REVISED COURSE CURRICULUM FOR

(3rd) THIRD SEMESTER

(ELECTRICAL ENGINEERING)

W.E.F. 2023-24

BOARD OF TECHNICAL EDUCATION

MUNI MAYA RAM MARG
PITAMPURA, DELHI-
110034

Curriculum Revision for 3rd semester with credits

THIRD SEMESTER: (ELECTRICAL ENGINEERING)

Sr. No.	Code No.	Course Title	Hours per week			Marking Scheme		Credits
			L	T	P	Internal	External (3hr.)	
1	23-EEPC-201	Electrical Machines –I	3	0	0	50	100	3
2	23-EEPC-203	Electrical and Electronic Measurement	3	0	0	50	100	3
3	23-EEPC-205	Electrical Circuit	3	0	0	50	100	3
4	23-EEPC-207	Electric Power Generation System	3	0	0	50	100	3
5	23-EEPC-209	*Electrical Engineering Drawing	0	0	4	50	100	2
6	23-EEPC-251	Electrical Machines –I Laboratory	0	0	2	50	50	1
7	23-EEPC-253	Electrical and Electronic Measurement Lab	0	0	2	50	50	1
8	23-EEPC-255	Electrical Circuit Lab	0	0	2	50	50	1
9	23-EEPC-257	Electric Power Generation System Lab	0	0	2	50	50	1
10	23-EESI-259	**Summer internship 1	0	2	0	50	50	2
	Total					**500**	**750**	**20**

* External exam of EED will be conducted by BTE.

**Four week summer internship training after 2nd sem will be evaluated on the basis of daily diary/training report/ppt. presentation

Detailed 3rd Semester Curriculum Contents

Course Name: **Electrical Machines - I**	
Semester-III (Electrical Engineering)	
Course Code:	23-EEPC-201
Course Title:	Electrical Machines - I
Number of Credits:	Total: 3(L=3, T=0, P=0)

Rationale:

Electrical Machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder will become competent in installing, operating, repairing and maintaining these machines and give suggestions upon their applications as well as improvement in their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications.

Learning Outcome:

After learning this subject student will be able to demonstrate the following industry oriented activities:

- Maintain, Install and operate different types of DC generators
- Maintain, Install and operate single phase transformer
- Maintain, Install and operate three phase transformers
- Maintain different types of special purpose transformers used in different applications.

Detailed Contents:

Unit I. Direct Current Generators

1.1 Introduction, DC generator construction, working principle of operation. lap and wave winding. Types of DC generators, separately excited &self excited DC generators, EMF equation, simple numerical problems on generated voltage and armature current

1.2 Armature reaction in DC generators, commutation and methods of improving commutation, methods of excitation

1.3 Characteristics of DC generators, voltage build-up in self excitedDC generator.

Unit II. Direct Current Motors

2.1 DC Motor construction and working principle, back EMF, equivalent circuit, torque of a DC machine, types of DC motors.

2.2 Performance characteristics of DC motors, speed control of DC motors

2.3 Starting of DC motors, need of starters, three point DC shunt motor starter, four point starter, reversal of direction of rotation.

2.4 Losses in DC machines, efficiency of a DC machine, condition for maximum efficiency. Determination of efficiency by direct loading method and by Swinburne's Test. DC motors applications

Unit III. Single Phase Transformers

3.1 Introduction, constructional features of single phase transformer, working principle of transformer, EMF equation, transformation ratio, Step-up & Step down Transformer, core and shell type, simple numerical problems

3.2 Transformer operation under no-load and loaded condition, equivalent circuit, phasor diagram for no-load and for loaded condition, voltage regulation of a transformer- unity, lagging and leading load power factor, simple numerical problems

3.3 Losses in a transformer, open circuit and short circuit test. calculation for efficiency, condition for maximum efficiency, current & KVA at maximum efficiency, all day efficiency.

3.4 Auto transformer construction, working and application. Instrument transformers- CT & PT.

Unit IV. Three Phase Transformers

4.1 Construction of three phase transformer, different Parts, Buchholz relay. Advantages and disadvantages of three phase transformer over single phase transformer. Three phase transformer connections i.e. delta-delta, delta-star, star-delta and star-star, advantages and disadvantaged of each type.

4.2 Transformers name plate, rating of transformers, polarity of transformers, labelling of transformer terminals, polarity test.

