West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Reduced Draft Syllabus
of

Diploma in Electrical Engineering

Part-III (6th Semester)

Only for Academic Session 2021 - 2022

W.B.S.C.T.E.

TEACHING AND EXAMINATION SCHEME FOR DIPLOMA COURSES

COURSE NAME: ELECTRICAL ENGINEERING

COURSE CODE : EE

DURATION OF COURSE : 6 SEMESTERS

SEMESTER: SIXTH SEMESTER SCHEME : C

Sr.No	SUBJECT	PERIODS			EVALUATION SCHEME							
					SESSIONSAL EXAM				PR(INT.)	PR (EXT.)		Credits
	THEORY	L	T	P	TA	CT	Total	ESE				
1	Electrical Design Estimation & Costing	04		03	10	20	30	70	25	25		5
2	Electrical Installation , Maintenance , Testing	04			10	20	30	70				4
3	Industrial Project			05					50	50		3
4.	Electrical Workshop II			03					25	25		1
4	Industrial Management	03			10	20	30	70				3
5	Elective II (Any One)	03	--	03	10	20	30	70	25	25		4
	Industrial Automation											
	Process Control											
	Control of Electrical Machine											
	Computer Hardware & Networking											
6	Professional Practice -IV			04					50			2
7	General Viva voce								100			2
	Total	14		18	40	80	120	280	275	125		24

STUDENT CONTACT HOURS PER WEEK: 32 HRS
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, T - Tutorial, PR (INT.) – Practical (Internal) PR(EXT.)- Practical(External), ESE - End Semester Exam.

TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.
Total Marks : 800

Minimum passing for sessional marks is 40%, and for theory subject 40%.

West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995) Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Subject: Electrical Design, Estimation & Costing	
Subject Code: EE/S6/EDEC	Semester: S6
Duration: one Semester	Maximum Marks: 150
Teaching Scheme	Examination Scheme
Theory: 4 Hrs/Week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical: 3 Hrs/week	End Semester Exam.: 70 Marks
Credit: 5	Practical : 50 Marks

Aim:

Sl. No.	
1.	Electrical Diploma holders have to work as Technicians & Supervisors for Electrical Installations of various companies, commercial and Industrial electrification schemes and prepares estimates for these schemes.
2.	Knowledge of electrical engineering drawing, IE rules, NEC, different types of electrical Installation their design considerations equips the students with the capability to design and prepare working drawing of different Installation projects.
3.	Understanding of the methods and procedure of estimating the material is also required

Objective:

Sl. No.	Student will be able to:
1.	State IE rules, NEC related to Electrical Installation and testing
2.	Interpret the Electrical Engineering Drawing
3.	State and describe the basic terms, general rules, circuit design procedure, wiring design and design considerations of Residential Electrical Installations,
4.	Explain the sequence to be followed in carrying out the estimate of Residential Electrical Installations.
5.	Design of main dimensions of rotating machines.
6.	Design of core and winding of a 3-phase transformer up to 200KVA
7.	Understand the concept of contracts, contractors, tender and tender document and its related procedures.

Pre-Requisite:

Sl. No.	
1.	Basic Electrical Engineering
2.	Engineering Graphics

Contents (Theory)		Hrs./Unit
Unit: 1	Indian Electricity Rules (1956): Rule 28: Voltage level definitions. Rule 30: Service lines & apparatus on consumer premises. Rule 31: Cut-out on consumer's premises. Rule46: Periodical inspection & testing ofconsumer's installation. Rule 47: Testing of consumer's installation Rule 54: Declared voltage of supply to consumer. Rule 55: Declared frequency of supply to consumer.Rule 56: Sealing of meters & cut-outs. Rule 77: Clearances above ground of the lowestconductor. Rule 79: Clearances between conductors & trolleywires. Rule 87: Lines crossing or approaching each other.Rule 88: Guarding.	02
Unit: 2	Design of Lighting circuits: Determination of number of lamps & selection of lamp type, Design for placement of lamps in a room for proper & uniform illumination. (Numerical)	03
Unit: 3	Service Connection 3.1 Concept of service connection. 3.2 Types of service connection & their features. 3.3 Methods of Installation of service connection. 3.4 Estimation of underground & overhead domestic service connections. (Numerical)	06
Unit: 4	Residential Building Electrification 4.1 General rules guidelines for wiring ofResidential Installation and positioning of equipments. 4.2 Principles of circuit design in lighting andpower circuits. 4.3 Procedures for designing the circuits anddeciding the number of sub- circuits. 4.4 Method of drawing single line diagram &wiring diagram 4.5 Selection of type of wiring and rating of wires &cables. 4.6 Selection of rating of main switch, distributionsboard, protective switchgear ELCB, MCB and wiring accessories. 4.7 Earthing of Residential Installation. 4.8 Sequence to be followed for preparingEstimation of wiring. 4.9 Preparation of detailed estimates and costing asper PWD schedule of electrification of Residential Installation. (Numerical)	10
Unit: 5	Electrification of commercial Installation 5.1 Concept of commercial Installation. 5.2 Differentiate between electrification of Residential and commercial Installation (shopping mall, Office complex) 5.3 Fundamental considerations for planning of anelectrical Installation system for shopping mall/office complex.	3

