

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**DIPLOMA IN ELECTRICAL ENGINEERING**  
**TEACHING SCHEME (w.e.f. 18<sup>th</sup> July '2011 )**

**SEMESTER- V**

SR. NO	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	2350901	Electrical Installation & Maintenance	4	0	2	6
2	2350903	Electrical Wiring, Estimation, Costing & Contracting	4	2	2	8
3	2350904	Digital Electronic & Digital Instrument	4	0	2	6
4		Elective	4	0	2	6
5	2350906	Project - I	0	0	4	4
		<b>Total</b>	<b>16</b>	<b>2</b>	<b>12</b>	<b>30</b>

Select **ANY ONE** from the following Elective subjects

SR. NO	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	TUTORIAL
1	2350902	Industrial Electronics	4	0	2	6
2	2350905	Energy Conservation Techniques	4	0	2	6

**GUJARAT TECHNOLOGICAL  
UNIVERSITY  
DIPLOMA IN ELECTRICAL ENGINEERING  
Semester – V**

Subject Code : **2350901**

Subject Name : **Electrical Installation & Maintenance**

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
1.	<b>Commissioning and Testing:</b> 1.1 Standard procedure for commissioning of various static/ rotating electrical machines/equipment and power installation. 1.2 Oil sampling, testing & filtering. 1.3 Polarization index, Drying out procedure of transformer, winding etc. 1.4 Measurement of Insulation Resistance (I.R.). 1.5 Check before commissioning such as Mechanical & Electrical checks as per I.S. 1.6 Safety rules and regulations to be observed. 1.7 Technical reports to be prepared. 1.8 Different types of electrical and mechanical tests. 1.9 Insulation resistance test. 1.10 Classification of insulating materials	12
2.	<b>Installation:</b> 2.1 Standard procedure for installation of various electrical machines 2.2 Inspection on arrival and before installation. 2.3 Foundation preparation for installation. 2.4. Tools / instruments required for installation 2.5. Safety precautions to be observed 2.6. Installation procedure for electrical machine/ equipment. 2.7 Preparation of technical report & specification sheet.	6

3.	<b>Maintenance of Electrical Machine/Equipment:</b> 3.1 Basic need of maintenance. 3.2 Meaning, Importance and advantages of preventive maintenance of preventive maintenance. 3.3 Maintenance schedules of different types of electrical machines (Rotating and static) and equipment, transmission line, circuit breakers and cables 3.4 Break down maintenance and its record keeping. 3.5 Safety rules applicable for preventive maintenance and breakdown maintenance.	8
4.	<b>Installation &amp; Maintenance of Domestic Appliances:</b> 4.1 Common faults in domestic appliances. 4.2 Installation procedure for domestic appliances 4.3 Maintenance procedure for domestic appliances. 4.4 Tools/equipments required for maintenance of domestic appliances. 4.5 Safety rules observed during maintenance of domestic appliances.	8
5.	<b>Trouble Shooting:</b> 5.1 Definition of trouble shooting. 5.2 Causes of faults and types of faults. 5.3 Common faults in domestic appliances and electrical machine/ equipment. 5.4 Common faults in electrical installation and cable. 5.5 Location of faults in above machines and equipments 5.5 Trouble shooting charts for above electrical equipment and machines. 5.6 Tools and equipment used in trouble shooting and repairs. 5.7 Servicing procedure for electrical equipment and list of the servicing materials 5.8 Testing of equipment after repairs and servicing	8
6.	<b>Earthing:</b> 6.1 Necessity of earthing. 6.2 System earthing. 6.3 Equipment earthing. 6.4 Methods of earthing 6.5 Earth electrodes, Earth bus & Earth wire. 6.6 Measurement of earth resistance. 6.7 Values of earthing resistance of different equipment/ installation. 6.8 Reduction of earth resistance. 6.9 Earthing procedure of the following, <ul style="list-style-type: none"> <li>- Installations in building</li> <li>- Domestic fitting &amp; appliances</li> <li>- Industrial premises.</li> <li>- Substation &amp; Generating station.</li> <li>- Overhead power lines.</li> </ul>	8
7.	<b>Electrical Accidents and Safety:</b> 7.1 Types and causes of electrical accidents. 7.2 Factors affecting severity of electric shock.	6

