CURRICULUM FOR FOURTH SEMESTER OF THREE-YEAR DIPLOMA COURSE IN ELECTRICAL ENGINEERING

Study Scheme 4th semester

Code	Subjects	Classes per week			Total Hours	Credits			Total credits L+T+P
		L	T	P		L	T	P	
EEM 202	Electrical Machines -II	3	0	0	3	3			3
EEM 204	Electrical Machines -II Lab	0	0	2	2	0	0	1	1
EEM 206	Power Electronics	3	0	0	3	3			3
EEM 208	Power Electronics Lab	0	0	2	2	0	0	1	1
EEM 210	Electrical Power – II	3	0	0	3	3			3
EEM 212	Electrical Power - II Lab	0	0	2	2	0	0	1	1
EEM 214	Renewable Energy	3	0	0	3	3			3
EEPE 202	Elective – I	3	0	0	3	3			3
EEPE 204	Elective – I LAB	0	0	2	2	0	0	1	1
EEPR 202	Electrical workshop Practice – III			6	6			3	3
		15		14	29	15		7	22

Elective-1:

1. INDUSTRIAL INSTRUMENTATION AND CONDITION MONITORING
2. ELECTRICAL ESTIMATION AND CONTRACTING
3. ELECTRICAL TESTING AND COMMISIONING

Overall

HS	BS	ES	EEM	PE	OE	MP	SL/PR	AU	Total
0	0	0	16	4	0	0	2	0	22

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 202	Course Title: Electrical Machines- II
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain Induction, Synchronous and FHP Machines used in different applications.

COURSE CONTENT

1. Three Phase Induction Motor

1.1 Constructional details of 3 phase induction motors: Squirrel cage and Slip ringinduction motor
1.2 Working principle: production of rotating magnetic field, Synchronous speed, rotor speed and slip.
1.3 Rotor quantities: frequency, induced emf, power factor at starting and running condition.
1.4 Characteristics of torque versus slip (speed),
Torques: starting, full load and maximum with relations among them.
1.5 Power flow diagram of an induction motor
1.6 Starters: need and types; stator resistance, auto transformer, star delta, rotor resistance
1.7 Speed control methods: stator voltage, pole changing, rotor resistance
1.8 Motor selection for different applications as per the load torque-speed requirements.
1.9 Harmonics and its effects, cogging and crawling in Induction Motors.

2. Single phase induction motors

2.1 Double field revolving theory, principle of making these motors self-start.
2.2 Construction and working: Resistance start induction run, capacitor start induction run, capacitor start capacitor run, shaded pole, repulsion type, series motor, universal motor.
2.3 Comparison between three phase and single phase Induction motors.
2.4 Applications of single phase induction motors.

3. Three phase Alternators

3.1 Constructional details: parts and their functions, rotor constructions, moving and stationary armatures
3.2 Working Principle, Windings: Single and Double layer. E.M.F. equation of an Alternator with numerical by considering short pitch factor and distribution factor.
3.3 Alternator loading: Factors affecting the terminal voltage of alternator; Armature resistance and leakage reactance drops.
3.4 Armature reaction at various power factors and synchronous impedance.
3.5 Voltage regulation: direct loading and synchronous impedance methods.

3.6 Need and necessary conditions for parallel operation of alternators
3.7 Synchronizing of an alternator (Synchroscope method) with the bus bars

4. Synchronous motors

4.1 Construction and Principle of operation
4.2 Effect of change in excitation of synchronous motor at constant load (no numerical)
4.3 Synchronous motor as condenser
4.4 Causes and effects of hunting, Prevention of hunting
4.5 Applications of synchronous motors

5. Fractional horse power (FHP) Motors

5.1 Construction and working principle of: Synchronous Reluctance Motor, Hysteresis motor, Brushless DC (BLDC) motor
5.2 Brief idea about: Permanent Magnet Synchronous Motors, stepper motors, AC and DC servomotors.
5.3 Applications of above mentioned motors

COURSE OUTCOME

After the completion of the course the student will be able to:

- Operate and maintain three phase induction motor used in different applications.
- Operate and maintain single phase induction motor used in different applications.
- Operate and maintain three phase alternators used in different applications.
- Operate and maintain synchronous motors used in different applications.
- Operate and maintain FHP motors used in different applications

RECOMMENDED BOOKS:

1. Electric Machines by P.S. Bimbhra, Khanna Book Publishing Co., New Delhi (ISBN: 978- 93-86173- 294)
2. Basic Electrical Engineering by Mittle, V.N. and Mittle, Arvind., McGraw Hill Education New Delhi, ISBN :9780070593572
3. Electrical Machines by Kothari, D. P. and Nagrath, I. J., McGraw Hill Education. New Delhi, ISBN:9780070699670
4. Electrical Machines Bhattacharya, S. K., McGraw Hill Education, New Delhi, ISBN:9789332902855
5. (AC and DC machines by Theraja, B.L.,), S.Chand and Co. Ltd., New Delhi, ISBN: 9788121924375
6. Special Purpose Electrical Machines by Sen, S. K., Khanna Publishers, New Delhi, ISBN: 9788174091529
7. Special Electrical Machines Janardanan E. G, Prentice Hall India, New Delhi ISBN: 9788120348806
8. Electrical Technology Hughes E. ELBS
9. Electrical Technology Cotton H., , ELBS
10. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
11. Electrical Engineering by JB Gupta, SK Kataria and sons, New Delhi
12. Electrical Machines by Samarjit Ghosh, Pearson Education (Singapore) Pte, Ltd. 482, FIE Patparganj, Delhi 110092
13. Electrical Machines by DR Arora, Ishan Publications, Ambala City.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	15	30
4	5	10
5	8	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 204	Course Title: Electrical Machines- II LAB
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain Induction, Synchronous and FHP Machines used in different applications.

LIST OF PRACTICALS:

1. Identify the different parts (along with function and materials) for the given single phase and three phase induction motor
2. Connect and run the three phase squirrel cage induction motors (in both directions) using the DOL, star-delta, auto-transformer starters (any two phase)
3. Conduct the No-load and Blocked-rotor tests on given 3-f squirrel cage induction motor and determine the equivalent circuit parameters.
4. Control the speed of the given three phase squirrel cage/slip ring induction motor using the applicable methods: i) auto-transformer, or ii) VVVF.
5. Measure the open circuit voltage ratio of the three phase slip ring induction motor.
6. Conduct the direct load test to determine the efficiency and speed regulation for different loads on the given single phase induction motor; plot the efficiency and speed regulation curves with respect to the output power.
7. Perform the direct loading test on the given three phase alternator and determine the regulation and efficiency.
8. Determine the regulation and efficiency of the given three phase alternator from OC and SC tests (Synchronous impedance method)
9. Control the speed and reverse the direction of stepper motor/ AC/DC servo motor
10. To study the effect of a capacitor on the starting and running of a single- phase induction motor by changing value of capacitor and also to reverse the direction of rotation of a single phase induction motor

COURSE OUTCOME

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency: a) Maintain three phase induction motor used in different applications. b) Maintain single phase induction motor used in different applications. c) Maintain three phase alternatorsused in different applications. d) Maintain synchronous motors used in different applications. e) Maintain FHP motors used in different applications.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 206	Course Title: Power Electronics
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of power electronic devices.

COURSE CONTENT

1. Power Electronic Devices

1.1 Power transistor: construction, working principle, V-I characteristics and uses.
1.2 IGBT: Construction, working principle, V-I characteristics and uses.
1.3 Concept of single electron transistor (SET) - aspects of Nano- technology.

2. Thyristor Family Devices

2.1 SCR: construction, two transistor analogy, types, working and characteristics. SCR mounting and cooling.
2.2 Types of Thyristors: SCR, LASCR, SCS, GTO
2.3 Thyristor family devices: symbol, construction, operating principle and V-I characteristics of UJT, DIAC AND TRIAC
2.4 Protection circuits: over-voltage, over-current, Snubber

3. Turn-on and Turn-off Methods of Thyristors

3.1 SCR Turn-On methods: High Voltage thermal triggering, Illumination triggering, dv/dt triggering, Gate triggering.
3.2 Gate trigger circuits – Resistance and Resistance-Capacitance circuits. SCR triggering using UJT, PUT: Relaxation Oscillator and Synchronized UJT circuit.
3.3 SCR Turn-Off methods:
Class A- Series resonant commutation circuit, Class B-Shunt Resonant commutation circuit, Class C-Complimentary Symmetry commutation circuit, Class D –Auxiliarycommutation, Class E- External pulse commutation, Class F-Line or natural commutation.