4.3 Parallel operation of transformers, need of parallel operation, conditions of parallel operation,

4.4 Cooling of transformers, power and distribution transformers.

Learning Approach:

- Brief idea of different machines with physical demonstration in the laboratory may be given at the beginning of each chapter. Audiovisual aids can be used to explain the operational aspects. Students are encouraged to carry out practical training independently on each machine for their better understanding.

References/suggested learning resources:

(a) Books

1) Electrical Technology by B. L. Theraja, A. K. Theraja, S Chand & Company Ltd.
2) Electrical machines by SK Bhattacharya, Tata Mc grow Hill, New Delhi
3) Electrical machines by Ashfaq Husain, Dhanpat Rai & Co.
4) Electrical machines by SK Sahdev, Uniqe International Publications, Jalandhar
5) Electrical machines by SB Gupta, SK Kataria and Sons, New Delhi
6) Electrical machines-I by Tarlok Singh, SK Kataria and Sons, New Delhi

(b) Open Source/Online Resources:

1. www.udemy.com/course/fundamentals-of-transformer-for-electrical-power-engineering/
2. www.electrical4u.com/
3. www.classcentral.com/course/swayam-electrical-machines-iitd-14030
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-cience/6-685-electric-machines-fall-2013/
5. www.nptelvideos.in/electricalengineering/m

Course Name: **Electrical Machines – I Lab**	
Semester-III (Electrical Engineering)	
Course Code:	23-EEPC-251
Course Title:	Electrical Machines –I Lab
Number of Credits:	Total: 1(L=0, T=0, P=2)

List of Practical:

1. Study of DC starter for starting of DC motor.
2. Speed control of dc shunt motor by Armature control method.
3. Speed control of dc shunt motor by Field control method.
4. Study of dc series motor with starter (to operate the motor on no load for a moment).
5. Measurement of terminal voltage of a DC shunt generator as a function of load current.
6. Determine efficiency of single phase transformer by direct loading.
7. To perform open circuit and short circuit test for determining equivalent circuit parameter of a transformer.
8. To determine the regulation and efficiency from the data obtained from open circuit and short circuit test.
9. Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations
10. Finding the voltage and current relationships of primary and secondary of a three phase transformer under balanced load in various configurations conditions.

Atleast 8 practicals from the above have to be performed

Course Name: **Electrical and Electronic Measurement**	
Semester – III(Electrical Engineering)	
Course Code:	23-EEPC-203
Course Title:	Electrical and Electronic Measurement
Number of Credits:	Total: 3 (L: 3 T: 0 P:0)

Rationale:

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

- Use relevant measuring instruments in different electrical applications.

Learning Outcome:

After studying this course, students will be able to:

- To identify electrical and electronic measuring instruments.
- Use ammeter and voltmeter for electrical measurement.
- Use wattmeter and power factor meter for measurement of electric power and power factor respectively.
- Use of energy meter to measure the energy consumed in the premises of a consumer (Household, Commercial and Industrial).
- Demonstrate the need and procedure of calibration of energy meter.

Detailed Contents

UNIT I. Fundamentals of Measurements and Measuring Instruments

Measurements: Significance, Units, fundamental quantities and standards. Classification of instruments – Absolute and Secondary instruments, Active and Passive Instruments. Null-Type and Deflection-Type Instruments. Analogue and Digital Instruments. Smart Instruments. Performance characteristics: Static and Dynamic Characteristics. Errors in measurements, Types of error. Analog Electrical Instruments: Absolute instruments and Secondary, Indicating, Integrating and Recording Instruments. Essential requirements of an indicating instruments, PMMC, MI, Electrodynamometer and Electromagnetic Induction type instruments. Analog Electronic Instruments: Rectifier type instruments. CRO (Terminals and controls on front panel to be discussed). Digital Electronic Instruments: Familiarization (Terminals and controls on front panel to be discussed) with DMM, Signal Generators, DSO (No internal circuitry description).

UNIT II. Measurement of Resistance, Inductance and Capacitance

Measurement of Resistance: Low resistance – Kelvin Bridge and Kelvin's double bridge, medium resistance (Voltmeter and Ammeter method), High resistance (Megger and Ohm meter: Series and shunt). Measurement of Inductance: Using Anderson's Bridge (no derivation and phasor diagram). Measurement of capacitance: Using Schering bridge.