Unit: 6	Electrification of factory unit Installation 6.1 Important guidelines about power wiring andMotor wiring. 6.2 Design consideration of Electrical Installationin small Industry/Factory/workshop. Motor current calculations. Selection and rating of wire, cable size. 6.2.3 Deciding fuse rating, starter, distributionboards main switch etc. 6.2.4. Deciding the cable route, determination oflength of wire, cable, conduit, earth wire, and earthing. Sequence to be followed to prepare estimate.	7
Unit: 7	Design of Electrical Transformer: i) Single phase transformer up to 1 KVA- Core Design, Selection of stamping, winding design, window area calculation. (Numerical) ii) 3-phase transformer up to 250 KVA - Basic design principles and approaches, Specification, Magnetic circuit, Output equations and Output Co-efficient, Core construction and design, Window design, Winding design, Size of tank, Winding temperature rise, (Numerical)	6
Unit: 8	Contracts, Tenders and Execution 8.1 Concept of contracts and Tenders 8.2 Contracts, types of contracts, contractors. 8.3 Valid Contracts, Contract documents. 8.4 Tender and tender notices. 8.5 Procedure for submission and opening Tenders. 8.5.1 Comparative statements, criteria for selectingcontractors, General conditions in order form.	3
	Total	40

Contents (Practical)

Suggested list of Laboratory Experiments:

Sl. No.	Laboratory Experiments (any five)
1.	A newly constructed workshop is required to be fitted with a 10 H.P. Squirel cage induction motor. I) Draw Installation plan showing location of main control board, motor control board,motor etc., (using CAD) Draw single line wiring diagram. (using CAD) Draw wiring diagram starting from energy meter up to electric motor. (using CAD)
2.	Draw Single line diagram and layout plan of 11KV indoor Substation (using CAD)
3.	Draw Sectional Drawing of different types of cables, overhead conductors (using CAD)
4.	Draw Sectional Drawing of different types of insulators (using CAD)
5.	Draw Core construction, H.T. & L.T. winding, other accessories of 3 phase transformer (using CAD).

6.	Draw pole, yoke, field coils, commutator and its details of D.C. Machine (using CAD).		
7.	Draw transmission line structure (using CAD)		
Text Books:			
Name of Authors	Title of the Book	Edition	Name of the Publisher
K.B. Raina S.K.Bhattacharya	Electrical Design; Estimating and costing		New Age International (p) Limited, New Delhi
Surjit Singh	Electrical Estimating and costing		Dhanpat Rai and company, New Delhi
J.B.Gupta	A course in Electrical Installation, Estimating & costing		S.K.Kataria & sons
S.L. Uappal	Electrical wiring Estimating and costing		Khanna Publication.
A.K.Sawhney	Electrical Machine Design		Danpat Rai & co.
	The Electricity Rule 2005		Universal Law Publishing Co. Pvt. Ltd.
N. Alagappan S. Ekambaram	Electrical Estimating and costing		Tata Mc Graw Hill Publication, New Delhi
Surjit Singh	Electrical Engineering Drawing		S.K.Kataria & Sons

Name of the Subject : Electrical Installation , Maintenance , Testing			
Subject Code: EE/S6/EIMT		Semester: SIXTH	
Duration: one Semester		Maximum Marks: 150	
Teaching Scheme		Examination Scheme	
Theory: 4 Hrs/week		Mid Semester Exam.:	20 Marks
Tutorial:		Assignment & Quiz:	10 Marks
Practical: 3 Hrs/Week		End Semester Exam.:	70 Marks
Credit:		Practical :	NIL
Aim:			
Sl. No.			
1.	This is technology level subject with application in Industry, commercial, public utility departments such as PWD, Electricity Board etc.		
2.	After studying this subject student will be able to inspect, test, install & commission electrical machines as per IS.		
Objective:			
Sl. No.	The student will be able to:		
1.	Know safety measures & state safety precautions.		
2.	Test single phase, three phase transformer, DC & AC machine as per IS.		
3.	Identify / Locate common troubles in electrical machines & switch gear.		
4.	Plan & carry out routine & preventive maintenance.		
5.	Install LV switchgear & maintain it.		
6.	Ascertain the condition of insulation & varnishing if necessary.		
7.	Identify faults & measures to repair faults.		
Pre-Requisite:			
Sl. No.			
1.	Knowledge of electrical equipments		

Contents (Theory)		Hrs./Unit
Unit: 1	Safety & Prevention of Accidents: Definition of terminology used in safety Meaning & causes of electrical accidents factors on which severityof shock depends, Procedure for rescuing the person who has received an electricshock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons,operation of fire extinguishers	05
Unit: 2	General Introduction: Objectives of testing routine tests, type tests, special tests. Methods of testing a) Direct, b) Indirect, c) Regenerative. Classification and need of maintenance Advantages of preventive maintenance,	03