4. Phase Controlled Rectifiers

4.1 Phase control: firing angle, conduction angle. Single phase half controlled, full controlled and midpoint controlled rectifier with R, RL load:
4.2 Circuit diagram, working, input- output waveforms, effect of free wheeling diode.
4.3 Different configurations of bridge controlled rectifiers:
Full bridge, half bridge with common anode, common cathode,

5. Industrial Control Circuits Applications:

5.1 Illumination control and fan speed control using Diac / TRIAC/SCR
5.2 SMPS. UPS: Offline and Online SCR based(Brief Idea with Block Diagram)

COURSE OUTCOME

After the completion of the course the student will be able to:

- Select power electronic devices for specific applications.
- Maintain the performance of Thyristors.
- Troubleshoot turn-on and turn-off circuits of Thyristors.
- Maintain phase controlled rectifiers.
- Maintain industrial control circuits

RECOMMENDED BOOKS:

1. An Introduction to Thyristors and their applications by Ramamoorty M. East-West Press Pvt. Ltd., New Delhi, ISBN: 8185336679.
2. Thyristors: Theory and Applications by Sugandhi, Rajendra Kumar and Sugandhi, Krishna Kumar,New Age International (P) ltd. Publishers, New Delhi, ISBN: 978-0-85226-852-0
3. Fundamentals of Power Electronics by Bhattacharya, S.K., , Vikas Publishing House Pvt. Ltd. Noida ISBN: 978-8125918530
4. Power Electronics Circuits Devices and Applications Rashid, Muhammad, Pearson Education India, Noida, ISBN: 978-0133125900.
5. Power Electronics by Singh, M. D. and Khanchandani, K.B.,Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2008 ISBN: 9780070583894
6. Power Electronics by Dr. PS Bhimbra, Khanna Publishers, New Delhi
7. Fundamentals of Power Electronics by S Rama Reddi, Narosa Publishing House Pvt Ltd, New Delhi
8. Power Electronics and its Applications ,Jain & Alok,Penram International Publishing(India) Pvt. Ltd, Mumbai, ISBN: 978-8187972228
9. SCR Manual by Grafham D.R , General Electric Co., ISBN: 978-0137967711
10. Industrial Control Electronics, John Webb, Kevin Greshock, Maxwell, Macmillan International editions.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	7	15
2	14	30
3	15	30
4	8	15
5	4	10
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 208	Course Title: Power Electronics Lab
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of power electronic devices.

LIST OF PRACTICALS:

1. Test the proper functioning of power transistor and IGBT.
2. Test the proper functioning of DIAC to determine the break over voltage.
3. Determine the latching current and holding current using V-I characteristics of SCR
4. Draw the V-I characteristics of a DIAC.
5. Draw the V-I characteristics of a TRIAC
6. Draw the V-I characteristic of UJT
7. Observe the output wave of an UJT relaxation oscillator.
8. Test the variation of R, C in R and RC triggering circuits on firing angle of SCR.
9. Test the effect of variation of R, C in UJT triggering technique.
10. Perform the operation of Class – A, B, C, turn off circuits.
11. Use CRO to observe the output waveform of half wave controlled rectifier with resistive Load and determine the load voltage
12. Use CRO to observe the output waveform of Full wave controlled rectifier with R load, RL load, freewheeling diode and determine the load voltage.
13. Observe the wave shape across SCR/ DIAC/ TRIAC and load (lamp or motor)
14. Simulate above circuits on SCILAB software (only those ckts which can be simulated on SCILAB) .

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 210	Course Title: Electrical Power – II
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of the electrical transmission and distribution systems.

COURSE CONTENT

1 Basics of Transmission and Distribution

1.1 Single line diagram of Electric power system, standard voltage level used in India.
1.2 Classification of transmission lines: based on type of voltage, length and construction
1.3 Advantages of high voltage for Transmission of power in both AC and DC
1.4 Comparison of different systems: AC versus DC for power transmission, conductor material for over head lines
1.5 Method of construction of electric supply transmission system – 110 kV, 220 kV, 400 kV. Method of construction of electric supply distribution systems – 220 V, 400V, 11 kV, 33 kV

2 Line parameters

2.1 Concepts of R, L and C of line parameters and types of lines.
2.2 Performance of short line: Efficiency, regulation, effect of power factor, vector diagram for different power factors
2.3 Performance of medium line: representation, nominal 'T', nominal 'π' and end condenser methods (Introduction only).
2.4 Transposition of conductors and its necessity.
2.5 Skin effect and proximity effect
2.6 Concept of corona. Effects of corona and remedial measures

3 A.C Distribution System

3.1 AC distribution: Components classification, requirements of an ideal distribution system, primary and secondary distribution system. Feeder and distributor, factors to be considered in design of feeder and distributor.
3.2 Types of different distribution schemes: radial, ring and grid, layout, advantages, disadvantages and applications. Voltage drop, sending end and receiving end voltage.