Unit III.Measurement of voltage and current

Galvanometer (a PMMC instrument). DC Ammeter: Basics, multi-range ammeter, Universal shunt. DC Voltmeter: Basics, multi-range voltmeter. AC Ammeter: Rectifier type (half-wave and full-wave), AC Voltmeter: Rectifier type (half-wave and full-wave. CT and PT: Construction, Working and application (no derivation and phasor diagram).

UNIT IV. Measurement of Electrical Power and Power factor

Dynamometer type wattmeter, Range: Multiplying factor and extension of range, errors and compensation, Active and reactive power measurement: one, two and three wattmeter methods. Effect of power factor on wattmeter reading. Power factor meter: construction and principal of working of dynamometer type power factor meter- single phase and three phases.

Unit– V Measurement of Electrical Energy and Special Meters

Single and three-phase electronic energy meter (no internal circuitry description). Calibration of single-phase electronic energy meter using direct loading. Special Meters**:** Maximum demand indicator, four quadrant meters, Maximum demand tariff – type of M.D indications –tri-vector meter. Earth Tester. Frequency meters: - mechanical resonance type- electrical resonance type – Weston frequency meter. Integrated measuring digital instrument (for measuring electrical Power in KW, KVA and KVAR etc.).

References:

1. Sawhney, A.K. - A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co. (P) Limited (1 January 2015), ISBN: 978-8177001006
2. Rajput R.K. - Electrical and Electronics Measurements and Instrumentation, S Chand & Company (1 January 2016), ISBN: 978-9385676017.
3. Purkait, Prithwiraj, Biswas, Budhaditya, Koley, Chiranjib - Electrical and Electronics Measurements and Instrumentation, McGraw Hill Education, ISBN: 978-1259029592.
4. Gupta, J. B. - A Course In Electrical & Electronics Measurement & Instrumentation, S K Kataria and Sons; Reprint 2013 edition, ISBN: 978-8188458936.

Course Name: **Electrical and Electronic Measurement Lab**	
Semester III(Electrical Engineering)	
Course Code:	23-EEPC-253
Course Title:	Electrical and Electronic Measurement Lab
Number of Credits:	Total: 1 (L: 0 T: 0 P:2)

List of Practical:

1. Study of PMMC, PMMI, Electrodynamometer type analog instruments using demonstration model.
2. DMM: Use of multi meter for measuring voltage, current and resistance.
3. Signal generator, CRO: cathode ray Oscilloscope and DSO - Measurement of voltage, frequency of a sinusoidal signal.
4. Megger: Hand-driven type, Analog Electronic type and Digital Electronic type.
5. Use of LCR meter for measuring inductance, capacitance and resistance.
6. Connecting appropriate instruments at the supply of an installation to measure supply voltage, current, frequency, power, power factor.
7. To measure the power, power factor in a single-phase circuit, using wattmeter and power factor meter and verify results with calculations.
8. Measurement of power and power factor of a three-phase balanced load by 2-wattmeter methods.
9. To calibrate 1 – phase energy meter by direct loading method.
10. Connection of 3-phase energy meter in an electrical system for measurement of energy.
11. Measurement of energy in a 3-phase circuit using CT, PT and 3-phase energy meter.

Atleast 8 practicals from the above have to be performed

Course Name: **Electrical Circuits**	
Semester-III (Electrical Engineering)	
Course Code:	23-EEPC-205
Course Title:	Electrical Circuits
Number of Credits:	Total:3 (L=3, T=0, P=0)

Rationale:

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

- Maintain electrical systems applying AC and DC circuit fundamentals.

Learning 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) Troubleshoot problems related to single phase A.C series circuits.
  b) Troubleshoot problems related to single phase A.C parallel circuits.
  c) Troubleshoot problems related to three phase circuits.
  d) Use principles of circuit analysis to troubleshoot electric circuits.
  e) Apply network theorems to troubleshoot electric circuits

Detailed Contents

Unit I D.C. Circuits

Resistive Circuits: Ohm's law, Series circuits, Parallel circuits, Kirchhoff's Law – KCL and KVL. Nodal and Mesh Analysis. DC Network Theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum Power Transfer theorem. star / delta transformation. Reactive Circuits: Series RL circuit operation – Charging and discharging of inductor current, Series RC circuit operation – charging and discharging of capacitor. Series RLC circuit analysis for step-input.