Unit: 3	Testing & maintenance of rotating machines: Type tests, routine tests & special tests of 1 & 3 phase Inductionmotors, Routine, Preventive, & breakdown maintenance of 1 & 3 phaseInduction motors as per IS 9001:1992 Maintenance schedule of alternators & synchronous machines as per IS 4884-1968	07
Unit: 4	Testing & maintenance of Transformers: Listing type test, routine test & special test as per I.S. 2026-1981 Procedure for conducting following tests: Insulation resistance, Impulse voltage withstand test, Temperaturerise test of oil & winding, Different methods of determining temp rise, back to back test, open delta (delta - delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028(part III): 1981	06
Unit: 5	Testing & maintenance of Insulation: Classification of insulating materials as per I.S. 8504(part III)1994.Factors affecting life of insulating materials. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot. Properties of good transformer oil. Understand the procedure of following tests on oil as per I.S.1692-1978 a) acidity test b) sludge test c) crackle test d) flash point test. Methods of internal heating & vacuum impregnation.	06
Unit: 6	Trouble shooting of Electrical Machines & Switch gear: Various types of faults (mechanical, electrical & magnetic) inelectrical machines and reason for their occurrence. Use of following tools: Bearing puller, Filler gauge, dial indicator,spirit level, growler. Trouble shooting charts for Single & 3-phase induction motor,Single & 3- phase transformer. List the common troubles in HV and LV switchgear, contactors & batteries.	05
Unit: 7	Installation: Inspection procedure of Machine Installation. Factors involved in designing the machine foundation, Installation of rotating machines as per I.S. 900-1992. Method of drying out of Machines. Classification of transmission tower Installation of Transmission Tower	05
Unit: 8	Earthing: Introduction & importance. Step potential & Touch potential. Factors affecting Earth Resistance. Methods of earthing.	03
	Total	40

Text Books:			
Name of Authors	Title of the Book	Edition	Name of the Publisher
Tarlok Sibgh	Installation, Commissioning & Maintenance of Electrical Equipment		S.K.Kataria & Sons
B.V.S.Rao	Operation & Maintenance of Electrical Machines Vol I & II		Media Promoters & Publisher Ltd. Mumbai

Name of the Course: Electrical Workshop II	
Course Code: EE/S6/WSII	Semester: SIXTH
Duration: one Semester	Maximum Marks: 50
Teaching Scheme	Examination Scheme
Theory:	Practical : 50 Marks
Tutorial:	
Practical: 3 hrs./week	
Credit: 1 (One)	

Aim:	
Sl. No.	
1.	A technician should carry out routine & preventive maintenance of electrical machines & possesses knowledge of Indian Electricity Act, safety rules, safety of machines & persons, prevention of accident. He/She should also able to repair various appliances.

Objective:	
Sl. No.	
1.	Identify / Locate common troubles in electrical machines & switch gear.
2.	Plan & carry out routine & preventive maintenance.
3.	Ascertain the condition of insulation & varnishing if necessary.
4.	Identify faults & measures to repair faults.

Pre-Requisite:	
Sl. No.	
1.	Knowledge of electrical equipments and accessories.

Contents (Practical)	
Suggested list of Practicals/Exercises:	
Sl. No.	Practicals/Exercises
1.	To Demonstrate various components of D.O.L., Star-Delta and Auto Transformer Starter.
2.	To prepare a report on specifications of earthing at different substations/different locations& new trends in earthing schemes.
3.	To observe & carry out periodic maintenance of D.C & A.C. motor in your workshop or laboratories & prepare its report
4.	To prepare trouble-shooting chart & carry out maintenance of a single and three phase transformers
5.	To prepare trouble-shooting chart & carry out maintenance of single and three phaseinduction motors
6.	To prepare trouble-shooting chart for HV and LV Switch Gear

7.	To carry out filtration of insulating oil and measure Break Down Voltage.
8.	Dismantling, assembly, testing, preparation of list of components, parts for: (any four) D.C. compound motor 3 phase Induction motor. Geyser. UPS / Inverters / battery chargers Microwave Ovens Semi automatic & fully automatic washing machine

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. Continuous Internal Assessment of 25 marks is to be carried out by the teachers throughout the Sixth Semester.

Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.

2. External Assessment of 25 marks shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system.

Distribution of marks: On spot job – 15, Viva-voce – 10.

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Name of the Subject : ELECTRICAL ENGINEERING PROJECTS	
Subject Code: EE/S6/EEP	Semester: Sixth
Duration: one Semester	Maximum Marks:
Teaching Scheme	Examination Scheme
Theory:	Mid Semester Exam.: Marks
Tutorial:	Assignment & Quiz: Marks
Practical: 5 hrs/week	End Semester Exam.: Marks
Credit: 03	Practical : 100 Marks

Aim:

Sl. No.	
1.	This subject is intended to teach students to understand facts, concepts and techniques of electrical equipments, its repairs, fault finding and testing, estimation of cost and procurement of material, fabrication and manufacturing of various items used in electrical field
2.	This will help the students to acquire skills and attitudes so as to discharge the function of supervisor in industry and can start his own small-scale enterprise

Objective:

Sl. No.	
1.	Develop leadership qualities.
2.	Analyze the different types of Case studies.
3.	Develop Innovative ideas.
4.	Develop basic technical Skills by hands on experience.
5.	Write project report.
6.	Develop skills to use latest technology in Electrical field.

Pre-Requisite:

Sl. No.	
1.	Knowledge of subjects up to 5th Semester of Electrical Engineering
2.	