4. Sub-Station

4.1 Classification, site selection, advantages, disadvantages and applications.
4.2 Symbols and functions of substation components.
4.3 Single Line diagram (layout) of 33KV/11KV Sub-Station, 11KV/400V sub-station.

5. Components of Transmission and Distribution Line

5.1 Overhead Conductors: Properties of material, types of conductor with trade names, significance of sag, calculation of sag (Level Supports), effects of wind and ice related problem

5.2 Line supports: Requirements, types of line structures and their specifications, methods of erection.

5.3 Line Insulators: Properties of insulating material, types of insulators and their applications, causes of insulator failure, derivation of equation of string efficiency for string of three suspension insulator, methods of improving string efficiency.

5.4 Underground Cables: Requirements, classification, construction, comparison with overhead lines, cable laying methods

RECOMMENDED BOOKS:

1. Utilization of Electric Power & Electric Traction by G.C. Garg, , Khanna Book Publishing Co., New Delhi (ISBN: 978-93-86173-355)
2. Principles of Power System, S. Chand by Mehta, V.K., and Co. New Delhi, ISBN: 9788121924962
3. A Course in Electrical Power Soni;Gupta; Bhatnagar, , Dhanpat Rai and Sons New Delhi, ISBN: 9788177000207
4. A Course in Power Systems Gupta,J.B., , S.K. Kataria and sons, New Delhi, ISBN:9788188458523
5. A Textbook of Electrical Technology Vol. III by Theraja, B.L.; Theraja, A.K., , S.Chand and Co. New Delhi, ISBN : 9788121924900
6. A Course in Electrical Power by Uppal,S.L., , S.K.Khanna Publisher New Delhi, ISBN : 9788174092380
7. Electrical Power Transmission and Distribution by Sivanagaraju S.; Satyanarayana S., Pearson Education, New Delhi, ISBN:9788131707913
8. Electrical Power System: A First Course Ned Mohan by Wiley India Pvt. Ltd. New Delhi, ISBN:9788126541959
9. Power System Analysis and Design by Gupta, B.R., S. Chand and Co. New Delhi, ISBN: 9788121922388
10. Electrical Power Distribution System by Kamraju, V., Tata McGraw-Hill, New Delhi, ISBN:9780070151413
11. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi
12. Substation Design and Equipment by Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi
13. Electrical Power –I by SK Sahdev, Uneek Publications, Jalandhar
14. Sub-Station Design by Satnam, Dhanpat Rai and Co., New Delhi
15. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi
16. Electrical Power System by S Channi Singh, Tata McGraw Publishing Co. New Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	9	20
2	10	20
3	10	20
4	9	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 212	Course Title: Electrical Power- II Lab
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of the electrical transmission and distribution systems.

COURSE CONTENT

Following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

1. Prepare a report based on transmission line network in J & K
2. Collect the information on components of transmission line.
3. Evaluate transmission line performance parameters of a given line.
4. Library/ Internet survey of electrical high voltage line and HVDC lines.
5. Visit a 132kv /33 KV Substation and write a report on it
6. Visit a 33kv /11 KV Substation and write a report on it
7. Visit 11KV/400V Distribution Substation and write a report on it.
8. Prepare a model showing: i. Single line diagram of electric supply system. ii. Single line diagram of a given distribution system. iii. Short line and medium transmission line. iv. Write a report on the same by giving the details of lines in J &K
9. Draw a layout diagram of 132 kv /33 KV Grid station
10. Draw a layout diagram of 33kv /11 KV substation
11. Draw a layout diagram of 11KV/400 V substation in your campus/ adjacent substation.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 214	Course Title: Renewable Energy
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The course is designed to give knowledge of various renewable energy sources, systems and applications in the present context and need.

COURSE CONTENT

1. Energy Scenario in India:

1.1 Renewable and Non-renewable Energy sources,
1.2 Causes of Energy Scarcity, Solution to energy Scarcity,
1.3 Need for Renewable Energy, Advantages and Disadvantages of Renewable energy, Renewable Energy statistics worldwide and India.