	7.3 Preventive measures against electrical accident. 7.4 General and specific safety rules to avoid electrical accident as per I.E. acts. 7.5 Importance of "permit to work" in power station. 7.6 Safety tools and devices with their applications like Slogan, Board, Notice, Fire extinguisher.	
	<b>Total</b>	56

### **Laboratory Experiences:**

1. Prepare test report of an electrical machine after commissioning.
2. Prepare complete layout of wiring for installation of given machine with specifications.
3. Measure earth resistance of installation in building/domestic fitting & appliances etc.
4. Measure Insulation Resistance of a winding/ cables/ wiring installation and write the procedure.
5. Perform various tests applied to an insulating oil.
6. Prepare plate/ pipe earthings as per I.S. and measure the earth resistance.
7. Trouble shooting of an induction motor.
8. Dismantle and trouble shoot of ceiling fan.
9. Use of following
  - (a) Bearing puller tools
  - (b) Filler gauge
  - (c) Different types of spanners
  - (d) Cork screw driver
10. Use of following instruments
  - (a) Megger
  - (b) Clip on meter
  - (c) Earth tester
  - (d) Phase sequence indicator
  - (e) Growler
11. Read and interpret I.E. rules pertaining to safety.

### **References Books:-**

- 1 Commissioning of Electrical Machines & Equipment by S Rao
- 2 Commissioning of electrical machines by Richardsson
- 3 Relavent IS Code for--Maintenance of Transformer, Induction motors, switchgears, insulating oil
- 4 Electrical measurement, instrument & instrumentation by A K Sawhney
- 5 Electrical Estimating & costing by Dr. S L uppal

**GUJARAT TECHNOLOGICAL  
UNIVERSITY  
DIPLOMA IN ELECTRICAL ENGINEERING  
Semester – V**

Subject Code : **2350902**

Subject Name : **Industrial Electronics**

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
1.	<b>Polyphase Rectifier and Controlled Rectifier:</b> 1.1 Advantages and applications of polyphase rectifiers. 1.2 Three phase half wave rectifier. 1.3 Three phase full wave or bridge rectifier. 1.4 Six phase half wave rectifier. 1.5 Effect of transformer reactance. 1.6 Construction and characteristics of SCR, UJT, DIAC, TRIAC 1.7 Single phase half wave and full wave controlled rectifiers using SCR, UJT & phase shift circuits. 1.8 Construction and use of pulse transformer. 1.9 Understand principle of A.C. load control.	10
2.	<b>Speed Control of D.C. Motor:</b> 2.1 Speed control of D. C. motors using SCR, UJT & RC phase shift control. 2.2 Speed control of D.C. motors using techogenerator. 2.3 Need of armature voltage regulators & O.L. protection. 2.4 Speed control of small single phase A.C. motors	8
3.	<b>Invertors for Ac Motor Control:</b> 3.1 Commutation circuits to turn off SCRs. (a)Current commutation. (b)Voltage commutation. (c)Complementary commutation. (d)Line commutation. 3.2 Single phase series and parallel invertors. 3.3 Three phase series and bridge voltage invertors. 3.4 Pulse width modulation system, its advantages and disadvantages. 3.5 Transistorised PWM invertors & MOSFET invertors. 3.6 Current source invertors 3.7 New devices in power electronics. (a) I G B T (b) M C T	8

	3.8 Lift control, compute $V_{dc}$ , $I_{dc}$ , Efficiency, ripple factor, P.I.V. etc.	
4.	<b>Use of Choppers for Speed Control of Motor:</b> 4.1 Class A Chopper. 4.2 Class B Chopper. 4.3 John's Chopper. 4.4 Chopper for speed control of slipring motor.	6
5.	<b>High Frequency Applications:</b> 5.1 High frequency induction heating. 5.2 High frequency dielectric heating. 5.3 X-Ray tubes, its properties and applications. 5.4 Ultrasonic waves, its properties and applications. 5.5 LASER and microwave and its applications.	7
6.	<b>Resistance Welding Control:</b> 6.1 A.C. / D.C. timers using solid state devices. 6.2 Synchronous and non synchronous timers, Sequence timer 6.3 Duty cycle of welding process. 6.4 Electronic welding controls 6.5 SCR as electronic contactor in welding 6.6 Heat control 6.7 Energy storage welding 6.8 Poly phase welding 6.9 Sequence timer using IC	6
7.	<b>Industrial Applications of Photo-Electric Devices:</b> 7.1 Photo electricity and photo devices. 7.2 Photo relays 7.3 Smoke detector. 7.4 Twilight relay (switch). 7.5 Flame failure relays. 7.6 Temperature control of furnace. 7.7 Level indicator.	6
8.	<b>Power Supplies:</b> 8.1 Uninterrupted Power Supplies. (UPS) 8.2 Switching Mode Power Supplies ( SMPS ) 8.3 Constant Voltage Transformers (CVT) 8.4 Servo Voltage Stabilizer.	5
	<b>Total</b>	56

### **Laboratory Experiences:**

1. Establish the relationship between A.C. and D.C. voltage and calculate efficiency, voltage ratio and ripple factor.
2. Control the single phase controlled rectifier using R-C phase shift net work.
3. Control the single phase rectifier using SCR fired by UJT.
4. Control speed of single phase A.C. motor using SCR and UJT.
5. Control the speed of three phase Induction motor using solid state devices.
6. Control the speed of fan using DIAC and TRIAC.
7. Design and operate the Chopper circuit with load.
8. Operate high frequency, induction and dielectric unit and measure voltage and Current (demonstrate).
9. Operate photo electric relay using twilight switch.
10. Design and operate smoke detector circuit.
11. Operate SMPS/CVT and obtain its characteristic.
12. Demonstration of A C voltage stabilizer.

### **Reference Books:**

1. Industrial electronic circuits, John E. Ryder.
2. Electronic in Industry, Chute & Chute.
3. Theory and applications of Industrial electronics, Cage.
4. Industrial Electronic circuits and applications - Benedict & Verner.
5. Thyristor, R. K. Sughandhi S.K. Sughandhi.
6. Industrial electronic. G. K. Mittal.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ELECTRICAL ENGINEERING

### Semester – V

Subject Code : 2350903

Subject Name : **Electrical Wiring, Estimation, Costing & Contracting**

Sr. No.	Subject Content	Hrs.
1.	<b>Electrical Wiring:</b> 1.1 Types of wires. 1.2 Different types of wiring system and wiring procedure. 1.3 Merits, demerits and comparison of different types of wiring. 1.4 Different types and specifications of wiring materials, Accessories and wiring tools. 1.5 Domestic and industrial panel wiring. 1.6 I.E. rules for wiring, including Electricity supply act-1948. 1.7 Different types of wiring circuits.	6
2.	<b>Elements of Estimating:</b> 2.1 Definition of “Estimation”. 2.2 Types of estimation and estimation tools. 2.3 Overhead and service charges. 2.4 Purchase procedure.	6
3.	<b>Estimating and Costing of Domestic and Industrial Wiring:</b> 3.1 Layout and wiring diagram for residential building and industrial wiring. 3.2 Selection of number of circuit for project as per IE rules. 3.3 Estimation for residential wiring and industrial wiring. 3.4 I.E. rules observed for above wiring.	8
4.	<b>Estimating and Costing of Service Connection (Domestic and Industrial):</b> 4.1 Survey work for domestic and industrial service connection. 4.2 Lay out/ wiring diagram of service connection (given project work). 4.3 List of materials and accessories along with specifications required for given project work. 4.4 Estimation of service connection for domestic and industrial (1-phase and 3-phase) service connections. 4.5 I.E. rules pertaining to above wiring.	7