Contents

This subject is the continuation of the part of Industrial Project of subject "INDUSTRIAL PROJECT AND ENTREPRENEURSHIP DEVELOPMENT " studied in 5th Semester. Following activities related to project are required to be dealt with, during this semester.

1 . Each project batch should carry out the actual Project works which have been approved in Fifth Semester.

2.At the end of this semester each project batch should prepare the detailed project report & submit the same to respective guide.

The list of projects are same as in 5th semester which are as follows:			
Group	Projects		
1	(1) Design of Rural Electrification Scheme for small Village, Colony. Energy Conservation and Audit. Substation Model (Scaled) Wind Turbine Model (Scaled) (5) Pole Mounted Substation Model (Scaled) 6) Conduct load survey to ascertain the total load requirements of a locality / polytechnic. Any other items as may be assigned by the teacher concerned.		
2	(1) Rewinding of Three Phase/Single Phase Induction Motor. Rewinding of Single Phase Transformer. Fabrication of Inverter up to 1000 VA. Fabrication of Battery Charger. (5) Fabrication of Small Wind Energy System for Battery Charging. (6) Fabrication of Solar Panel System for Battery Charging. (7) Fabrication of Water level controller. (8)Fabrication of DC motor speed control circuit by SCRs. (9) Microprocessor/ Micro controller Based Projects. Simulation Projects using Matlab. Any other items as may be assigned by the Teacher concerned.		

Continuous Internal Assessment of 50 marks is to be carried out by the teachers throughout the semesters. Distribution of marks: Project Work – 25, Project Report Presentation – 15, Viva-voce – 10.

External assessment of 50 marks shall be held at the end of the Sixth Semester on the entire Project Work. The external examiner is to be from Industry / Engineering College / University / Government Organization. Distribution of marks: Project Work - 25, Project Report Presentation – 15, Viva-voce – 10.

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Name of the Subject: Industrial Management

Syllabus of Industrial Management common as Mechanical Engg

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Name of the subject: INDUSTRIAL AUTOMATION (Elective)	
Subject Code: EE/S6/IA (EL)	Semester: Sixth
Duration: one Semester	Maximum Marks: 150
Teaching Scheme	Examination Scheme
Theory : 3 hrs/week	Mid Semester Exam: 20Marks
Tutorial: - hrs/week	Assignment & Quiz:10 Marks
Practical : 2 hrs/week	End Semester Exam: 70Marks
Credit: 04	Practical : 50Marks

Aim:

Sl. No.	
1.	To explain applications of control systems / Automation
2.	Design & program PLC using Ladder logic.
3.	To study working of control components

Objective:

Sl. No.	Student will be able to
1.	Explain applications of control systems / Automation.
2.	Explain the hydraulic/ pneumatic systems.
3.	Describe & program PLC using Ladder logic.
4.	Describe working of control components.
5.	Draw power & control circuit.

Pre-Requisite:

Sl. No.	
1.	Control system
2.	Basic Electronics
3.	AC, DC motors

	Contents (Theory)	Hrs./Unit
Unit: 1	Automation Need of automation Advantages of automation Requirements of automation	02
Unit: 2	Control System 2.1 Development of block diagram for simple applications likelevel, speed control of motor (Concept only)	02

Unit: 3	Control System Components Contacts-types, current capacity & load utilization categories Solenoids-dc, ac 3.3 I/P devices- switches-push buttons, foot switch, selectorswitch, pilot switch, proximity, photoelectric, temperature actuated, level control, pressure sensing, overload sensing 3.4 O/P devices- contactors, valves, pilot lamps 3.5 Power & control circuit for applications like conveyer belt, induction motors.	05
Unit: 4	Application of Electrical Actuators in control system: Potentiometers in control system. Servomotors-AC & DC with their working principle. Stepper motor-PM & variable reluctance- working principle.	03
Unit: 5	Controllers 5.1 Hydraulic-advantages & disadvantages, hydraulic servomotor,types of pumps used, control valves, components like accumulator, filter, seals Pneumatic-resistance & capacitance of pressure system, pneumatic flapper-nozzle system, pneumatic relays, actuating valves, cylinders, comparison between pneumatic &hydraulic systems 5.3 Digital controllers-brief overview of microprocessor & micro-controller to be worked as controller	07
Unit: 6	Control actions On-Off, P, I, P+I, P+D,P+I+D, actions P+I+D action using hydraulic, pneumatic electronic controller Tuning of P+I+D controller	05
Unit: 7	Programmable Logic Controller 7.1Block diagram of PLC. 7.2 Basic blocks like CPU, I/O modules, bus system, powersupplies & remote I/Os. Programming of PLC 7.3 Development of Ladder logic 7.4 Some simple programs such as I/O connections, starter of IM (DOL, Star-Delta).	06
	Total	30

Contents (Practical)	
Sl. No.	Skills to be developed
1.	Intellectual Skills: a. Logical development b. Programming skills
2.	Motor Skills: a. Interpretation skills b. Connecting properly

List of Practical: (At least Six experiments are to be performed)	
Sl. No.	
1.	To plot the characteristics of potentiometer. Use of potentiometer as error detector.
2.	To plot V-I characteristics of DC & AC servomotors. compare them with DC & AC motor characteristics.
3.	To plot the characteristics of synchro transmitter. Use of synchro transmitter- control transformer pair as error detector.
4.	To measure step angle of a stepper motor in forward & reverse direction.
5.	Observe various components /parts/symbols/connections of a PLC.
6.	To perform Forward and Reverse operation of 3 phase Induction Motor using PLC.
7.	To perform stepper motor/ temperature control using PLC.
8.	To Identify the parts of hydraulic/ pneumatic servomotor from cut-section/model.
9.	To build P, I, PI, PD & PID controller using op-amps & R-C circuits. Plot V-I characteristics.