Unit II Single Phase A.C Series Circuits

Generation of alternating voltage, Phasor representation of sinusoidal quantities, R, L, C circuit elements its voltage and current response, R-L, R-C, R-L-C combination of A.C series circuit, impedance, reactance, impedance triangle, Power factor, active power, reactive power, apparent power, power triangle and vector diagram Resonance, Bandwidth, Quality factor and voltage magnification in series R-L, R-C, R L-C circuit

Unit III Single Phase A.C Parallel Circuits

R-L, R-C and R-L-C parallel combination of A.C. circuits. Impedance, reactance, phasor diagram, impedance triangle, R-L, R-C, R-L-C parallel A.C. circuits power factor, active power, apparent power, reactive power, power triangle, Resonance in parallel R-L, R-C, R-L-C circuit, Bandwidth, Quality factor and voltage magnification.

Unit IV Network Reduction and Principles of Circuit Analysis in AC Circuits

Source transformation, Star/delta and delta/star transformation, Mesh Analysis, Node Analysis

Unit V Three Phase Circuits

Phasor and complex representation of three phase supply, Phase sequence and polarity Types of three-phase connections, Phase and line quantities in three phase star and delta system, Balanced and unbalanced load, neutral shift in unbalanced load. Three phase power, active, reactive and apparent power in star and delta system.

References:

1. Ashfaq Husain, Networks & Systems, Khanna Book Publishing, New Delhi.
2. Gupta, B.R; Singhal, Vandana;, Fundamentals of Electrical Network, S.Chand and Co., New Delhi, ISBN : 978-81-219-2318-7
   Saxena, S.B Lal; Dasgupta, K; Fundamentals of Electrical Engineering, Cambridge University Press Pvt. Ltd., New Delhi, ISBN : 978-11-0746-435-3
3. Theraja, B. L. : Theraja, A. K;, A Text Book of Electrical Technology Vol-I, S. Chand & Co. Ramnagar, New Delhi, ISBN : 9788121924405

Course Name: **Electrical Circuits Lab**	
Semester-III (Electrical Engineering)	
Course Code:	23-EEPC-255
Course Title:	Electrical Circuits Lab
Number of Credits:	Total:2 (L=0, T=0, P=2)

List of Practical:

1. Use dual trace oscilloscope to determine A.C voltage and current response in given R, L, C circuit.
2. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L series circuit. Draw phasor diagram
3. Use voltmeter, ammeter to determine active, reactive and apparent power consumed in given R-C series circuit. Draw phasor diagram.
4. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L-C series circuit. Draw phasor diagram.
5. Use variable frequency supply to create resonance in given series R-L-C circuit or by using variable inductor or variable capacitor.
6. Use variable frequency supply create resonance in given parallel R-L-C circuit or by using variable inductor or capacitor.
7. Use voltmeter, ammeter to determine current through the given branch of an electric network by applying mesh analysis.
8. Use voltmeter, ammeter to determine current through the given branch of an electric network by applying node analysis.
9. Use voltmeter, ammeter to determine current through the given branch and voltage across the given element of circuit by applying superposition theorem.
10. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem
11. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Norton's theorem
12. Use voltmeter, ammeter to determine load resistance for maximum power transfer for a given circuit by applying maximum power transfer theorem.

Atleast 8 practicals from the above have to be performed

Course Name: **Electric Power Generation System**	
Semester-III (Electrical Engineering)	
Course Code:	23-EEPC-207
Course Title:	Electric Power Generation System
Number of Credits:	Total:3 (L=3, T=0, P=0)

Rationale:

The majority of the polytechnic pass outs have to perform various activities in the state Electricity Boards in the field of Generation, Transmission and Distribution of Electrical power. Understanding the principles of electric power generation provides a solid foundation in electrical engineering is crucial for any technical career. Knowledge of power generation systems equips students with the necessary technical skills to understand and work with complex electrical systems. In this subject most of these skills and knowledge are dealt with.

Learning Outcome:

- Demonstrate the types of power generation
- Maintain the optimized working of the power plants &apply safe practices in power plants

Detailed Contents:

Unit – I Thermal Power Plants I: Coal based Power Plants

Layout and working of a typical thermal power plant with steam turbines and electric generators. Properties of Coal as conventional fuels used in the energy conversion equipment used in thermal power plants. Safe Practices and working of coal based thermal power plants. Functions thermal power plants and their major auxiliaries: Coal fired boilers: fire tube and water tube.