5.	<b>Estimation of Overhead and Underground Distribution System:</b> 5.1 Survey work for estimation of overhead and underground distribution system. 5.2 Planning and layout of project. 5.3 List of materials and accessories required for the given project. 5.4 Procedure for preparing estimate for 440 V, 3-phase, 4 wire or 3 wire overhead and underground distribution system. 5.5 Necessary drawing/ sketches of overhead and underground service connection. 5.6 I.E. rules pertaining to above project.	8
6.	<b>Estimating and Costing of Electrical Product:</b> 6.1 Market survey for cost of given product like D.O.L. starter, small motor, mono block pump, automatic electric iron, table/ceiling fan, ICDP/ICTP switch, etc. 6.2 Preparation of detailed drawing work of the product. 6.3 Preparation of material quantity sheet for the product. 6.4 Market survey for availability of required materials, their cost and other requirements. 6.5 Preparation of cost schedule of product. 6.6 Find out cost of product considering material cost, labour cost and overhead Charges. 6.7 Validation of cost schedule. 6.8 Financial arrangement for the product.	7
7.	<b>Estimating and Costing of Repairs and Maintenance of Electrical Devices and Equipment:</b> 7.1 Location of fault. 7.2 Materials required and their cost for remedial measure of fault. 7.3 Estimation of repairing cost. 7.4 Estimation of maintenance, servicing and testing cost including labour cost (Service charge). 7.5 Tools used for repairs & maintenance work. 7.6 Detailed estimation and preparation of cost schedule for repair and maintenance of electric fan, automatic electric iron, single phase transformer, mixer grinder, D.O.L. Starter, etc.	7
8.	<b>Principles of Contracting:</b> 8.1 Terms, conditions, and types of contract system. 8.2 Tender, tendering procedure and preparation of simple tender. 8.3 Terms and conditions of tender, procedure for inviting and scrutinizing of tender. 8.4 Importance of Earnest Money Deposit, Security Deposit and S.O.R.	7
	<b>Total</b>	56

## **Laboratory Experiences:**

1. Carryout following wirings
  - a. Tube light wiring
  - b. Stair case wiring
  - c. Godown wiring
  - d. Parallel loop wiring
2. Select appropriate wiring and list materials and accessories for given project.
3. Estimating and costing of a domestic installation cost (Residential building, laboratory room or Drawing hall etc) with concept of illumination design.
4. Estimating and costing of industrial installation. (work shop, agriculture, flour mill etc)
5. Estimating and costing of overhead service connection. (single phase and three phase).
6. Estimating and costing of underground service connection (single phase and three phase).
7. Estimating and costing of overhead, 440 V, 3-phase ,4 wire or 3 wire distribution line.
8. Estimating and costing of underground, distribution line.
9. Estimating and costing of any one Electrical Product.
10. Estimating and costing of repairs and maintenance of any one domestic appliance.
11. Prepare a tender notice for given project work.

## **Tutorial Work:**

1. Select appropriate wiring, list materials and accessories for given drawing or a room, residence, workshop, etc. and prepare wiring diagram.
2. Give the case study for Estimation and costing of a domestic installation cost with concept of illumination design.
3. Give the case study for Estimation and costing of industrial installation. (work shop)
4. Give the case study for Estimating and costing of overhead service connection. (single phase and three phase).
5. Give the case study for Estimating and costing of underground service connection (single phase and three phase).
6. Give the case study for Estimating and costing of overhead, 440 V, 3-phase, 4 wire or 3 wire distribution line.
7. Give the case study for Estimating and costing of underground, distribution line.
8. Give the case study for Estimating and costing of any one Electrical Product.
9. Give the case study for Estimating and costing of repairs and maintenance of any one domestic appliance.

## **REFERENCES BOOKS:-**

- 1 Electrical Estimating & costing by Dr. S L uppal
- 2 Relavent IS Code for-service line connection,laying of cable,wiring installation
- 3 National Building Code- Vol. IV