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Nagrath Gopal	Control System Engg.		Wiley Eastern
K.Ogata	Modern Control Engg.		Prentice Hall
Jacob	Industrial Control Engg		Prentice Hall
Andrew Parr	Hydraulics & Pneumatics		Jaico Publication
Webb & Reis	Programmable Logic Controller: Principle applications		Wiley Eastern
S.K. BhattachryaBrijinder Singh	Control of Electrical Machines		New Age International Publishers
Jon stenerson	Industrial automation and processcontrol		Prentice Hall
Richad Shell	Handbook of Industrial automation		Taylor and Francis

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. Continuous Internal Assessment of 25 marks is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.**

2. External Assessment of 25 marks shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the subject : Control of Electrical Machines (Elective)	
Subject Code : EE/S6/CEM(EL)	**Semester : Sixth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit: 04	

Aim:

Sl. No.	
1.	This subject is the combination of Electrical machine and Control system. Most of the motor control circuits are based on these systems.
2.	Understanding of the subject will provide skill to the students of different motor controlsystems and their applications in industry.

Objective:

Sl. No.	Student will be able to:
1.	Interpret the basics of the motor control systems.
2.	Demonstrate the solid state control of motor.
3.	Describe the implementation of PLC in control systems.

Pre-Requisite:

1.	Knowledge of Electrical machine.
2.	Knowledge of Control system.

	Contents (Theory):	Hrs./Unit
Unit : 1	**Control Systems :** Concept of Automatic control system Basic elements of a servo mechanism Concept of solid state control with example	**03**
Unit : 2	**Magnetic Control Systems:** 2.1 Operation & Applications of Contactor control circuitcomponents – (i) Switches – Push button type, Selector type, Limit switch,Pressure, Float type, Proximity, Thermostat (Temperature) Electromagnetic Contactor. (ii) Overload relays – Voltage operated, Current operated,Thermal overload relay, Magnetic overload relay, Time delay relays (OFF delay, ON delay). Timer – Pneumatic type, Electronic type.	**7**

	(viii) Relays –Frequency response relay, Latching relay, Phasefailure relay (single phase preventer), Solid state relay. Solenoid valve.	
Unit : 3	**MAGNETIC CONTROL OF DC MOTOR:** Operation of Control circuit & Power circuits of - Jogging operation of DC motor in one and two directions. (ii) Starters of DC motor - Current limit acceleration starter, Seriesrelay & Counter emf starter, Definite time acceleration starter. (iii) Braking of DC motor - Dynamic braking, Reversing &plugging. (iv) Protection of DC motor - Field failure protection circuit, Field acceleration protection circuit, Field deceleration circuit.	**6**
Unit : 4	**MAGNETIC CONTROL OF AC MOTOR:** Operation of Control circuit & Power circuits of - (i) Reversing the direction of rotation of induction motor withInterlocking systems Simple ON-OFF motor control circuit, Automatic Sequential control of motor. Automatic Star-Delta starter. Starter for multispeed operation of motor. Plugging & Dynamic braking of AC motor. (vii) Protection of AC motor – Overload, Short circuit and Over temperature protection of high rating motors. **4.2 Solid State Control of AC Motor:** (i) Speed control of single-phase induction motor usingthyristor. (II) Speed control of universal motor.	**6**
Unit : 5	**Use of Programmable Logic Control (PLC):** 5.1 Introduction & Advantages of PLC. 5.2 Function of each part of PLC. 5.2.1Hardware of PLC. 5.3 Concept of Ladder diagram in PLC programming. 5.4 Ladder logic diagram for – DOL starter of Induction motor, Automatic Star-Delta starter of Induction motor, 5.5 Sequential operation of three motors with a time gap. 5.6 Concept of PID control using PLC	**8**
	.	
	Total	**30**
Practical:		
Skills to be developed:		

Intellectual Skills:
1. To select appropriate component and equipment.
2. Apply different designing skills.
Motor Skills:
1. Ability to draw the control & power circuit diagrams.
2. Ability to interpret the circuits and waveforms.
List of Practical: (At least Six experiments are to be performed)
1. To study control components - Electromagnetic contactor, Thermal overload relay, Timer (OFF delay, On delay), Push button Switches, Solenoid valve, MCB.
2. To make & test the control and power circuit for Jogging operation, forward & reverse rotation of Sq.cage induction motor using contactor control.
3. To make & test the control and power circuit for fully-automatic star-delta starter operation of cage induction motor using contactor control.
4. To make & test the control circuit for dynamic braking operation of induction motor using contactor control.
5. To make & test the working of single phase preventer using contactor control.
6. To control speed of DC shunt motor using SCR drive.
7. To make & test the control circuit operation of DOL starter of induction motor using PLC.
8. To make & test the control circuit operation of automatic star-delta starter of induction motor usingPLC.
9. To study the Speed control of DC shunt motor with PID control using PLC.
10. To make & test the control circuit operation of three sequential motor operations using PLC.