Unit – II Thermal Power Plants II: Coal, Gas/ Diesel and Nuclear-based Power Plants

Layout and working of a typical nuclear based thermal power plant with steam turbines and electric generators. Nuclear fuels –fusion and fission action. Safe Practices and working of nuclear-based power plant. Types of nuclear reactors: Disposal of nuclear waste and nuclear shielding. Properties of conventional fuels used in the energy conversion equipment used in thermal power plants: Gas/ diesel. Layout and working of a typical Gas/Diesel based thermal power plant with electric generators. Gas/diesel-based combustion engines.

Unit – III Hydro Power Plants

Energy conversion process of hydro power plant. Classification of hydro power plant: High, medium and low head. Construction and working of hydro turbines used in different types of hydro power plant: a. High head – Pelton turbine b. Medium head – Francis turbine c. Low head – Kaplan turbine. Safe Practices for hydro power plants. Different types of micro- hydro turbines for different heads: Pelton, Francis and Kaplan turbines.

Unit– IV Solar Power Plant, Biomass based Power Plants and Wind Power Plants

Solar Map of India: Global solar power radiation. Solar Power Technology, Concentrated Solar Power (CSP) plants. construction and working of: Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors. Solar Photovoltaic (PV) power plant: layout, construction, working. Biomass-based Power Plants. Layout of a Bio-chemical based (e.g. biogas) power plant:Layout of a Thermo-chemical based (e.g. Municipal waste) power plant. Layout of an Agro-chemical based (e.g. bio-diesel) power plant. Features of the solid, liquid and gas biomasses as fuel for biomass power plant. Wind Map of India: Wind power density in watts per square meter. Layout of Horizontal axis large wind power plant. Geared wind power plant. Direct-drive wind power plant. Salient Features of electric generators used in large wind power plants: Constant Speed Electric Generators: Squirrel Cage Induction Generators (SCIG), Wound Rotor Induction Generator (WRIG), Variable Speed Electric Generators: Doubly-fed induction generator (DFIG), wound rotor synchronous generator (WRSG), permanent magnet synchronous generator (PMSG)

Unit– V Economics of Power Generation and Interconnected Power System

Related terms: connected load, firm power, cold reserve, hot reserve, spinning reserve. Base load and peak load plants; Load curve, load duration curve, integrated duration curve Cost of generation: Average demand, maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor. Choice of size and number of generator units, combined operation of power station. Causes and Impact and reasons of Grid system fault: State grid, national grid, brownout and black out; sample blackouts at national and international level.

Course Outcomes:

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 the optimised working of the thermal power plant.
b) Maintain the optimised working of large and micro hydro power plants.
c) Maintain the optimised working of solar and biomass-based power plants.
d) Maintain the optimised working of wind power plants.
e) Select the adequate mix of power generation based on economic operation.

Course Name: **Electric Power Generation System Lab**	
Semester-III (Electrical Engineering)	
Course Code:	23-EEPC-257
Course Title:	Electric Power Generation System Lab
Number of Credits:	Total:1 (L=0, T=0, P=2)

List of Practicals:

1. Study and write the routine maintenance parts of the coal fired thermal power plant after watchinga video programme
2. Study and write the routine maintenance parts of the gas fired thermal power plant after watching avideo programme
3. Study and write the routine maintenance parts of the nuclear fired thermal power plant after watchinga video programme.
4. Study and write the routine maintenance parts of the large hydro power plant after watching a videoprogramme
5. Study and write the routine maintenance parts of the micro hydro power plant after watching a videoprogramme.
6. Assemble a micro hydro power plant and then dismantle it.
7. Assemble the parabolic trough or parabolic dish Concentrated Solar Power (CSP) plant.
8. Assemble the solar PV plant to produce electric power and then dismantle it.
9. Assemble a small biogas plant to generate electric power
10. Dismantle the biogas plant.
11. Identify the routine maintenance parts of the large wind power plant after watching a videoprogramme.

Atleast 8 practicals from the above have to be performed

Course Name: **Electrical Engineering Drawing**	
Semester-III(Electrical Engineering)	
Course Code:	23-EEPC-209
Course Title:	Electrical Engineering Drawing
Number of Credits:	Total: 2(L=0, T=0, P=4)

Rationale:

A diploma holder in Electrical Engineering is supposed to have good knowledge of designing wiring schemes for domestic and power installation and also to draw layout for wiring diagram, so that execution job can be undertaken. He is also required to understand and interpret the drawings prepared by others. He should be familiar with the Indian standards and relevant Indian Electricity Rules. The design of the curriculum of this subject is done keeping in view the above requirements.