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ELECTRICAL ENGINEERING

### Semester – V

Subject Code : 2350904

Subject Name : Digital Electronics & Digital Instrument

Sr. No.	Subject Content	Hrs.
1.	<b>Number System and Codes:</b> 1.1 Types of number system. 1.2 Conversion of number system from one to another. 1.3 Basic mathematical operations. 1.4 Binary addition, subtraction, multiplication and division.	7
2.	<b>Switching Systems and Codes:</b> 2.1 Diode and transistor as a switch. 2.2 Diode as a clipper circuit with input and output waveforms.	6
3.	<b>Boolean Algebra:</b> 3.1 Positive logic and negative logic. 3.2 Laws and theorems of Boolean algebra. 3.3 Demorgan's 1st and 2nd theorems. 3.4 Commutative law, associate law and distributive law.	7
4.	<b>Logic Gates:</b> 4.1 Logic families and circuits. 4.2 RTL, DTL, TTL, ECL logic. 4.3 MOS, PMOS, NMOS, CMOS logic circuits. 4.4 Different types of logic gates, symbol and truth table. 4.5 Combinational logic. 4.6 Arithmetic circuit.	7
5.	<b>Flip-Flop and Counters:</b> 5.1 Flip-flop circuits R-S, T, D, J-K and master slave J-K. 5.2 Shift register. 5.3 Asynchronous and synchronous counter using 7493 and 7490. 5.4 Up-down counter. 5.5 Encoder and decoder. 5.6 Semiconductor memory ROM, PROM, E-PROM.	8
6.	<b>Digital Display Devices:</b> 6.1 Digital LED display devices. 6.2 Alpha numerical display devices 14 segment and dot matrix. 6.3 Digital LCD display. 6.4 BCD to seven segment decoder.	6

7.	<b>A to D and D to A Converters:</b> 7.1 Digital to analog conversion. 7.2 Analog to digital conversion.	7
8.	<b>Digital Instruments:</b> 8.1 Comparison of digital instrument with analog instrument. 8.2 Digital volt-meter. 8.3 RAMP type integrating, and stair case type. 8.4 Successive approximation type DVM. 8.5 Phase meter. 8.6 Functional block diagram of Digital frequency meter. 8.7 Digital multi meter with Functional block diagram. 8.8 Digital energy meter with Functional block diagram. 8.9 Digital watt meter with Functional block diagram.	8
	<b>Total</b>	<b>56</b>

### **Laboratory Experiences:**

1. Study of R.C. differentiating circuit.
2. Study of R.C. integrating circuit.
3. Testing the given combinational logic and preparing truth table.
4. Half addition and full addition.
5. Half subtraction and full subtraction.
6. Verify the Demorgan's theorem.
7. Verify NAND and NOR as universal gates.
8. Building and testing R-S and D flip-flops.
9. Building and testing J-K master and slave flip-flops.
10. Operation of shift register.
11. 4 bit binary asynchronous counting.
12. 4 bit Up/Down counting.
13. Study of decoder and encoder circuit truth table.
14. BCD to seven segment display.
15. A/D conversion.
16. D/A conversion.
17. Study of clipping circuit.
18. Study of clamping circuit.
19. Study of seven segment LED display.
20. Study of seven segment LCD display.
21. Study of alphanumeric display.
22. Study of digital instrument.

**Note: Minimum 10 experiments should be performed.**

**Reference Books:**

1. Digital principles & applications A. P. Malvino (TMH).
2. Pulse digital & switching wave forms Millman & Taub (MH).
3. Electronic devices & circuits Allen Mottershed.
4. Principles of digital electronics Malvino & Leach (TMH).
5. Digital circuits & systems Douglass V. Hall (MH).
6. Modern digital electronics R. K. Jain.
7. CD' – Digital electronics (Maxwell).

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ELECTRICAL ENGINEERING

### Semester – V

Subject Code : **2350905**

Subject Name : **Energy Conservation Techniques**

Sr. No.	Subject Content	Hrs.
1.	<b>Elements of Energy Conservation And Management:</b> 1.1 Concept of energy conservation. 1.2 Conservation of electrical energy. 1.3 Energy conservation in different areas. 1.4 Energy management concept. 1.5 Elements of energy management. 1.6 Different approaches of energy management, Energy balance and organization for energy management.	9
2.	<b>Energy Conservation Approaches In Industry:</b> 2.1 Improvement in power factors in electrical system. 2.2 Improved illumination design by use of energy efficient light sources. 2.3 Use of energy efficient electric motors. 2.4 Reduction in heat loss in motor control centre (starters, main switches, fuse, cables etc) 2.5 Energy saving in the welding equipment. 2.6 Use of PAM motors for speed control in traction. 2.7 Energy saving in series parallel & star delta control of traction motor. 2.8 Use of electronic control in industrial drives. 2.9 Energy saver technology and equipments.	23
3.	<b>Technology Economic Evaluation of Energy Conservation Option:</b> 3.1 Calculation and costing of energy conservation project. 3.2 Depreciation cost, sinking fund method. 3.3 Cost evaluation by ROI and pay back method etc. 3.4 Case study.	9
4.	<b>Energy Conservation In Power Generation, Transmission And Distribution:</b> 4.1 Performance improvement of existing power plant. 4.2 Use of combined cycle power plants. 4.3 Use of co-generation plants, Use of small hydro power plants.	9

	4.4 Improved power transmission lines & reduction in line losses. 4.5 Power quality-monitoring systems. 4.6 Energy conservation by demand side management different approaches.	
5.	<b>Energy Audit:</b> 5.1 Energy audit-a concept. 5.2 Detailed energy audit. 5.3 Preliminary energy audit. 5.4 Detailed energy audit reporting & remedial measures. 5.5 Tools of electrical energy audit. 5.6 Diagnostic approaches.	6
	<b>Total</b>	56

### **Laboratory Experiences:**

1. Energy conservation by energy efficient motors.
2. Energy conservation by power factor improvement.
3. Energy conservation by optimum loading of motor and proper control of motors.
4. Energy conservation by good illumination design.
5. Project cost evaluation case study no 1.
6. Demand side management Case study no 2.
7. Energy saving in starters Case study no 3.
8. Energy audit and techniques.
9. Energy conservation in power station by combined cycle method and co-generation.
10. Study of pole amplitude motor.
11. Energy conservation by improving load curves.
12. Energy conservation in the electric arc furnaces and welding

**Note: Minimum 10 experiments should be performed.**

### **References Books:**

1. Renewable energy sources and conservation N. G. Bansal Kleemon & Meliss. Technology TMH Publication
2. Energy Technology Non conventional Renewable & conventional energy S.Rao – Parulkar, Khanna – publishers
3. Electric energy utilization and conservation S.C. Tripathi, T. M. H., Publisher
4. A text book of power plant engineering, A special appendix 1998 edition. Arora and S. Domkundwar Khanna Publication.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ELECTRICAL ENGINEERING

TEACHING SCHEME (w. e. f. 18<sup>th</sup> July' 11)

### SEMESTER- V

Subject Code : 2350906

Subject Name : Project - I

- 1) Department shall help in allocating students amongst various industries, the students shall be free to select the industries in consultation with the institute faculties or guide.
- 2) Students shall pursue their project work on their own risk; they need to observe all safety rules and precautions. In the case of accident /mishap / untowards incidence, institute / faculty shall not be held responsible.
- 3) Students are required to submit problem definition alongwith the possible remedial measures within the stipulated time period, decided by the institute or by the concerned authority.
- 4) For the areas, in which sufficient industries are not available, in that case, they may be allowed to take up project in the institute itself, but faculty should ensure that, it should be justifiable, keeping in view the weightage given.

(e.g. problem solving / maintenance work / Energy Conservation study case / Estimating Costing of wiring (Domestic or Industrial), preparing trainer kit /model (Application based) etc.)

- 5) Electrical engineering students can be placed at concerned industries / Vij Company / Meter Testing Lab / Sub-station etc for carrying out their project work.

### INSTITUTE LEVEL PROJECT WORK:

- Detailed visit report of the sub-station / Power Station /Wind farm etc. including necessary diagrams of main circuit,



**protection circuit, communication circuit, control circuit etc with explanation / specification of each and every major component of the system / circuit.**

- **Maintenance / repair work of machines / starters /meters / making of instruments or equipments at institute level with diagram procedure etc.**
- **Installation of electrical wiring in the institute with test report as per I.E.**
- **Panel wiring of machine at the institute level.**
- **Simulation of the application level not readily available in any version of simulation tool/software, or Simulation of minimum ten practicals of any subject of electrical engg.**

**For all aforesaid alternates, the faculties have to see that, the quality of the project should be maintained, and there should not be any repetition. The alternates are only for those institutes / students where the IDPs are not sufficient / appropriate.**