2. Solar Energy

2.1 Solar photovoltaic, PV Technologies-Amorphous, monocrystalline, polycrystalline.
2.2 VI characteristics of a PV cell, PV module, array.
2.3 Maximum Power Point Tracking (MPPT) algorithms, Concentrated Solar Power, types of collectors, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond.
2.4 Application of Solar Power, Economic Policies to Promote Solar Energy.

3. Wind Energy

3.1 Introduction, Electricity Generation using Wind Energy Generators (WEG),
3.2 Evaluating Wind Turbine Performance,
3.3 Wind Potential, Wind Energy in India, Wind Turbine Size and Power Ratings,
3.4 Advantages of Wind-Generated Electricity, Cost Issues, Environmental Concerns, Supply and Transport Issues.

4 Bio Energy, Tidal Energy

4.1 Types of Bio Gas Plants, Tidal energy.
4.2 Classification of Tidal Plants, Ocean Thermal Energy systems, Open OTEC Cycle, Closed OTEC Cycle.
4.3 Introduction to Magneto Hydro Dynamics (MHD) Power & Fuel cells.
Note: Solar power plants and Wind power plants should be demonstrated to students in the lab .

COURSE OUTCOME:

After learning the subject, student will be able to:

- Appreciate the importance of energy crises and consequent growth of the power generation from the renewable energy sources
- Demonstrate the knowledge of physics of solar power generation and the associated issues.
- Demonstrate the knowledge of the physics of wind power generation and all associated issues.
- Understand the utilization of Bio Gas Plants, Tidal, MHD, Fuel Cells by identifying the sites where their production is feasible.
- Demonstrate the ways by which energy can be stored in different forms.

RECOMMENDED BOOKS:

1. Solar Energy, S. P. Sukhatme and J. K. Nayak, McGraw-Hill Education
2. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3. Non-conventional energy resources, ShobhNath Singh, Pearson India
4. Solar Energy Engineering, Soteris Kalogirou, Elsevier/Academic Press.
5. Principles of Solar Energy, Frank Krieth& John F Kreider, John Wiley, New York
6. From Sunlight to Electricity: a practical handbook on solar photovoltaic application; Deambi, Suneel: TERI, New Delhi ISBN:9788179935736
7. Renewable Energy Systems, David M. Buchla, Thomas E. Kissell, Thomas L. Floyd - Pearson Education New Delhi , ISBN: 9789332586826,
8. Wind Power Technologies Rachel, Sthuthi; Earnest, Joshua –, PHI Learning, New Delhi, ISBN: 978-93-88028-49- 3; E-book 978-93-88028-50-9
9. Biogas Technology: Towards Sustainable Development Khoiyangbam, R S Navindu; Gupta and Sushil Kumar;; TERI, New Delhi; ISBN: 9788179934043
10. Wind Energy Basics Gipe, Paul:, Chelsea Green Publishing Co; ISBN: 978-1603580304
11. Renewable Energy Sources and Emerging Technologies Kothari, D.P. et al:, PHI Learning, New Delhi, ISBN: -978-81-203-4470-9
12. Wind Electrical Systems installation Bhadra, S.N., Kastha, D., Banerjee, S,; Oxford University Press, New Delhi, ISBN: 9780195670936
13. Energy Technology O.P. Gupta,Khanna Publishing House, New Delhi (ISBN: 978-9386173-683)

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	20
2	15	30
3	15	30
4	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 202	Course Title: ELECTRICAL TESTING AND COMMISIONING
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industryidentified competency through various teaching learning experiences:

- Follow standard safety procedures in testing and commissioning of electrical equipment

COURSE CONTENT

1. Electrical Safety and Insulation

1.1 Do's and don'ts regarding safety in domestic electrical appliances as well for substation/ power station operators

1.2 Electrical safety in industry/power stations/ substations at the time of operation/ control/ maintenance.

1.3 Fire detection alarm, fire-fighting equipment.

1.4 Factors affecting life of insulating materials, classifications of insulating materials. Measuring insulationresistance by Megger

1.5 Insulating oil : properties of insulating oil, causes of deterioration of oil, testing of transformer oil

2. Installation and Erection

2.1 Concept of foundation for installation of machinery. Requirements of foundation for static and rotating electrical machinery.