Learning Outcome:

After studying this course, students will be able to:

- Read, understand and interpret engineering drawings
- Communicate and co-relate through sketches and drawings
- Prepare working drawings of panels, transmission and distribution

Detailed Contents:

UNIT I. Symbols & Light Circuits

1.1 Various Electrical Symbols used in Domestic and Industrial Installation as per BIS.
1.2 Lights & Fan points controlled from individual switches.
1.3 Fluorescent tube controlled by two switches.
1.4 One lamp controlled by two switches, One bell controlled by one push button, Two bell controlled by three button.
1.5 Bell response circuit using one bell & a relay.
1.6 A light circuit which gets automatically connected to DC supply in case of power failure.

UNIT II. Connection Diagrams and Wiring Diagrams

2.1 Design and Drawing of panels/Distribution board using MCBs, ELCB, main switches etc. for domestic Installation.
2.2 Wiring circuit of sodium vapor lamp/high pressure mercury vapor lamp.
2.3 Wiring circuit of Automatic Electric Iron, Water Heater, Battery charger.
2.4 Star-Delta starter of three-phase induction motor.
2.5 Panel wiring diagram of parallel operation of three phase alternators. (Dark & Bright lamp).
2.6 Different types of earthing, drawings of plate and pipe earthing.

UNIT III. House Wiring

3.1 Installation plan, single & multi-line wiring diagram, selection and rating of necessary equipments and prepare a list of material required for electrical wiring of a small house (In batten/concealed conduit system).
3.2 Determination of size of distribution boards for multistoried buildings. Introduction to concept of rate schedule

UNIT IV. Service Line Connection

4.1 Layout diagram (from supply pole to building) and to prepare a list of materials required for giving a service line connection (single phase & three phase small loads)

UNIT V.Power Wiring for a Small Workshop

5.1 Installation plan, single line wiring diagram, selection & rating of necessary equipment & to prepare a list of materials required for a small workshop. Determination of size of panel for given loads, Introduction of concept of rate schedule.
5.2 Single line circuit & layout plan of 11/0.4 KV indoor substation (i.e. Key Diagram)
5.3 Single line circuit & layout plan of 66/11/0.4 KV outdoor substation with 11KV indoor switchgear (Key Diagram).

Learning Approach:

- For understanding and interpret co-relate the drawings with working drawings of panels, transmission and distribution.
- Teacher should show model of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instrument and its proper use.

References/suggested learning resources:

(a) Books

1) Electrical Engineering Design and Drawings by Surjeet Singh, Dhanpat Rai and Co, New Delhi
2) Electrical Engineering Design and Drawings by SK Bhattacharya, SK Kataria and Sons, New Delhi
3) Electrical Engineering Design and Drawings by Ubhi& Marwaha, IPH, New Delhi.
4) Electrical Design and Drawing by SK Sahdev, Uneek Publications, Jalandhar

(b) Open source software and website address:

1. https://wiki.librecad.org/index.php/LibreCAD_users_Manual
2. https://www.autodesk.in/campaigns/autocad-tutorials
3. https://www.youtube.com/watch?v=6gYLGt9DEqs An Introduction to AutoCAD Electrical.
4. https://www.youtube.com/watch?v=Ua2IK-PCfUU for single line diagram
5. https://www.youtube.com/watch?v=Z05xuqhGNZ8 AutoCAD Electrical Tutorial | Panel Drawings.

Course Name: **Summer Internship I**	
Semester-III(Electrical Engineering)	
Course Code:	23-EESI259
Course Title:	Summer Internship I
Number of Credits:	Total: 2 (L=0, T=2, P=0)

Rationale:

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.

Learning Outcome:

After studying this course, students will be able to:

- Demonstrate organizational setup, product range, manufacturing process, important machines and materials used in the training organization.
- Write daily & final report and its presentation later on.
- Demonstrate working culture of industry.
- Solve problem in industrial setup and to apply the knowledge and skills learnt in real life situations.

Detailed Contents

- Industrial training of a minimum of 4 weeks duration to be organized during the semester break starting after second Semester examinations.
- 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.
- Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An assessment has been provided in the study and evaluation scheme of III Semester. Evaluation of summer training report through viva-voce/presentation may comprise of weightage to performance in general behavior, quality of report, presentation during viva-voce examination 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.

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