List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	S.K.Bhattacharya	Industrial Electronics and Control	M.H.
2.	Dr. S.K.Sen	Electrical Machine	Khanna Publisher
3.	V. Subrahmanyam	Electric Drives – concepts & applications	M.Hill
4	Petruzella	Programmable Logic Controller	M.Hill

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the subject : Process Control & Instrumentation (Elective)	
Subject Code : EE/S6/PC(EL)	**Semester : Sixth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit: 04	

Aim:

Sl. No.	
1.	This subject is the combination of control system and instrumentation. Most of the subjectsof Electrical Engineering are based on these systems.
2.	Understanding of the subject will provide skill to the students of different process control systems and their use in industry.

Objective:

Sl. No.	Student will be able to:
1.	Know about the basics of the process control systems.
2.	Know about the digital Data Acquisition System.
3.	Learn about the use of PLC in control systems.
4.	Know about the digital Data Transmission Systems.

Pre-Requisite:

1.	Knowledge of control system.
2.	Knowledge of Instrumentation.

	Contents (Theory):	Hrs./Unit
Unit : 1	**Process Control System:** 1.1 Introduction to the terminology of process control system – Balanced condition, Self-regulation, Process disturbance, Process time lag, Process reaction curve. 1.2 Block diagram of a process control system. 1.3 Realization of control actions using P, PI, PD, PID controller. 1.4 Concept of Feedback and feed forwards control systems, Ratio control, Cascade control	**5**
Unit : 2	**Measurement of Non Electrical Quantity:** Basic requirements of a transducer. Measurement of Pressure: Manometer, Bellows, Bourdon tube, Capacitance typedifferential pressure transducer. Measurement of Temperature: Resistance temperature detector, Thermocouple, Pyrometer. Measurement of Flow: Rotameter, Electromagnetic flow meter, Hot wire anemometer.	**5**

	Measurement of liquid level. Measurement of Humidity - Hygrometer.	
Unit : 3	**Data Acquisition System:** Basic components of Data Acquisition System. Components of a PC-based Data Acquisition System. Analog input & output subsystem. Digital input & output subsystem. Single channel data acquisition system. (Concept only) Multi-channel data acquisition system.(concept only) Concept of Distributed Control System (DCS, DDC)	**5**
Unit : 4	**Data Transmission Element / Telemetry:** 4.1 Land line telemetry 4.2 Voltage and current telemetering, two wire current transmitter. 4.3 Time division multiplexing, synchronousand asynchronous communication. RF telemetry. Modulation methods – Amplitude modulation, Frequency modulation.	**05**
Unit : 5	**Spectrum Analyzer:** Basic principle. Block diagram. Low cost Spectrum Analyser. Experiments with low-cost components (Concept only). Concept of spectrum analysis software.	**05**
Unit : 6	**6. Use of Programmable Logic Control (PLC) in process control:** 6.1 Introduction & Advantages of PLC. 6.2 Function of each part of PLC. 6.3 Hardware of PLC. 6.4 PLC operation & Program execution. 6.5 Application of PLC in process control – Pressure, Temperature, Liquid level control.	**05**
	Total	**30**

Practical:
Skills to be developed:
Intellectual Skills:
1. To select appropriate equipment.
2. Apply different designing skills.
Motor Skills:
1. Ability to draw the circuit diagrams.
2. Ability to interpret the circuits and waveforms.

List of Practical: (At least Six Experiments are to be performed)

1. To study of a bourdon tube, manometer and bimetallic transducer.
2. To measure fluid pressure using manometer.
3. To monitor and control of temperature using bimetal.
4. To study of different telemetering systems with the help of slide / model.
5. To study of AM, FM, PWM using trainer kit.
6. To study of a temperature controller and its application in temperature control circuit.
7. To study a typical pneumatic control system.
8. To study of Data Acquisition System using slide.
9. To study distributed digital control using 8085 microprocessor / microcontroller.
10. To make and execute circuit of any process control system using PLC programming.
11. To apply PID controller in a process control system and observe the output with variation of inputusing MATLAB software.
12. Visit to a nearby Process Control Industry and study the control process with its allied components.

List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	Eckman	Automatic Process Control	Wiley Eastern
2.	D. Patranabis	Principle of Process Control	T.M.H.
3.	Purkait	Electrical & Electronics Measurements& Instrumentation	T.M.H.
4.	Curtis Johnson Ltd.	Process Control Instrumentation	P.H.I. Ltd.
5.	Petruzella	Programmable Logic Controller	T.M.Hill

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Subject: Computer Hardware and Networking (Elective)			
Subject Code: EE/S6/CHN (EL)		**Semester: SIXTH**	
Duration: one Semester		**Maximum Marks:**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 Hrs/Week		Mid Semester Exam.:	20 Marks
Tutorial:		Assignment & Quiz:	1 0 Marks
Practical: 2 Hrs/Week		End Semester Exam.:	70 Marks
Credit: 04		Practical : 50	Marks

Aim:	
SI. No.	
1.	To Identify various components of PC
2.	To study construction, working and function of different peripheral devices.
3.	To study Networking basic and know how to set up Local Area Network

Objective:	
SI. No.	
1.	• Identify various components of PC.
2.	• Describe the construction, working and function of different peripheral devices.
3.	• Read and interpret documentation.
4.	• Assemble the PC and connect the modules.
5.	• Install system software, application software and drivers.
6.	• Set up Local Area Network.