2.2 Concept of leveling and aligning: Procedure for leveling and aligning, alignment of direct coupled drive, effects of mis-alignment

2.3 Procedure for installation of transformer, Requirements of installation of pole mounted transformer.

2.4 Devices and tools required for loading, unloading, lifting, and carrying heavy equipment and precautions to be taken while handling them.

3. Testing and Commissioning

3.1 Concept of testing, Objectives of testing. Roles of I.S.S in testing of electrical equipment,

3.2 Types of tests and concepts, Routine tests, type tests, supplementary test, special tests, Methods of testing - Direct/Indirect/Regenerative testing.

3.3 Tests beforeCommissioning for transformer, induction motor and DC Machine.

4. Maintenance

4.1 Concept of maintenance, types of maintenance, Routine, preventive and breakdown maintenance.

4.2 Causes of failure of electrical machines

4.3 Preventive maintenance-procedure or developing maintenance schedules for electrical machines.

4.4 Factors affecting preventive maintenance schedules.

4.5 Maintenance schedules of the following as per I.S.S.

1. Distribution transformer as per I.S.1886-1967
2. Single phase and three phase Induction motors as per I.S.900-1965.
3. Batteries

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	9	20
2	15	30
3	15	30
4	9	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 204	Course Title: ELECTRICAL TESTING AND COMMISIONING LAB
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Follow standard safety procedures in testing and commissioning of electrical equipment.

LIST OF PRACTICALS:

1. Determine breakdown strength of transformer oil.
2. Perform insulation resistance test on any one motor/transformer.
3. Prepare trouble shooting charts for Transformer
4. Prepare trouble shooting charts for induction motor
5. Measure impedance voltage and load losses of three-phase transformer
6. Determine efficiency of D.C. machine by Swinburne's test
7. Determine efficiency of D.C. machine by Hopkinson's test
8. Perform reduced voltage running up test on three-phase Induction motor as per I.S.325 -1967.
9. Perform no load test on single phase Induction motor for the measurements of no load current, power input, and speed at rated voltage.
10. Perform temperature rise test on single-phase transformer.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 202	Course Title: ELECTRICAL ESTIMATION AND CONTRACTING
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design electrical installation with costing for tendering

COURSE CONTENT

1. Electric Installation and Safety

1.1 Scope and features of National electric code 2011
1.2 Types of electrical installation
1.3 Fundamental principles for electrical installation, Permit to work, safety instructions and safety practices

2. Purpose of estimating and costing

2.1 Estimation and Costing: Meaning and purpose of rough estimate, detailed estimates, supplementary estimate, annual maintenance estimate and revised estimate
2.2 Factors to be considered while preparation of detailed estimate and economical execution of work
2.3 Contracts- Concepts of contracts, types of contracts, contractor, role of contractor
2.4 Tenders and Quotations- Type of tender, tender notice, preparation of tender document, and method of opening of tender
2.5 Quotation, quotation format, comparison between tender and quotation, Comparative statement, format comparative statement, Order format, placing of purchasing order.

3. Non-Industrial Installations / Industrial Installation

3.1 Types of Non-industrial installations; Office buildings, shopping and commercial centre, residential installation.
3.2 Design consideration and procedure of electrical installation in commercial buildings.
3.3 Estimating and costing of unit Earthing of commercial installation.
3.4 Single line diagram, Installation plan along with estimating and costing for small workshops - (Single phase motors, Three Phase motors etc)

4. Public Lighting Installation

4.1 Classification of outdoor installations streetlight/ public lighting installation Street light pole structures.
4.2 Selection of equipments, sources used in street light installations.
4.3 Cables, recommended types and sizes of cable.
4.4 Control of street light installation.
4.5 Design, estimation and costing of streetlight

5. Distribution Lines and LT Substation

5.1 Materials used for HT and LT Over head line.
5.2 Design, estimation and costing of HT and LT overhead line.
5.3 Types of 11 KV Distribution substations and their line diagrams,
5.4 Design, estimation and costing of outdoor and indoor 11KV/ 400v substation.

COURSE OUTCOME

After the completion of the course the student will be able to:

- Follow National Electrical Code 2011 in electrical installations.
- Estimate the electrical installation works 193 Electrical Engineering Curriculum Structure
- Estimate the work of non-industrial electrical installations.
- Prepare abstract, tender, quotation of public lighting and other installations
- Prepare abstract, tender, quotation of low tension (LT) substations.

