3] Study of Various Methods for Speed Control of D.C. Motor.
- [4] Study of Pole and Bow Current Collector.
- [5] Study of Pentagraph Current Collector.
- [6] Study of Metadyne Control System.
- [7] Study of breaking system.
- [8] Protection system for A.C. Traction.

**UNIT-1** Introduction to PLC-

What is PLC ,Technical Definition of a PLC. Advantage of PLC. Chronological Evolution of a PLC. Type of PLC. Block diagram PLC.

**UNIT-2** PLC Hardware, Timers &Counters-

Relays. Ladder logic diagram. PLC Connection. Electrical Wiring diagram. JIC Wiring Symbols. Latches, Timer. Classification of Timer. PLC Counters. Operation of PLC Counter. Counter Parameters

**UNIT-3** Advance Instruction & Programming Techniques-

Introduction. Comparison Instruction. Discussions on Comparison Instruction – EQUAL, NOTEQUAL, LESS THEN, LESS THEN OR EQUAL, GRATER THEN, MASKED COMPARISION FOR EQUAL, LIMIT TEST. Mathematical Instruction. Logical Instruction ,Data handling Instruction.

**UNIT-4** PLC Input-Output (I/O) Modules Power Supply-

Introduction, Classification of Input Output Modules. input-Output System. Sinking Sourcing Special Input Modules. RTD Input Module. Stepper Motor Control Module. Thermocouple Input Module. Power Supply Configuring. Power Line conditioner. Reliability, Safety and Redundancy. Filter.

**UNIT-5** Industrial Automation & Selection of Programmable Logic Controllers-

Introduction. Utility of automation. Example of some simple Automated Systems. Selection of PLC

**UNIT-6** PLC Applications-

Distributed control system, (DCS). Industrial control systems, (ICS). Programmable automation controller, (PAC). Industrial safety systems. SCADA.

**References**

1. PLC Programming Method and Application :- John R Hackworth, Fredric D Hackworth (publication:- Pearson Education)
2. Process Dunamic and control, D.E.seborg, T.F.Edgar, D.A.Melichamp (publication:- Wiley publication)
3. Programmable Controllers operation and Application (publication :-PHI publication )
4. Programmable Logic Controllers and Industrial Automation an Introduction  
By:- Madhuchanda Mitra and Samarjit Sen Gupta (publication:-Penram International Publishing (India) Pvt.Ltd.
5. Programmable Logic Controllers By:-W. Bolten Programmable Logic Controllers and Industrial Automation By:- Kelvin Collins (publication:-Exposure Publishing)
6. Programmable Logic Controllers By:-Collin Simpson
7. Programmable Logic Controllers By:-Morriss Brian publication :-PHI

## List of Experiments

- [1] Develop a Simple Ladder Logic Program that will turn on an output X if input A and B or C is on.
- [2] Develop a relay based Controller that will allow three switches in a room to control a single light.
- [3] How temperature control system can be developed in a process industry.
- [4] Develop a traffic control System.
- [5] Speed control of Induction Motor.

Project work is the area in which a student can show his creativity resources fullness, knowledge and various skills attained through the labs and work-shop during the course duration.

Project work leads the student to develop his original thinking, group discussion, leadership, interpersonal relations, inter disciplinary relation and polishes his behavior in the society.

He is also exposed to market survey for procurement of components, suiting to the circuit, their equivalents, the process of try outs of circuits, modification of circuit values and finally getting the desired result.

An electronics diploma student has very vast scope of preparing project, as electronics has entered in every walk of life of the society and every hour of one's daily life. The support of the institution, faculty members, and supporting staff is of paramount Importance and their quality is also reflected in the quality of the final shape of the project.

A good project work earns credit for all concerned and increase scope of employment / self employment when presented to potential employer. With this view curriculum cannot be bound in any limits and boundary on papers. Reasonable freedom has to be given for selecting the project work as far as the project is feasible and economically viable and socially useful.

#### **The objective of the course 'Project' is**

- To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.
- To students an opportunity to do something creative and to assimilate real life work situation in institution.
- To adapt students for latest developments and to handle independently new situations.
- To develop good experiences power and presentation abilities in students.

The faculty and student should work according to following schedule:

1. Each student undertakes substantial and individual project in an approved area of the subject and supervised by member of staff.
2. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.
3. The project development must be carried out according to following steps and final write-up should have the same sequence.

#### **Project objectives.**

- Requirement gathering.
- Modeling of project should be done in any well- known modeling tools.

- Analysis of Project.
- Design of Project.
- Implementation of project.
- Testing on project.
- Quality consideration of project.
- Designing a small user manual.
- Estimating the cost of the project.
- Future scope and suggestions.

### **Action Plan for Project Work**

Orientation of students by HOD/Project supervisor, Literature survey and resource collection, Selection and finalization of topic before a committee\*, Detailing and preparation of project, (Modeling, Analysis and Design of Project work), Development Stage, Testing, improvements, quality control of project, Acceptance testing, Report writing, Presentation before a committee (including user manual), Seminar-I, Seminar-II. Committee comprises of HOD, all project supervisors including external guide from industry (if any).

### **References / Sources for Guidance to Student for Selection of Project Work:**

1. Electronics Magazines & Journals.
2. District Industries Center.
3. Industry-Institution Interaction (III)
4. Small Scale industry
5. Industrial problems discussed during industry visit/training.
6. Entrepreneurship development Board Magazine.
7. "Prime Minister Rojgar Yojana" projects from district Collectorate.

**Professional Activities** is not a descriptive course, as per conventional norms; Therefore specific content for this course cannot be prescribed. It is a group of opened activities; where in variety of tasks are to be performed, to achieve objectives. However general guidelines for achieving the target and procedure for its Assessments are given under the course content. As the student has to practice this course in all the six semesters, the guidelines given therein are common and applicable to each semester.

**Objectives:**

To allow for professional development of students as per the demand of engineering profession.

- To provide time for organization of student chapter activities of professional bodies) i.e. Institute of engineers, ISTE or Computer Society of India etc.)
- To allow for development of abilities in students for leadership and public speaking through organization of student's seminar etc.
- To provide time for organization of guest lectures by expert engineers/ eminent professionals of industry.
- To provide time for organization of technical quiz or group discussion or any other group activity.
- To provide time for visiting library or using Internet.
- To provide time for group discussion or solving case studies.
- To provide time for personality development of students.
- To provide time for working for social cause like awareness for environmental and ecology etc.

**DETAILED INSTRUCTIONS TO CONDUCT PROFESSIONAL ACTIVITIES:**

**A.** Study hours, if possible should be given greater time slot with a minimum of two hrs/week to a maximum of four hrs/week.

**B.** This course should be evaluated on the basis of grades and mark sheet of students, should have a separate mention of the grade awarded. There will be no pass/fail in professional activities (PA).

**C.** Following grade scale of evaluation of performance in PA has been established.

<b>Grades</b>	<b>Level of performance</b>
A	Excellent
B	Good
C	Fair
D	Average
E	Below Expectations

**D.** Grades once obtained in a particular examination shall become final and no chance of improvement in grades will be given to the students.

**E.** Assessment of performance in PA is to be done internally by the Institution, twice in a Semester/Term through a simultaneous evaluation of the candidate by a group of three teachers, of the deptt. Concerned. Group of teachers will jointly award the grade to

candidate in the assessment. Best of the grades obtained by the student in these two assessments shall be finally taken on the mark sheet of the respective Semester/Term.

Candidate abstaining from the prescribed course work and/or assessment planned at the Institute shall be marked ABSENT in the mark sheet, instead of any grade.

**F.** While awarding the grades for performance in PA, examining teacher should reach the final consensus based on the attendance, punctuality, interest, presentation skills in seminar on the topic assigned (collection of relevant data, observations, analysis, findings/conclusion) and its written report, awareness of latest developments in the chosen programme of study.

**G.** Institution shall maintain the record of grades awarded to all the students in PA for a period of 1 year.

**H.** It shall be mandatory for students to submit a compendium for his PA in the form of a Journal.

I. Compendium shall contain following:

I. Record of written quiz.

II. Report/write up of seminar presented

III. Abstract of the guest lectures arranged in the Institution.

IV. Topic and outcome of the group discussion held.

V. Report on the problems solved through case studies.

VI. Report on social awareness camps (organized for social and environmental prevention).

VII. Report on student chapter activities of professional bodies like ISTE, IE (India), CSI etc.

**J.** PA is not a descriptive course to be taught in the classroom by a particular teacher. Various activities involved in the achievement of objectives of this course should be distributed to a number of teachers so that the talent and creativity of group of teacher's benefit the treatment of the course content.

These activities should preferably be conducted in English language to maintain continuity and provide reinforcement to skill development.

Small groups shall be formed like in tutorials, group discussion, case studies, seminar, project methods, roll play and simulation to make the development of personality affective. Treatment of PA demands special efforts, attention, close co-operation and creative instinct on the part of teachers of department concerned. Since this course is totally learner centered, many of the activities planned under this course shall come out from the useful interaction of student, among themselves and with the teachers. The guide teacher/s shall best act as a facilitator of these creative hunts/ exercises, which unfold many of the hidden talents of the students or bring out greater amount of confidence in them, to execute certain activity.