Pre-Requisite:	
SI. No.	
1.	Digital Electronics
2.	

	Contents (Theory)	Hrs./Unit
Unit: 1	**Introduction** PC system units - Front Panel / Rear side connectors, switches and indicators -specification parameters - Lap top PCs.	02
Unit: 2	**Inside PC** 2.1 Inside PC - functional blocks of mother board - CPU, RAM, BIOS, Cache RAM, BUS extension slots, on-board I/O and IDE connectors PCI, AGP & PCI express. 2.2 BIOS, services, organization and interaction. 2.3 CMOS, CMOS setup utilities, CMOS setup program. 2.4 Motherboard types. 2.5 Processors - CISC and RISC. 2.6 Power supplies -SMPS for Computers, Power requirements in PCs.	10

Unit: 3	**On board memory, I/O interface and storage device 3.1 PC's memory organization** **3.2 ROM, RAM, distinguish between static and dynamic RAM** **3.3 Hard disk drives : Functional block diagram** **3.4 CD-ROM drive - Principle of operation, block diagram.**	**03**
Unit: 4	**Input and Output Devices** **eyboard - types, operation, and keyboard signals, interface logic, keyboard functions.** **4.2 Mouse - principle of operation, mouse signals, optical mouse, mouse installation.** **4.3 Digital display technology (thin displays) - Liquid crystal displays, TFT monitors.** **4.4 Dot matrix printer - principle of operation. 4.5 LASER printer - principle of operation** **4.6 Ink-jet printer- principle of operation,**	**05**
Unit: 5	**Computer Network Basics:** **Introduction - OSI layer model - Function of each layer network types - LAN- WAN- MAN - internet - intranet - extranet.** **TCP/IP: Introduction, Function of each layer of TCP/IP, Comparison of OSI and TCP/IP.** **IP Addressing, IP address classes**	**6**
Unit: 6	**Network Media & Hardware** **Twisted wire - Coaxial cable - fiber optic cable.** **Local Area Network:** **Introduction to LANs,** Features of LANs, Components of LANs, Usage **of LANs, LAN topologies - star - ring - mesh – bus.**	**4**
	Total	**30**

Contents (Practical)

SI. No.	Skills to be developed
1.	**Intellectual Skills: i) Identify various components of Computer** **Able to prepare a block diagram to correlate all the components based on their functions**
2.	**Motor Skills: i) Able to use the various tools efficiently** **ii) Able to set Local Area Network.**

List of Laboratory Experiments:	
SI. No.	Laboratory Experiments (Any Six)
1.	Connecting & disconnecting computer peripherals and components & driver installation (For example Printer/Modem/DVD/Scanner etc.)
2.	To carry out Hard disk partitioning and formatting.
3.	To install operating System like Windows 7 / Linux (Ubuntu)
4.	To change the Standard settings and advanced settings (BIOS and Chipset features) of CMOS set up Program.
5.	To install the Network Interface Card and Familiarize with 0 Networking cables (CATS, UTP) o Connectors (RJ45, T-connector) o Hubs, Switches
6.	To carry out Straight Through and Cross Over Cable connection with RJ 45 and CAT 5 cable
7.	To set up a Local area Network with 5 nos. of computers.
8.	To share Printer, Folder and Drives.

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Vikas Gupta	Hardware and Networking Course Kit		Dream tech Press
Steve Rackley	Networking in easy steps		Dream tech Press
Behrouz A. Forouzen	Data communication and Networking		Tata Mc. Graw-Hill Publishing Co. Ltd.
D Bala Subramanian	Computer Installation and Servicing		TMH, New Delhi
Mike Meyers, scott Jernigan	Managing and troubleshooting P Cs		TMH, New Delhi
Bhushan Trivedi	Computer Network		Oxford University Press

Name of the Subject: Professional Practices IV			
Subject Code: EE/S6/PFIV		Semester: Sixth	
Duration: one Semester		Maximum Marks: 50	
Teaching Scheme		Examination Scheme	
Theory:		Mid Semester Exam.:	Marks
Tutorial:		Assignment & Quiz:	Marks
Practical: 4 hrs / week		End Semester Exam.:	Marks
		Practical : 50	Marks
Credit: 2			
Aim:			
Sl. No.			
1.	To acquire information from different sources		
2.	To present a given topic in a seminar, discuss in a group discussion		
3	To prepare report on industrial visit, expert lecture.		
Objective:			
Sl. No.	The student will be able to		
1.	Acquire information from different sources		
2.	Prepare notes for given topic		
3.	Present given topic in a seminar		
4	Interact with peers to share thoughts		
5	Prepare a report on industrial visit, expert lecture		
Pre-Requisite:			
Sl. No.			
1.	Knowledge of studying 5 semesters in Diploma Engineering		

Activities

Sr . No.	Activities	Hours
1.	Industrial / Field Visit : Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to <u>any ONE</u> from the list below (<u>should not have completed in earlier semester</u>): Multistoried building for power distribution Any industry with process control and automation District Industries Centre (to know administrative set up, activities,various schemes etc) Railway / metro railway signaling system Motor rewinding in a motor rewinding shop Visit warehouse / Rail yard / port and observe Material Handling Management & documentation.	09

	A thermal / Hydel power generating station A Wind mill and / or Hybrid power station of wind and solar An electrical substation A switchgear manufacturing / repair industry Protection system in a large industry. xii) Visit to maintenance dept of a large industry.xiii)A large industry to study protection system Industry of power electronics devices Transmission tower project area Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. A large industry to study protection system xviii) Industry of power electronics devicesxix)Transmission tower project area xx) Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. xix) Any other technical field area as may be found suitable alternative to above list.	
2.	Guest Lecture by professional / industrial expert: The guest lecture (s) any three of two hours duration each from the field /industry experts, professionals or from experienced faculty members(from own department or other departments) will be encouraged) are to be arranged from the following or alike topics. A brief report to be submitted on the guest lecture by each student as a part of term work. <u>Group A (at least one)</u> i) Career opportunities for diploma engineersii)Industrial Dispute and Labour Laws Challenges in industrial working environment for diploma engineers Scope for diploma electrical engineers Working in shop floor. Opportunities in the service sector vii) Any other topic of relevance as may be deemed fit for fresh engineers as he starts his career in industry. <u>Group B (at least one)</u> Eco friendly air conditioning / refrigeration. ii) Modern trends in AC machineiii)Testing of switchgear iv)Biomedical instruments – working, calibration etc.v)Automobile pollution, norms of pollution control. vi)nanotechnology Modern techniques in Power Generation viii) New trends in power electronics devicesix)TQM	06

	x)Recent modification in IE rules xi)standardization / ISO certification xii)Role of micro, small and medium enterprise. In Indian economy. xiii)Entrepreneurship development and opportunities Interview techniques xv) Any topic that could not be covered in earlier semesters and having relevance to technical knowledge gathered in all semesters.	
3.	Information search Information search can be done through manufacturers, catalogue, internet, magazines, books etc. and a report need to be submitted. Can be done in a group of 2/3 students Topic suggested (any two)Teachers may assign work on any other cross disciplinary subjects for enrichment of knowledge outside course work of Electrical discipline) Blue tooth technology Artificial technology Data warehousing Cryptography Digital signal processing Bio-informatics Magnetic levitation system Recent development in electrically operated vehicles formass transport 9. Comparative study of metro railway in Kolkata and Delhi 10.Alternative fuel and energy options Comparison of transformer companies 12. Latest trends in classification of insulating materials 13.Design consideration for dry type transformers 14.State and national statistics of power generation Market survey of contactors, relays and their comparative analysis. Market survey of any other electrical product which must include among other things various manufacturers, cost, specification, application areas etc.	05
4.	Group Discussion The students should discuss in a group of six to eight students. Each group to perform <u>any TWO</u> group discussions. Topics and time duration of the group discussion to be decided by concerned teacher. Concerned teacher may modulate the discussion so as to make the discussion a fruitful one. At	10

	the end of each discussion each group will write a brief report on the topicas discussed in the group discussion. Some of the suggested topics are – i) Scope of outsourcing of electrical Engineering services.ii)Pollution Control Rain water harvesting Trends in energy conservation Safety in day to day life vi) Use of plastic carry bag (social & domestic Hazard)vii)Pollution control viii) Any other common topic related to electrical field as directed by concerned teacher.	
5.	Seminar / Poster presentation: Students should select a topic for seminar based on recent development in Electrical Engineering fields, emerging technology etc. Concerned Teachers will guide students in selecting topic.	10

EXAMINATION SCHEME (SESSIONAL)

Continuous internal assessment of 50 marks is to be carried out by the teachers throughout the sixth semester. **Distribution of marks: Information search = 10, seminar = 10, Group discussion = 5, field visit = 10, guest lecture attendance and report = 15**

Name of the Subject: General Viva Voce	
Subject Code: EE/S6/GVV	Semester: SIXTH
Duration: one Semester	Maximum Marks:
Teaching Scheme	Examination Scheme
Theory:	Mid Semester Exam.:
Tutorial:	Assignment & Quiz:
Practical:	End Semester Exam.:
Credit: 02	Practical : 100 Marks

Aim:

Sl. No.	
1.	It is required to revisit the contents of the departmental subjects learnt by the students up to sixth semester.
2.	As a diploma holder of Electrical Engineering, students should be able to co relate the various ideas and concepts learnt from various subjects throughout the course duration.
3.	Student should equip themselves to face various types of technical questions during various competitive examinations/ Interview Board.

Contents (Theory)

The syllabi of all the theoretical and sessional subjects taught in the three years of diploma education

E X A M I N A T I O N S C H E M E (SESSIONAL)

The Final Viva-Voce Examination shall take place at the end of Sixth Semester. It is to be taken byFaculty members of the Institute concerned.