RECOMMENDED BOOKS:

1. Electrical Design Estimating and Costing by Raina, K.B.; Dr. S. K. Bhattacharya New Age International Publisher First, Reprint 2010, ISBN: 978-81-224-0363-3
2. Electrical Estimating and Costing by Allagappan,, N. S. Ekambarram, Tata Mc-Graw Hill Publishing Co. Ltd, , ISBN 13: 9780074624784
3. Electrical Estimating and Costing by Singh, Surjit Ravi Deep Singh, Dhanpat Rai and Sons, , ISBN 13:1234567150995
4. A Course in Electrical Installation Estimating and Costing by Gupta, J.B. S.K. Kataria and Sons Reprint Edition, ISBN 10: 935014279113: 978-9350142790.
5. Code of Practice for Electrical Wiring Installation by Bureau of Indian Standard. IS: 732-1989,
6. National Electrical Code 2011 by Bureau of Indian Standard. SP-30:2011,

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	9	20
2	10	20
3	9	20
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 204	Course Title: ELECTRICAL ESTIMATION AND CONTRACTING LABORATORY
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design electrical installation with costing for tendering.

LIST OF PRACTICALS:

1. Prepare a tender notice for purchasing a transformer of 200 KVA for commercial installation.
2. Prepare a quotation for purchasing different electrical material required.
3. Prepare a comparative statement for above material
4. Prepare purchase order for the above material
5. Design drawing, estimating and costing of hall
6. Estimate the material and cost required for 11kv HT distribution line
7. Estimate the material and cost required for 415v/ 220 v LT distribution line
8. Estimate the material and cost required for 100KVA, 11/ 0.415 KV outdoor Substation.
9. Estimating and costing of unit Earthing of commercial installation
10. Estimating and costing of two room domestic installation.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 202	Course Title: INDUSTRIAL INSTRUMENTATION AND CONDITION MONITORING
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: • Use instrumentation equipment for condition monitoring and control.

COURSE CONTENT

1. Fundamentals of instrumentation

1.1 Basic purpose of instrumentation.
1.2 Basic block diagram (transduction, signal conditioning, signal presentation) and their function.
1.3 Construction, working and application of switching devices- Push button, limit switch, float switch, pressure switch, thermostat, electromagnetic relay.

2. Transducers

2.1 Distinguish between Primary and Secondary, Electrical and Mechanical, Analog and Digital, Active and Passive. Mechanical devices pry. and sec. transducers
2.2 Advantages of electric transducers
2.3 Required characteristics of transducers.
2.4 Factors affecting the choice of transducers
2.5 Construction and principle of resistive transducer, Potentiometer, variac and strain gauges, No derivation. Only definition and formula for gauge factor Typesof strain gauges like unbonded, bonded and semiconductor.
2.6 Construction and principle of Inductive transducers-L.V.D.T. and R.V.D.T, their applications.
2.7 Construction, principle and applications of transducers–Piezo-Electric transducer, photoconductive cells, photo voltaic cells.

3. Measurement of Non-Electrical Quantities

3.1 Temperature measurement - Construction and Working of RTD, Thermistor and Thermocouple, radiation pyrometer, technical specifications and ranges.
3.2 Pressure measurement – Construction and working of bourdon tube, bellow diaphragm and strain gauge, Combination of diaphragm and inductive transducer, Bourdon tube and LVDT, bellow and LVDT, diaphragm capacitance and bridge Circuit.
3.3 Construction and Working of Speed measurement by contacting and non- Contact Type- DC tachometer, photo- electric tachometer, toothed rotor tachometer Generator - magnetic pickup and Stroboscope.
3.4 Construction and Working of Vibration measurement by accelerometer-LVDT

accelerometer, Piezo electric type.

3.5 Construction and Working of Flow measurement by electromagnetic and Turbine Flow meter.

3.6 Construction and Working of Liquid level measurement by resistive, inductive, Capacitive gamma rays and Ultrasonic methods.

4. Signal Conditioning

4.1 Basic Concept of signal conditioning System.

4.2 Draw pin configuration of IC 741.

4.3 Define Ideal OP-AMP and Electrical Characteristics of OP-AMP.

4.4 Different Parameters of op-amp:-Input offset voltage, Input offset current, Input bias current, Differential input resistance, CMMR, SVRR, voltage gain, output voltage, slew rate, gain bandwidth.

4.5 Use of op-amp as inverting, non- inverting mode, adder, subtractor.

5. Data Acquisition System

5.1 Generalized DAS- Block diagram and description of Transducer, signal conditioner, multiplexer, converter and recorder. Draw Single Channel and Multi-channel DAS-Block diagram only. Difference between Signal Channel and Multi- Channel DAS.

5.2 Data conversion- Construction and Working of Analog to digital conversion-successive approximation method.

5.3 Digital to Analog conversion- Construction and Working of binary weighted resistance method.

5.4 Digital display device- operation and its application of seven segment display.

6. Condition Monitoring and Diagnostic Analysis

6.1 Definition of condition monitoring

6.2 Insulation deterioration Mechanism- factors affecting occurrence and rate of deterioration, types of stresses responsible for deterioration. Different tests on transformer, their purpose and the necessary condition of machine.

6.3 Power factor, capacitance /tan delta test

COURSE OUTCOME

After the completion of the course the student will be able to:

- Select relevant instruments used for measuring electrical and non-electrical quantities.
- Select relevant transducers/sensors for various applications.
- Use relevant instruments for measuring non-electrical quantities.
- Check the signal conditioning and telemetry system for their proper functioning.
- Use data acquisition systems in various applications.
- Undertake condition monitoring for diagnostic analysis of electrical equipment

RECOMMENDED BOOKS:

1. Electric and Electronic Measurement and instrumentation Sawhney, A.K., Dhanpat Rai and Co. Author, Nineteenth revised edition 2011 reprint, 2014, ISBN:10: 8177001000
2. Instrumentation devices and system, Rangan, C.S. G.R.Sharma. and V.S.V.Mani, Pen ram International Publishing India Pvt. Ltd. Fifth edition, ISBN:10: 0074633503
3. Electronics and instrumentation Mehta, V.K., Third edition-S.Chand and company Pvt Ltd Reprint, 2010, ISBN:81-219-2729-3
4. Industrial instrumentation and control, Singh, S.K., Tata McGraw-Hill, 1987. ISBN: 007451914X, 9780074519141.
5. Electronic Measurement and Instrumentation J.G. Joshi, , Khanna Publishing House, New Delhi (ISBN: 978-93-86173-621)

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Alloted (Hrs)	Marks Allotted (%)
1	5	10
2	14	30
3	14	30
4	5	10
5	5	10
6	5	10
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 204	Course Title: INDUSTRIAL INSTRUMENTATION AND CONDITION MONITORING LABORATORY
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use instrumentation equipment for condition monitoring and control.

LIST OF PRACTICALS:

1. Identify different switches used in instrumentation system.
2. Measure linear displacement by L.V.D.T.
3. Measure the strain with the help of strain gauge
4. Measure temperature by PT-100, thermistor, thermocouple along with simple resistance bridge.
5. Use Thermocouple to control the temperature of a furnace/machine.
6. Measure pressure using pressure sensor kit.
7. Measure angular speed using stroboscope and tachometer.
8. Measure the flow using flow meter.
9. Use op-amp as inverter, non-inverting mode, adder, differentiator and integrator.
10. Convert digital data into analog data by using analog to digital converters and analog data into digital data by digital to analog converter.

Visit to testing center of electrical testing lab for tan delta and diagnostic tests and determine polarization index

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPR 202	Course Title: Electrical Workshop – III
Semester: 4th	Credits: 3
Hours per week: 6 (L:0 T:0 P:6)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

LIST OF PRACTICALS

- Contactor control operations
- Wiring estimates for a residential building
- Wiring estimates for a polytechnic
- Contactor Control Circuits along with Schematic and wiring diagram DOL Starter of 3-phase induction Motor.
- Forwarding/reversing of 3-phase induction motor
- Limit switch control of a 3-phase induction motor
- Sequence operation of two motors using T.D.R.
- Two speed motor control.
- Automatic star-delta starter for 3-phase induction motor
- Crimping of CAT 6/ LAN cable along with accessories (RJ 45 connector/ switch etc).
- Crimping of 2/4 pair telephone wire along with accessories (RJ 45 connector/ switch etc).
- Assemble and dismantle a 1KWP Solar Power Plant
- Assemble and dismantle a small wind energy Power Plant

INDUSTRIAL TRAINING OF STUDENTS
(During summer vacation after IV Semester)

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

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

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

Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students, understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. Theformative and summative evaluation may comprise of weightage to performance in testing, general behavior, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry