TEACHING AND EXAMINATION SCHEME
FOR DIPLOMA **II Year ELECTRICAL ENGINEERING**
SESSION – 2015-2016 & ONWARDS
Third Semester

Code No.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks
		Hours per week				University's Exam.				Sessionals			
		L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)	
DEE 301	Applied Electronics	3	--	-	3	70	3	-	-	30	--	-	100
DEE 302	Mechanical Engineering	2	2/2	-	3	70	3	--	--	30	25	-	125
DEE 303	Electrical Technology	3	2/2	--	4	70	3	--	--	30	25	--	125
DEE 304	Electrical Engineering Materials	3	2/2	-	4	70	3	-	-	30	50	-	150
DEE 305	Non-Conventional Energy Sources	3	2/2	-	4	70	3	-	-	30	50	-	150
DEE 306	Electrical Instruments and Measurement	2	--	-	2	70	3	--	--	30	--	-	100
DEE 307	Electrical Workshop-I	2	--	-	2	70	3	-	-	30	--	-	100
	Total of TH	18	4	-	22	490		-	-	210	150	-	850
DEE 308	Applied Electronics Lab	-	-	2	2	-	-	-	-	-	-	50	50
DEE 309	Mechanical Engineering Lab	-	-	2	2	-	-	-	-	-	-	25	25
DEE 310	Electrical Technology Lab	-	-	2	2	-	-	50	3	-	-	25	75
DEE 311	Electrical Instruments and Measurement Lab	-	-	2	2	-	-	50	3	-	-	50	100
DEE 312	Electrical Workshop-I Lab	-	-	6	6	-	-	50	3	-	-	50	100
	Total of PR	-	-	14	14	-	-	150	-	-	-	200	350
	Grand Total	**18**	**4**	**14**	**36**	**490**	**-**	**150**	**-**	**210**	**150**	**200**	**1200**

1. L:Lecture
2. T:Tutorial
3. P:Practical
4. TH:Marks for University Examination for Theory
5. PR: Marks for University's Examination for Practicals
6. CT:Marks for Class Tests
7. TU:Marks for Tutorials
8. PR(S):Marks for Practical and Viva

TEACHING AND EXAMINATION SCHEME
FOR DIPLOMA **II Year ELECTRICAL ENGINEERING**
SESSION – 2015-2016 & ONWARDS
Fourth Semester

Code No.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks
		Hours per week				University's Exam.				Sessionals			
		L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)	
DEE 401	Electrical Machines-I	2	2/2	-	3	70	3	-	-	30	25	-	125
DEE 402	Electrical Circuit Theory	2	2/2	-	3	70	3	--	--	30	50	-	150
DEE 403	Generation of Electrical Energy	2	2/2	--	3	70	3	--	--	30	50	--	150
DEE 404	Electrical Estimating and Costing	2	-	-	2	70	3	-	-	30	-	-	100
DEE 405	Instrumentation	2	2/2	-	3	70	3	-	-	30	25	-	125
DEE 406	Electrical Design and Drawing	2	--	-	2	70	3	--	--	30	--	-	100
DEE 407	Electrical Workshop-II	2	--	-	2	70	3	-	-	30	--	-	100
	Total of TH	14	4	-	18	490		-	-	210	150	-	850
DEE 408	Electrical Machines-I Lab	-	-	2	2	-	-	50	3	-	-	25	75
DEE 409	Electrical Estimating and Costing Lab	-	-	2	2	-	-	50	3	-	-	50	100
DEE 410	Instrumentation	-	-	2	2	-	-	-	-	-	-	25	25
DEE 411	Electrical Design and Drawing Lab	-	-	6	6	-	-	50	3	-	-	50	100
DEE 412	Electrical Workshop-II Lab	-	-	6	6	-	-	50	3	-	-	50	100
	Total of PR	-	-	18	18	-	-	200	-	-	-	200	350
	Grand Total	**14**	**4**	**18**	**36**	**490**	**-**	**200**	**-**	**210**	**150**	**200**	**1250**

5. L:Lecture
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TEACHING AND EXAMINATION SCHEME
FOR DIPLOMA **III Year ELECTRICAL ENGINEERING**
SESSION – 2016-2017 & ONWARDS
Fifth Semester

Code No.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks
		Hours per week				University's Exam.				Sessionals			
		L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)	
DEE 501	Electrical Machines-II	3	2/2	-	4	70	3	-	-	30	25	-	125
DEE 502	Power Electronics	2	--	-	2	70	3	--	--	30	--	-	100
DEE 503	Transmission and Distribution	3	2/2	--	4	70	3	--	--	30	50	--	150
DEE 504	Utilization of Electrical Power	3	2	--	5	70	3	--	--	30	50	--	150
DEE 505	Electrical Maintenance and Repair	2	--	-	2	70	3	-	-	30	--	-	100
DEE 506	**Elective – I** DEE 5061 Electromagnetic Field Theory DEE 5062 Electric Traction System	 2 2	 2 2	 -- --	 4 4	 70 70	 3 3	 -- --	 -- --	 30 30	 50 50	 -- --	150
DEE 507	**Elective – II** *DEE 5071 'C' Programming *DEE 5072 Computer in Business Systems	 2 2	 -- --	 - -	 2 2	 70 70	 3 3	 -- --	 -- --	 30 30	 -- --	 - -	100
	Total of TH	17	6	-	23	490		-	-	210	175	-	875
DEE 508	Electrical Machines-II Lab	-	-	2	2	-	-	50	3	-	-	25	75
DEE 509	Power Electronics Lab	-	-	3	3	-	-	-	-	-	-	50	50
DEE 510	Electrical Maintenance and Repair Lab	-	-	6	6	-	-	50	3	-	-	50	100
DEE 511	**Elective – II** *DEE 5111 'C' Programming Lab *DEE 5112 Computer in Business Systems Lab	-	-	2 2	2 2	-	-	-	-	-	-	50 50	50
DEE 512	Practical Training (24 Working Days)							100					
	Total of PR	-	-	13	13	-	-	200	-	-	-	175	375
	Grand Total	**17**	**6**	**13**	**36**	**490**	**-**	**200**	**-**	**210**	**175**	**175**	**1250**

9. L:Lecture
10. T:Tutorial
11. P:Practical
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6. CT:Marks for Class Tests
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*DEE 5071 & DEE 5111Common for All Branches of Engineering except CS & CE *DEE 5072 & DEE 5112 Common for All Branches of Engineering

TEACHING AND EXAMINATION SCHEME
FOR DIPLOMA **III Year ELECTRICAL ENGINEERING**
SESSION – 2016-2017 & ONWARDS
Sixth Semester

Code No.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks
		Hours per week				University's Exam.				Sessionals			
		L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)	
DEE 601	Electrical Machines-III	3	2	-	5	70	3	-	-	30	50	-	150
DEE 602	Microprocessor and Its Application	3	-	-	3	70	3	--	--	30	-	-	100
DEE 603	Switchgear and Protection	3	2	--	5	70	3	--	--	30	50	--	150
DEE 604	Electrical Installation and Design	2	-	-	2	70	3	-	-	30	-	-	100
DEE 605	Control System Engineering	3	2	-	5	70	3	-	-	30	50	-	150
DEE 606	**Elective – III** DEE 6061 Basic Digital Electronics DEE 6062 Electrical Machine Design DEE 6063 Power System Analysis	2 2 2	- 2 2	- - -	2 4 4	70 70 70	3 3 3	- - -	- - -	30 30 30	- 50 50	- - 	100 150 150
DEE 607	**Elective – IV** *DEE 6071 Management *DEE 6072 Entrepreneurship Development *DEE 6073 Production System Management	2 2 2	2 2 2	- - -	4 4 4	70 70 70	3 3 3	- - -	- - -	30 30 30	50 50 50	- - -	150
	Total of TH	18		-	26	490		-	-	210		-	
DEE 608	Microprocessor and Its Application	-	-	2	2	-	-	50	3	-	-	50	100
DEE 609	Electrical Installation and Design	-	-	6	6	-	-	50	3	-	-	50	100
DEE 610	**Elective – III** DEE 6061 Basic Digital Electronics	-	-	2	2	-	-	-	-	-	-	50	50
DEE 611	Project (24 Working Days)							100					
	Total of PR	-	-	10	10	-	-	200	-	-	-	150	250
	Grand Total	**18**			**36**	**490**	**-**	**200**	**-**	**210**	**200**	**150**	**1250**

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*DEE 5071 & DEE 5111Common for All Branches of Engineering except CS & CE *DEE 5072 & DEE 5112 Common for All Branches of Engineering

APPLIED ELECTRONICS

CODE DEE 301

L	T	P
3	--	2

RATIONALE

Applied electronics has the close relation with electrical engg. and at present the knowledge of applied electronics engg. is extensively used in all branches of engg. so for a diploma holder in electrical engg., it has become essential to have adequate knowledge of electronic devices.

The course covered in this subject provide sufficient knowledge of semiconductor devices as well as P-N junction, rectifiers, bipolar junction transistor, RC coupled amplifier, special devices, feedback amplifier and oscillator.

CONTENTS

1. Semiconductors:

1.1 Basic idea of semiconductors. N and P type semi-conductors
1.2 Potential barrier and temperature effect on barrier potential
1.3 Concept of energy band diagram for intrinsic and extrinsic semiconductors

2. Semi Conductor Diod:

2.1 P-N junction diode
2.2 P-N junction diode in forward and reverse bias
2.3 V-I characteristics of forward and reverse bias diodes
2.4 V-I characteristics of zener diode and its applications
2.5 Semiconductor diode as half wave rectifier, its efficiency and ripple factor
2.6 Semiconductor diode as full wave rectifier, its efficiency and ripple factor
2.7 Bridge rectifier, Overall comparison between half wave and other full wave rectifiers
2.8 Peak inverse voltage (PIV)
2.9 Use of filter circuit in rectifiers

2.9.1 L filter
2.9.2 C filter
2.9.3 LC section filter
2.9.4 π section filter

3. Bi-Polar Junction Transistor:

3.1 Concept of transistor
3.2 Types of transistor and their working in forward and reverse bias
3.3 Constants of transistor (α,β,γ)
3.4 Analysis of transistor amplifier, load line
3.5 Operating point and biasing
3.6 Input - output characteristics in CB, CC and CE configuration
3.7 Low frequency small signal hybrid equivalent circuit of transistor
3.8 Derivation of voltage, current and power gain, input and output impedance of CE configuration

4. R-C Coupled and Power Amplifier:

4.1 Gain at low, mid and high frequency range, cut off frequencies
4.2 Concept of power amplifiers
4.4 Types of power amplifier
4.5 Class A power amplifier, output power analysis
4.6 Push-pull amplifier.
4.7 Class - B power amplifier

5. Special Devices:

5.1 Construction, operation, equivalent circuit and characteristics of

5.1.1 JFET, MOSFET, CMOS
5.1.2 Semiconductor photo devices such as LED, LDR, photo transistor
5.1.3 Varactor diode

6. Feed Back and Oscillators:

6.1 Basic concept of feedback and types of feedback
6.2 Advantages and disadvantages of negative feedback for gain, stability, frequency and nonlinear distortion
6.3 Voltage series, shunt and current series and shunt feed back circuit
6.4 Use of positive feedback for oscillators
6.5 Barkhausen criteria
6.6 Principles of RC phase shift, Wein bridge oscillator
6.7 Principle of Hartely, Colpits oscillator
6.9 Crystal oscillator and its frequency stability criteria

PRACTICALS

1. To plot V-I characteristics of P-N semiconductor diode in forward and reverse bias
2. To plot the V-I characteristics of a zener diode and design a voltage regulator using zener diode.
3. Observe the wave form for HWR and calculate ripple factor.
4. Observe the wave form for FWR and calculate ripple factor.
5. Observe the wave form for bridge rectifier and calculate ripple factor
6. Observe the wave form for capacitor filter and find the effect of value of capacitor on ripple factor.
7. To plot input output characteristics of P-N-P transistor in CB configuration.
8. To plot input output characteristics of P-N-P transistor in CE configuration.
9. To plot V-I characteristics of N-P-N transistor in CB configuration
10. To plot V-I characteristics of N-P-N transistor in CE configuration
11. To calculate the operating point of N-P-N transistor for CE configuration
12. To study and perform RC phase shift oscillators
13. To study and perform Wein bridge oscillator.
14. To study and perform Hartely oscillators
15. To study the push-pull amplifier circuit
16. Observe the response of amplifier with feed back and without feed back.

REFERENCE BOOKS:

1. Integrated Electronics — Millman & Halkias (TMH)
2. Electronics Principle — V.K.Mehta (Student Pub.)
3. Electronics Devices & Circuits — A. Mottershead (PHI)
4. Electronics Principle — Malvino (TMH)
5. Electronics Devices & Circuits — Sanjeev Gupta

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MECHANICAL ENGINEERING

CODE DEE 302

L	T	P
2	2/2	2

RATIONALE

A Diploma holder in electrical engineering absorbed in State electricity boards & industries has to deal with the different types of water turbines, pumps, steam engine & boilers, therefore the basic construction/working of types of steam & water prime movers becomes essential. This subject fulfills the above need.

CONTENTS

1. Mechanical Properties of Metals:

1.1 Definitions -

- 1.1.1 Elasticity
- 1.1.2 Plasticity
- 1.1.3 Ductility
- 1.1.4 Brittleness
- 1.1.5 Toughness
- 1.1.6 Hardness
- 1.1.7 Malleability
- 1.1.8 Fatigue

1.2 Examples of applications of above terms related to electrical engineering.

2. Basic Concept of Thermal Engineering:

2.1 Energy
2.2 Internal energy
2.3 Potential energy
2.4 Kinetic energy
2.5 Heat
2.6 Work and enthalpy
2.7 Specific heat
2.8 Specific heat ratio
2.9 Characteristics gas equation
2.10 Universal gas constant
2.11 First law of thermodynamics
2.12 Second law of thermodynamics

3. Hydraulics:

3.1 Physical properties of a fluid

- 3.1.1 Density
- 3.1.2 Specific volume
- 3.1.3 Specific weight
- 3.1.4 Specific gravity
- 3.1.5 Viscosity

3.2 Pascal's law

4. Pressure Measuring Devices:

4.1 Manometers

- 4.1.1 Simple manometers
- 4.1.2 Differential manometers
- 4.1.3 Inverted 'U' tube

4.2 Pressure gauges
4.3 Continuity equation

5. Bernaulli's Theorem:

5.1 Energy of a fluid

5.1.1 Pressure energy
5.1.2 Velocity energy
5.1.3 Datum energy

5.2 Venturimeter & its uses

6. Pumps:

6.1 Types of lumps
6.2 Centrifugal pump
6.3 Reciprocation pump
6.4 Their relative advantages and performance

7. Turbine:

7.1 Working principles and types of water turbines
7.2 Selection of turbines
7.3 Brief idea of turbine

7.3.1 Pelton wheel turbine
7.3.2 Francis turbine

8. Properties of Steam:

8.1 Generation of steam at constant pressure
8.2 Enthalpy of water wet steam
8.3 Enthalpy of dry saturated stem
8.4 Dryness fraction
8.5 Superheated steam
8.6 Latent enthalpy
8.7 Enthalpy of steam
8.8 Specific volume
8.7 External work during evaporation
8.8 Internal content enthalpy
8.9 Internal energy of steam
8.10 Use of steam table
8.11 Simple numerical problems

9. Boilers:

9.1 Classification of boilers
9.2 Working of common boilers

9.2.1 Babcox and Wilcox
9.2.2 Chichram boiler

9.3 Boiler mounting and their accessories
9.4 Introduction to modern high pressure boiler for thermal power station (Lamont boiler, weffler boiler, Benson boiler and Velox boiler).

10. Steam Turbines:

10.1 Introduction
10.2 Types of steam turbine
10.3 Working principle of steam turbine
10.4 Uses and advantages of steam turbine

11. I.C. Engines:

11.1 I.C. engine cycle (otto, diesel)
11.2 Working principle of

11.2.1 Two stroke petrol and diesel
11.2.2 Four stroke petrol and diesel

12. Transmission:

12.1 Belt drive
12.2 Rope drive
12.3 velocity ratio
12.4 Tension ratio
12.5 Effect of centrifugal tension
12.6 Application of these drives

13. Lubrication:

13.1 Object of lubrication
13.2 Different methods of lubrication
13.3 Properties of lubricants

PRACTICALS

1. Verification of Bernualli's theorem
2. Determination of coefficient of venturimeter
3. Study of reciprocating pump and centrifugal pumps.
4. Testing of centrifugal pump for discharge & heads.
5. Study of Pelton wheel & Francis turbines.
6. Study of boiler available, its mountings & accessories.
7. Study of steam turbine.
8. Study of constructional features & working of cooling towers, ponds.
9. Study of two-stroke petrol engine.
10. Study of four-stroke petrol engine.
11. Study of four-stroke diesel engine.

REFERENCE BOOKS:

1.	Thermodynamics & Heat Power Engg.	Mathur & Mehta
2.	Thermal Engg.	P.L. Ballaney
3.	Hydraulics & Hyd. Machines	Khurmi
4.	Strength of Materials	G.C.Singh
5.	Heat Engines	Pande & Shah

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ELECTRICAL TECHNOLOGY

CODE DEE 303

L	T	P
3	2/2	2

RATIONALE

A Diploma holder in electrical engineering is expected to be well conversant with the basics of D.C. circuits, A.C. circuits, capacitive and inductive circuits. This subject covers the basic principles, which are required for a thorough understanding of electrical Technology.

CONTENTS

1. D.C. Circuits:

1.1 Resistance, specific resistance, Ohm's law, Resistance in series, parallel and series parallel circuits.
1.2 Kirchhoff's laws
1.3 Application of Kirchhoff's laws

2. Capacitance:

2.1 Capacitor
2.2 Capacitance of an isolated sphere
2.3 Parallel plate capacitor
2.4 Special cases of parallel plate capacitor
2.5 Cylindrical capacitor
2.6 Capacitor in series and parallel
2.7 Capacitor with compound dielectric
2.8 Energy stored in capacitor
2.9 Charging and discharging of a capacitor, time constant
2.10 Different types of capacitor used in various electrical applications.

3. Magnetic Circuits:

3.1 Introduction
3.2 Comparison between magnetic circuit and electric circuits
3.3 Behavior of magnetic circuits
3.4 Composite magnetic circuits
3.5 Parallel magnetic circuits
3.6 B-H curve
3.7 Rise of current in inductive circuit
3.8 Decay of current in inductive circuit
3.9 Eddy current and Eddy current loss

4. Phasor Algebra:

4.1 Mathematical representation of a vector
4.2 Symbolic notation
4.3 Significance of operator-j
4.4 Conjugate complex number
4.5 Trigonometrical form of vector representation
4.6 Exponential form of vector representation
4.7 Polar form of vector representation
4.8 Addition and subtraction of vector
4.9 Multiplication and division of vector quantity
4.10 120^{o} operator

5. A.C. Circuits:

5.1 Alternating quantity and its equation
5.2 Maximum, Average and RMS values.
5.3 Form factor
5.4 Behaviour of R, L and C in A.C. circuits with phasor diagrams
5.5 A.C. through R-L circuit, power factor, active and reactive component of current, power

5.6 Q-factor of a coil
5.7 A.C. through R-C circuit, dielectric loss and power factor of a capacitors
5.8 Solving series R-L-C circuits
5.9 Solving A.C. parallel circuit by phasor diagram and phasor algebra
5.10 Solving A.C. series and parallel circuits.

6. Polyphase System:

6.1 Need and advantage of 3-phase system
6.2 Generation of 3-phase voltage
6.3 Phase sequence
6.4 Star-Delta connections
6.5 Phase and Line relations of voltage and current in star -delta connections (for balanced load)
6.6 Expression of power in 3-phase circuits (for balanced load)

7. Battery:

7.1 Types of storage batteries
7.2 Construction and working of Lead acid batteries and Ni-Fe batteries
7.3 Discharging and recharging of Lead acid batteries
7.4 Care of Lead acid batteries
7.5 Ampere and watt-hour efficiencies

PRACTICALS

1. Measurement of armature winding and series field winding resistance of a D.C. machine by ammeter-voltmeter method.
2. Measurement of shunt field winding resistance of a D.C. machine by ammeter- voltmeter method.
3. Verification of Kirchhoff's laws in D.C. circuits.
4. Verification of Kirchhoff's laws in A.C. circuits.
5. Determination of B-H curve of a D.C. machine.
6. Measurement of power and power factor of single phase R-L-C series circuit
7. Determination of R and L of a choke coil using 3-voltmeter and an ammeter.
8. Determination of R and C of a capacitor using 3-ammeter and a voltmeter
9. Measurement of phase and line voltage and current in Star and Delta connection
10. Measurement of power in 3-phase circuit (for balanced load)
11. Study of lead acid battery
12. Charging and discharging of lead acid battery.

REFERENCE BOOKS:

1. Electrical Engineering (Hindi & English) K.D.Sharma
2. Electrical Technology B.L.Theraja
3. Electrical Engineering (Part-I) D.R.Nagpal
4. Electrical Technology J.B.Gupta
5. Basic Electrical Engg. V.N. Mittal
6. Basic Electrical Engg. Nagrath & Kothari

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ELECTRICAL ENGINEERING MATERIALS

CODE DEE 304

L	T	P
3	2/2	--

RATIONALE

A diploma holder in electrical engineering will be involved in efficient & effective maintenance, repair & production of electrical equipment & systems. In addition, he may be required to procure, inspect & test Electrical Engineering materials. Knowledge of properties of various types of materials is required in order to execute the above mentioned functions. He may also have to decide for an alternative when a particular material is either not readily available in the market or its cost becomes prohibitive.

CONTENTS

1. Classification:

1.1 General requirement of electrical engineering materials,
1.2 Classification of materials into conducting, semi-conducting and insulating materials through a brief reference to atomic structure

2. Conducting Materials:

2.1 Resistivity
2.2 Factors affecting resistivity such as

- 2.2.1 Temperature
- 2.2.2 Alloying
- 2.2.3 Aging effect

2.3 Classification of conducting materials into -

- 2.3.1 Low resistivity materials
- 2.3.2 High resistivity materials

3. Low Resistivity Materials:

3.1 General properties of copper, aluminium and steel as Conductors

- 3.1.1 Resistivity
- 3.1.2 Temperature coefficient
- 3.1.3 Contact resistance
- 3.1.4 Melting point
- 3.1.5 Density

3.2 Mechanical properties of hard and annealed copper, aluminium and low and high tensile steel

- 3.2.1 Mechanical strength
- 3.2.2 Resistance to corrosion
- 3.2.3 Ductility
- 3.2.4 Solderability etc.

3.3 Use of copper, aluminium with steel as a conductors and their comparison

4. High Resistivity Materials:

4.1 General properties, composition and use of high resistivity Materials as

- 4.1.1 Nichrome
- 4.1.2 Eureka

4.1.3 Manganin
4.1.4 German silver
4.1.5 Tungsten
4.1.6 Platinum

4.2 Materials for lamp filaments and their properties

5. Contact Materials:

5.1 General properties and uses of contact materials such as

5.1.1 Silver
5.1.2 Tungsten
5.1.3 Copper

6. Brush Materials:

6.1 General properties and uses of brush materials such as

6.1 Carbon
6.2 Electro graphite
6.3 Metal graphite

7. Insulating Materials:

7.1 Electrical properties

7.1.1 Volume resistivity
7.1.2 Surface resistance
7.1.3 Dielectric strength
7.1.4 Dielectric constant

7.2 Physical properties

7.2.1 Specific gravity
7.2.2 Viscosity
7.2.3 Hygroscopicity

7.3 Thermal properties

7.3.1 Heat resistance
7.3.2 Thermal conductivity
7.3.3 Ignitibility
7.3.4 Thermal expansion and contraction
7.3.5 Thermal stability of composition

7.4 Chemical properties

7.4.1 Solubility
7.4.2 Chemical resistance
7.4.3 Weatherability

7.5 Classification of insulating materials on the basis of Temperature limit

7.6 Composition, properties and applications of

7.6.1 Fibrous materials
7.6.2 Ceramics
7.6.3 Mica and mica products
7.6.4 Asbestos and asbestos products
7.6.5 Glass and glass products
7.6.6 Natural and synthetic rubber
7.6.7 PVC
7.6.7 Bakelite

7.7 Properties of liquid insulating materials such as

7.7.1 Transformer oils
7.7.2 Mineral insulating oils

7.8 Properties of gaseous insulating materials such as

7.8.1 Hydrogen
7.8.2 Air
7.8.3 SF_6

8. Magnetic Materials:

8.1 Terminology and classification

8.1.1 Diamagnetic material
8.1.2 Paramagnetic material
8.1.3 Ferromagnetic material

8.2 Effect of Curie temperature
8.3 Hysteresis loop
8.4 Soft and hard magnetic materials
8.5 Different magnetic materials such as

8.5.1 Soft ferrites
8.5.2 Silicon steel
8.5.3 Nickel Iron alloys
8.5.4 Cobalt steel
8.5.5 Tungsten steel
8.5.6 ALNICO
8.5.7 ALNI

9. Semiconducting Materials and their Properties:

10. Special Purpose Materials:

10.1 Metals/ alloys for fuses with their properties composition & uses
10.2 Composition and properties of soldering materials
10.3 Materials for thermocouple
10.4 Materials for bimetal
10.5 Super conductivity and super conducting materials application and recent trend in this field.

REFERENCE BOOKS:

1. Electrical Engineering Materials T.T.T.I. Madras
2. Electrical Engineering Materials Raina, Bhattacharya
3. Electrical Engg. Materials B.R. Sharma

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NON-CONVENTIONAL ENERGY SOURCES

CODE DEE 305

L	T	P
3	2/2	--

RATIONALE

The conventional sources of energy are depleting day by day and will not be sufficient to meet the future demand of energy. Therefore, there is a need for generation of energy by using non-conventional sources. With this in view diploma holders should be conversant with basic knowledge and practical applications of non-conventional sources of energy in rural, cottage and small industries. For rural development it is desirable to ensure the living conditions of the people in villages. For this purpose technology transfer to meet the rural needs, with the facilities available is essential, i.e. appropriate technology.

CONTENTS

1. Sources of Energy:

- 1.1 Different sources
- 1.2 Application of sources with reference to Rajasthan

2. Solar Energy:

- 2.1 Application
- 2.2 Unit of solar power and solar energy
- 2.3 Historical review and future prospects
- 2.4 Schematic diagram of a solar thermal power plant
- 2.5 Solar central receiver thermal power plant
- 2.6 Solar pond thermal plant
- 2.7 Solar thermal power supply system for space station
- 2.8 Introduction to photo voltaic system
- 2.9 Merits and limitation of solar PV system
- 2.10 Principle of photo voltaic cell
- 2.11 V-I characteristics of solar cell
- 2.12 Efficiency of a solar cell
- 2.13 Transparent, insulating and absorbing materials
- 2.14 Building heating by active and passive system
- 2.15 Solar still, solar dryer and solar cooker
- 2.16 Solar seasoning of timber

3. Wind Energy:

- 3.1 Introduction to wind energy
- 3.2 Merits and demerits of wind energy
- 3.3 Wind power and energy pattern factor
- 3.4 Wind machine
  - 3.4.1 Horizontal axis wind machine
  - 3.4.2 Vertical axis wind machine
- 3.5 Site selection of a wind machine
- 3.6 Maintenance of a wind machine
- 3.7 Efficiency of a wind machine
- 3.8 Application of a wind machine

4. Bio-Gas Energy:

- 4.1 Introduction to bio-gas energy
- 4.2 Properties of bio-gas
- 4.3 Principle of bio-gas production
- 4.4 Chemical and microbiological processors
- 4.5 Factors which affects bio-gas production
- 4.6 Different feed stocks for bio-gas production
- 4.7 Classification of bio-gas plant

4.7.1 Fixed dome type
4.7.2 Floating type

4.8 Comparison between fixed dome and floating type bio-gas plant
4.9 Site selection of bio-gas plant
4.10 Selection of size and specification of bio-gas plant
4.11 Water removing devices
4.12 Maintenance of bio-gas plants
4.13 Bio gas lamp and chulha
4.14 Bio gas storage and transportation
4.15 Purification of bio-gas
4.16 Environmental effect of bio-gas plant
4.17 Visit to a bio-gas plant
4.18 Preparation of a project report on a bio-gas plant

5. Ocean Energy:

5.1 Introduction to ocean energy
5.2 Types of ocean energy

5.2.1 Open cycle
5.2.2 Closed cycle

6. Appropriate Technology:

6.1 Introduction to appropriate technology
6.2 Concepts of appropriate technology
6.3 Need of appropriate technology
6.4 Merits and demerits
6.5 Comparison between appropriate and modern technology
6.6 Application

REFERENCE BOOKS:

1. Energy technology — S.Rao & B.B. Parulekar
2. Non-conventional Energy Sources — A.N. Mathur & N.S.Rathore
3. Non-conventional Sources of energy and appropriate technology — D.M. Agrawal & S.K. Bhatnagar
4. Non-conventional Energy Sources — G.D.Rai
5. Solar Energy — Garg & Prakash

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ELECTRICAL INSTRUMENTS AND MEASUREMENT

CODE DEE 306

L	T	P
2	--	2

RATIONALE

A diploma holder in electrical engineering where ever placed on job, has to select a suitable measuring instruments for measuring electrical quantities, so he/she should have adequate knowledge of construction, working, application, specification and errors of different measuring instruments.

This subject covers most commonly used electrical instruments and measuring processes for above need.

CONTENTS

1. Classification of Measuring Instruments:

- 1.1 Indicating, recording and integrating instruments
- 1.2 Accuracy and sensitivity
- 1.3 Types of errors
- 1.4 Deflecting, controlling and damping torque
- 1.5 Construction, working principle and operation of PMMC, moving iron (MI), dynamometer type ammeter and voltmeter.
- 1.6 Rectifier type instruments
- 1.7 Electrostatic voltmeter
- 1.8 Range extension using shunts and multipliers

2. Wattmeters and Energy Meters:

- 2.1 Construction, operation and working principles
  - 2.1.1 Dynamometer type wattmeter
  - 2.1.2 Induction type wattmeter
- 2.2 Blondels theorem and measurement of power by two wattmeter method in 3-phase circuits
- 2.3 Single phase and three phase induction type energy meter
- 2.4 Testing of single phase induction type energy meter by direct and phantom loading.
- 2.5 Adjustments of single phase induction type energy meter
- 2.6 Brief study of static energy meter (single and 3 phase)

3. Measurement of Resistance:

- 3.1 Classification of resistance
- 3.2 Measurement of low resistance by Kelvin's double bridge
- 3.3 Measurement of medium resistance by Ammeter and Voltmeter, Whetstone's bridge, Substitution methods
- 3.4 Measurement of high resistance and insulation resistance
- 3.5 Megger, Earth tester and Ohmmeter

4. Potentiometers:

- 4.1 Types of A.C. and D.C. potentiometers
- 4.2 Construction
- 4.3 Standardisation
- 4.4 Applications

5. A.C. Bridges:

- 5.1 General equation for bridge balance
- 5.2 Maxwell's inductance bridge
- 5.3 Maxwell's inductance capacitance bridge
- 5.4 Anderson's bridge
- 5.5 Schering bridge
- 5.6 Wein's bridge for frequency measurements

6. Brief study of:

6.1 CRO
6.2 Electronic voltmeter

PRACTICALS

1. Study of constructional features and calibration of moving iron and moving coil type ammeter and voltmeter.
2. Study of constructional features and calibration of dynamometer type wattmeter and induction type energy meter.
3. Measurement of power in 3-phase circuits by two wattmeter method
4. Testing of single-phase induction type energy meter by direct and phantom loading.
5. Measurement of resistance by Kelvin's double bridge
6. Measurement of resistance by Whetstone bridge
7. Study of the constructional details and working of Megger and measurement of insulation resistance.
8. Measurement of Earth's resistance by Earth tester
9. Study and use of multimeter
10. Calibration of ammeter and voltmeter by D.C. potentiometer
11. Measurement of resistance by D.C. potentiometer
12. Measurement of inductance and capacitance with the help of a suitable A.C. Bridge
13. Measurement of frequency using CRO

REFERENCE BOOKS:

1. Electrical Measurement & Instrumentation A.K.Sawhney
2. Electrical Measurement & Instruments J.B.Gupta
3. Electrical Measurement E.W.Golding
4. Electrical Measurement D.R.Nagpal

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ELECTRICAL WORKSHOP - I

CODE DEE 307

L	T	P
2	--	6

RATIONALE

A diploma holder in electrical engineering has to perform supervisory duty in industries and Electricity Corporation. He/ She should have adequate knowledge as well as should be able to educate his/her subordinates for electrical wiring, wiring circuits, fault investigation and repair of domestic appliances.

CONTENTS

1. Wiring:

1.1 System of wiring
1.2 Types of wiring and their application

2. Wire Joints:

2.1 Different types of joints
2.2 Their uses

3. Wiring Diagram of Different Lamp Control Circuits and Their Working:

3.1 Bell indicator
3.2 Fluorescent tube (single and double)
3.3 Mercury vapour lamp
3.4 Sodium vapour lamp
3.5 Neon sign lamp
3.6 Flasher

4. Study the Following Circuit:

4.1 Emergency light
4.2 Voltage stabilizer
4.3 Domestic refrigerator

5. Fault Investigation and Testing :

5.1 Specification, wiring, dismantling, fault investigation, repairing, assembling and testing the following electrical appliances -

5.1.1 Electric heater
5.1.2 Electric immersions heater
5.1.3 Room heater
5.1.4 Electric kettle
5.1.5 Electric soldering iron

6. Automobile Electrical System:

6.1 Dynamo
6.2 Self starter
6.3 Voltage regulator
6.4 Ignition coil
6.5 Lighting circuit

6.5.1 Four wheeler
6.5.2 Two wheeler

PRACTICALS

1. To test polarity of supply

   1.1 By tester
   1.2 By test lamp

2. Study of conduit and PVC casing capping wiring fitting and preparations of following circuits in above wiring -

   2.1 Control of one lamp from one point by a single pole switch
   2.2 Control of two lamp from two points by two single pole switches.
   2.3 Control of one lamp from two places by two way switches (staircase wiring)

3. Preparations of straight joints on multistrand insulated wire

   3.1 Twisted joint
   3.2 Married joint

4. Preparation of cross joints on insulated wires

   4.1 Plain cross joint
   4.2 Duplex cross joint

5. Preparation of wiring diagram and wiring of the following -

   5.1 Sodium vapour lamp
   5.2 Mercury vapour lamp
   5.3 Corridor wiring
   5.4 Row of lamps (decorative light)
   5.5 Double Fluorescent tube of 40 watts

6. To make the positions, fix and complete the internal wiring of the fitting of a switch board, containing at least four switches, one plug and one regulator.

7. Assembling, dismantling and fault investigation in the following domestic appliances

   7.1 Electric heater
   7.2 Electric immersion heater
   7.3 Room heater
   7.4 Electric kettle
   7.5 Electric soldering iron

REFERENCE BOOKS:

1. Study of electrical appliances and devices — K.B. Bhatia
2. Workshop practice in electrical engineering — M.L. Gupta
3. Electrical wiring — Arora, B.Dass
4. Domestic Appliance — Secondary Education Board Rajasthan, Ajmer
5. Basic shop practicals in electrical Engg. — Vinod kumar, & K. Vajay

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ELECTRICAL MACHINES - I

CODE DEE 401

L	T	P
2	2/2	2

RATIONALE

An electrical diploma holder is usually placed in Electricity Corporation, industries, public departments etc. An electrical diploma holder has to handle different electrical machines required for various types of jobs. They are to supervise the selection, installation, operation, maintenance, testing and repair of electrical machinery used in various industrial, domestic and other applications.

The most commonly used electrical machines are D.C. machines, A.C. machines, transformers, rectifiers etc. Knowledge of construction working and performance characteristics of such machines is a must for a diploma holder for doing job efficiently. D.C. machines, transformers and rectifiers have been covered in this subject.

CONTENTS

1. D.C. Generator:

1.1 Construction of D.C. machine
1.2 Lap and wave winding (Brief idea)
1.3 Principle of D.C. generator
1.4 Excitation methods and different types of D.C. Generator
1.5 E.M.F. equation
1.6 D.C. generator characteristics
1.7 Losses
1.8 Efficiency and condition for maximum efficiency
1.9 Concept of armature reaction
1.10 Effect of armature reaction on commutation and generated voltage.

2. D.C. Motor:

2.1 Different types of D.C. motor
2.2 Principle of D.C. motor
2.3 Concept of back emf
2.4 Torque, speed and power relations
2.5 Starters for D.C. shunt and compound motors
2.6 Characteristics of D.C. motor
2.7 Speed control of D.C. motor

2.7.1 Field control
2.7.2 Armature control
2.7.3 Series parallel control

2.8 Testing of D.C. machine by

2.8.1 Direct loading
2.8.2 Swineburn's test
2.8.3 Hopkinson's test and
2.8.4 Calculation of efficiency as a generator and motor from above test

3. Transformer:

3.1 Construction of single phase and three phase transformer
3.2 Principle of operation
3.3 Emf equation and Turn ratio
3.4 Idea of leakage reactance
3.5 Transformer phasor diagram

3.5.1 at no load
3.5.2 at load (Lagging, Leading and UPF)

3.6 Equivalent circuit of single phase transformer
3.7 Losses, efficiency and regulation
3.8 Condition for maximum efficiency

3.9 All day efficiency
3.10 Transformer testing

3.10.1 by direct loading
3.10.2 by open circuit and short circuit test

3.10.2.1 Determination of equivalent circuit parameters

3.10.3 Back to back test

3.11 Parallel operation of single-phase transformer with equal and unequal voltage ratio.
3.12 Off load and on load tap changers
3.13 Auto transformer
3.14 Poly phase connection (Descriptive study)

3.14.1 Scott connection
3.14.2 Open-Delta connection
3.14.3 Star-Star connection
3.14.4 Delta - Delta connection

3.15 Parallel operation of 3-phase transformer

PRACTICALS

1. Study of constructional features of D.C. machine and identify the terminals of D.C. shunt generator.
2. Determination of O.C.C of D.C. shunt generator
3. Determination of external characteristics of D.C. Shunt generator.
4. Determination of external characteristics of compound generator
5. Study of constructional features of D.C. shunt and compound motor starter and connecting, starting and reversing the direction of D.C. shunt motor.
6. Performing Swineburne's test on a D.C. machine
7. Performing Hopkinson's test on a D.C. machine.
8. Speed control of D.C. shunt motor by rheostatic control (both field and armature control)
10. Study of constructional features of single phase and three phase transformers
11. Determination of transformation ratio, regulation and efficiency of a single-phase transformer by direct loading.
12. Open circuit and short circuit test of a single-phase transformer and determination of its equivalent circuit parameters, efficiency and regulation.
13. Parallel operation of single-phase transformers with same voltage ratio and sharing of loads.

REFERENCE BOOKS:

1. Vidyut Engg. (S.I.Units) (Hindi) K.D.Sharma
2. Electrical Engg. Part I& II (Hindi) D.R.Nagpal
3. Electrical Engg. (Hindi) J.B.Gupta
4. Electrical Technology S.L.Uppal
5. Electrical Technology B.L.Theraja
6. A Basic Course in Electrical Engg. Sharma & Gupta
7. Electric Machine P.S. Bimbra
8. Electric Machine Nagrath & Kothari

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ELECTRICAL CIRCUIT THEORY

CODE DEE 402

L	T	P
2	2/2	--

RATIONALE

A diploma holder in electrical engg.is expected to analyse electrical and electronic circuits and networks during his job. For this sound understanding of the concept and methods of analysis of electrical circuits and network is a must for him. This course will develop analytical abilities of students in solving problems.

CONTENTS

1. Network Parameters:

- 1.1 Active and passive
- 1.2 Linear and non-linear
- 1.3 Unilateral and bilateral
- 1.4 Lumped and distributed
- 1.5 Time varying and time invariant parameters
- 1.6 Voltage and current sources (ideal and practical)
- 1.7 Dependent and Independent sources
- 1.8 Source conversion techniques

2. Network Theorems:

- 2.1 Kirchhoff's law, node and mesh analysis, Solution by Kramer's rule up to three variables
- 2.2 Superposition theorem
- 2.3 Thevenin's theorem
- 2.4 Norton's theorem
- 2.5 Maximum power transfer theorem
- 2.6 Tellegen's theorem
- 2.7 Star-delta transformation
- 2.8 Millman's theorem

3. Resonance:

- 3.1 Series resonance
- 3.2 Parallel resonance
- 3.3 Q-factor, bandwidth, selectivity, half power frequencies, graphical representations
- 3.4 Importance of resonance

4. Circuit Transients:

- 4.1 Introduction to Laplace transform and inverse Laplace transformations
- 4.2 Laplace transformation of following functions
  - 4.2.1 Unit impulse function
  - 4.2.2 Unit step function
  - 4.2.3 Exponential function
  - 4.2.4 Ramp function
  - 4.2.5 Sinusoidal function
  - 4.2.6 Derivative function
  - 4.2.7 Integral function
- 4.3 Laplace transformation theorem
  - 4.3.1 Shifting Theorem
  - 4.3.2 Shift in 's' domain theorem
  - 4.3.3 Complex differentiation theorem
  - 4.3.4 Final value theorem

4.3.5 Initial value theorem
4.3.6 Complex integration theorem

4.4 Solution of series RL, RC and RLC circuits by Laplace transformation

5. Two Port Network:

5.1 z-parameters
5.2 y-parameters
5.3 h-parameters
5.4 ABCD- parameters
5.5 Inter relation among z,y,h and ABCD parameters.
5.6 Special types of network such as T, π, Bridge - T, Parallel-T and Lattice.

6. Complex Frequency and Pole-Zero Diagram :

6.1 Concept of complex frequency
6.2 Poles and zeros of simple function
6.3 Ploting of poles and zero diagram of a simple function (up to second order)
6.4 Necessary conditions of pole and zero locations of driving point functions.

REFERENCE BOOKS:

1. Electrical Networks — Soni & Gupta
2. Electrical Network Analysis — Umesh Sinha
3. Electrical Network Analysis — G.K.Mithal
4. Text Book of Circuit Theory — G.S. Verma
5. Electrical Circuit — M.E. Valvenkerberg

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GENERATION OF ELECTRICAL ENERGY

CODE DEE 403

L	T	P
2	2/2	--

RATIONALE

Most of the diploma holders get employment in Electricity Corporation and industries. They are required to handle responsibilities in generating stations. The work of an engineer is for operation and maintenance of equipments and supervisory control in power plants.

It is expected that the different power stations taught in this course content shall make an engineer suitable for operation, maintenance and commissioning of power stations.

CONTENTS

1. Introduction:

- 1.1 Electrical energy demand and electrical energy growth in India
- 1.2 Electrical energy growth in India
- 1.3 Electrical energy sources
- 1.4 Fossil fuels and nuclear fuels
- 1.5 Preesent status of electrical demand in Rajasthan

2. Load and Load Curves:

- 2.1 Types of load
- 2.2 Variation in demand, chronological load curve
- 2.3 Load duration curve, energy load curve
- 2.4 Load factor, capacity factor, diversity factor, connected load, maximum demand, utilisation factor etc.
- 2.5 Base load and peak load plants

3. Tariffs and Power Factor Improvement:

- 3.1 Objectives of tariff
- 3.2 General tariff form and types of tariff
  - 3.2.1 Flat rate
  - 3.2.2 Straight meter rate
  - 3.2.3 Block meter rate
  - 3.2.4 Hopkinson demand tariff
  - 3.2.5 Doherty demand rate
  - 3.2.6 Wright demand rate
- 3.3 Present tariff pattern in Rajasthan

4. Power Factor Improvement:

- 4.1 Meaning of power factor
- 4.2 Causes of low power factor
- 4.3 Effects of low power factor
- 4.4 Advantages of power factor improvement
- 4.5 Methods of power factor improvement
- 4.6 Location of shunt capacitors

5. Thermal Power Station:

- 5.1 Selection of plant location
- 5.2 Block diagram of plant and its working
- 5.3 Coal handling plant
- 5.4 Pulverising plant
- 5.5 Draft system
- 5.6 Boilers

5.7 Ash handling plant
5.8 Turbine
5.9 Different types of condensers
5.10 Cooling towers and ponds
5.11 Feed water heater
5.12 Economiser
5.13 Super heater and reheater
5.14 Air preheater

6. Hydro Electric Power Plants:

6.1 Selection of site
6.2 Advantages and disadvantages of hydro power plant
6.3 Hydrology
6.4 Classification based on
6.1.1 Water flow regulations
6.1.2 Load
6.1.3 Head
6.5 Element of hydro power plant and their functions
6.5.1 Dam
6.5.2 Storage reservoir
6.5.3 Fore bay
6.5.4 Surge tank
6.5.6 Pen stocks
6.5.7 Spill way
6.5.8 Head race and tailrace
6.5.9 Types of turbines
6.5.10. Specific speed
6.6 Brief idea about small and mini hydro plants
6.7 Pumped storage plant

7. Nuclear Power Station:

7.1 Introduction and selection of site
7.2 Block diagram of plant and its working
7.3 Main components and their function
7.4 Energy mass relationship
7.5 Energy due to fission and fusion
7.6 Nuclear chain reaction
7.7 Multiplication factor and critical size
7.8 Moderators materials
7.9 Fissile and fertile materials
7.10 Classification of Nuclear reactor, main parts and their functions
7.11 Safety measures required in nuclear plant
7.12 Disposal of nuclear waste

8. Diesel Power Plants:

8.1 Main components and working of diesel power plant with the help of block diagram
8.2 Advantage and disadvantage of diesel power plant
8.3 Application of diesel power plant
8.4 Principle and operation of gas turbine plants
8.5 Comparison of different power stations
8.6 Inter connection of power stations

REFERENCE BOOKS:

1. Generation of Electrical Energy B.R. Gupta
2. Power Plant Engg. Domkundwar
3. A course in Electrical Power Soni,Gupta,Bhatnagar

ELECTRICAL ESTIMATING AND COSTING

CODE DEE 404

L	T	P
2	--	2

RATIONALE

Practically a diploma engineer is required to estimate material requirements. But for the basic concepts some exposure to estimating and costing is also thought essential for the diploma engineer. This course shall make him aware about estimating and costing of total material required for various jobs.

CONTENTS

1. Wiring Materials and Accessories:

1.1 Different electrical symbols
1.2 Brief description, general specification and approximate cost of

- 1.2.1 Different types of wire and cable
- 1.2.2 Switches, socket outlets, ceiling roses, lamp holders, plugs
- 1.2.3 Conduits and it accessories
- 1.2.4 Distribution boards and boxes
- 1.2.5 Fuses, MCB, isolators, E.L.C.B. and energy meters
- 1.2.6 Incandescent, Fluorescent and discharge lamps
- 1.2.7 D.C. and A.C. motors and starters
- 1.2.8 Diesel generating set

2. General Principle of Estimating and Costing:

2.1 Purpose and essential of estimating and costing
2.2 Preparation of list of materials
2.3 Market survey, price list and net prices
2.4 Calculation of material and labour cost, contingencies, supervision, overhead charges, profit and total cost.
2.5 Purchase process: quotations, comparative statement, purchase order, tender order, security money

3. Earthing:

3.1 Need of earthing
3.2 Pipe and plate earthing
3.3 Schedule of material and accessories, costing and estimates.

4. Service Connection :

4.1 General rules and regulation
4.2 Overhead and underground service connection
4.3 Schedule of material and accessories for single phase and three-phase service connection
4.4 Costing of material and work

5. Plan Estimation of 1-ϕ and 3-ϕ Electrical load:

5.1 Installation plan
5.2 Single line-wiring diagram
5.3 Calculation of conductor size
5.4 Design for main switch boards and distribution board
5.5 Calculation of number of circuits
5.6 List of material required for following and preparation of estimate, calculation of material cost using PWD B.S.R.

- 5.6.1 Single story building
- 5.6.2 Multistory building
- 5.6.3 Small workshop
- 5.6.4 Agricultural pump
- 5.6.5 Floor mill
- 5.6.6 Institution or office building

PRACTICALS

1. Design and estimate the material of electrical installation for the following (by conventional method).

1.1 Residential building upto 40 points
1.2 Office building upto 30 points
1.3 Community hall upto 40 points
1.4 Small workshop upto 10 light points and 5 power points
1.5 Motor pump set

2. Preparation of schedule of material and estimate for the following using PWD B.S.R.

2.1 Residential building upto 40 points
2.2 Office building upto 30 points
2.3 Community hall upto 40 points
2.4 Small workshop upto 10 light points and 5 power points
2.5 Motor pump set

3. Design and preparation of schedule of material of estimate for service connection

2.1 1-ϕ Overhead
2.2 3-ϕ overhead
2.3 1-ϕ underground
2.4 3-ϕ underground

REFERENCE BOOKS:

1. Electrical Estimating and Costing — TTTI Madras
2. Electrical Estimating and Costing — M.F. Buereslui
3. Electrical Estimating and Costing — Y.P. Jaggi
4. Electrical Estimating and Costing — Raina, Bhattacharya.
5. Electrical Drawing and Estimating — Surjit Singh

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INSTRUMENTATION

CODE DEE 405

L	T	P
2	2/2	2

RATIONALE

This course aims at imparting the basic concept of instrumentation. All production processes in variably comprises of the above mentioned branches of engg. These branches of study should prove useful both for field jobs and continuing studies.

After studying this course the students will be capable of implementation of these principles in process industries as well as engg. industries. Students shall be in a position to upkeep and maintain instruments and control systems.

CONTENTS

1. Instrumentation System:

- 1.1 Introduction to measurement system
- 1.2 Generalised block diagram representation of instrumentation system
- 1.3 Brief description of components of instrumentation system

2. Transducer:

- 2.1 Classification of transducer
  - 2.1.1 Primary transducer
  - 2.1.2 Secondary transducers
  - 2.1.3 Active transducer
  - 2.1.4 Passive transducer
  - 2.1.5 Analog transducer
  - 2.1.6 Digital transducer
- 2.2 Construction, principle of operation and application of the following transducers :
  - 2.2.1 Potentiometer
  - 2.2.2 L V D T and R V D T
  - 2.2.3. Resistance strain gauge
    - 2.2.3.1 Gauge factor
    - 2.2.3.2 Gauge materials
    - 2.3.3.3 Temperature compensation
  - 2.2.4 Thermocouple
  - 2.2.5 Thermister
  - 2.2.6 R T D
  - 2.2.7 Photo cell
  - 2.2.8 Piezo Electric
  - 2.2.9 Capactive
  - 2.2.10 pH electrode

3. Measurement of Following Physical Parameter Using Suitable Transducers:

- 3.1 Linear displacement
- 3.2 Angular displacement
- 3.3 Strain, Stress and force
- 3.4 Velocity and Speed
- 3.5 Temperature
- 3.6 Pressure
- 3.7 pH value
- 3.8 Flow measurement

4. Signal Conditioning:

- 4.1 Introduction
- 4.2 D.C. signal conditioning

4.3 A.C. signal conditioning
4.4 Brief idea of data acquisition system

5. Instrument Transformer:

5.1 Definition of terms related to instrument transformer
5.2 Current Transformer (CT)
5.3 Potential Transformer (PT)
5.4 Difference between CT and PT
5.5 Application of CT and PT

PRACTICALS

1. Measurement of displacement using following transducers:

   1.1 Potentiometer
   1.2 L.V.D.T.
   1.3 Capacitive

2. Measurement of temperature with the help of

   2.1 Thermocouple
   2.2 Thermister
   2.3 R.T.D.

3. Measurement of pH value by pH electrode.
4. Application of strain gauge for measurement of displacement
5. Measurement of strain with the help of strain gauge.
6. Velocity and speed measurement by suitable transducer
7. Pressure measurement by bourdon tube
8. Study of instrument transformers & measurement of turn ratio of current transform and potential transformer.

REFERENCE BOOKS:

1. Electrical and Electronics Measurement and Instrumentation — A.K.Sawhney.
2. Instrumentation and System — Rangan & Sharma
3. Electrical and Electronics Measurement — J.B. Gupta

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ELECTRICAL DESIGN AND DRAWING

CODE DEE 406

L	T	P
2	--	6

RATIONALE

Design aspect for diploma engineers is not much as compared to drawing and estimating. Practically an Engineer is required to estimate material requirements. But for the basic concepts some exposure to design aspects is also thought essential for engineers. This course shall make engineers aware about design, drawing and total material requirement for various jobs.

The contents shall make an Engineer to learn design concepts, draw various circuits of power systems and estimate requirements of materials for electrical works.

CONTENTS

1. Transformer Design:

1.1 Single phase and three-phase core type distribution transformer
1.2 Single phase shell type transformer
1.3 Output equation
1.4 Main dimension of frame
1.5 Core design and winding design

2. Design of Winding:

2.1 Definition of -

2.1.1 Single and double layer winding
2.1.2 Full pitch and short pitch winding
2.1.3 Integral and fractional winding

2.2 Developed winding diagrams of single phase and three-phase induction motors
2.3 Developed winding diagrams of alternators

3. Simple Alarm and Signal Circuits:

Using contactors, designing and drawing schematic and wiring diagrams of alarm and signal circuits. Circuits should involve use of switches, push buttons, bells, indicating light which are used in offices, hospitals, hotels and buses etc.

4. Contactor Control Circuits:

4.1 The circuit should incorporate remote control, interlocking, time delay, sequential operation, overload short circuit and no-load protection applicable to -

4.1.1 D.O.L starter
4.1.2 Star-Delta starter
4.1.3 Rotor resistance and reversing starters.

4.2 Contactor control schematic and wring diagram for speed reversing of motors.
4.3 Contactor control schematic and wring diagram for fast and slow speeds of motors.
4.4 Contactor control schematic and wiring diagram of sequential operation of motors.
4.5 Control of pump motor with water level indicators.

5. Panel Wiring Diagram: Panel wiring diagram for the following with usual protective devices and showing the various equipment with suitable ranges -

5.1 Synchronization and parallel operation of 3-phase alternators
5.2 A.C. 3-phase squirrel cage induction motor.
5.3 A.C. 3-phase slip ring induction motor.
5.4 Parallel operation of three phase transformers
5.5 D.C. compound generator

5.6 Parallel operation of D.C. compound generators

PRACTICALS

Drawing sheets to be prepared.

1. Electrical symbols as per I.S. 1 Sheet
2. Preparation of sectional plan, elevation and view of transformer
   - 2.1 Single-phase core and shell type 1 Sheet
   - 2.2 Three-phase core and shell type 1 Sheet
3. Alarm circuits. 3 Sheets
4. Contactor circuits. 3 Sheets
5. Developed winding diagrams. 4 Sheets
6. Panel wiring diagram. 3 Sheets

REFERENCE BOOKS:

1. Electrical Design, Estimating and Costing — K.B. Raina, S.K. Bhattacharya
2. Electrical M/C Design — A.K. Shawney
3. Electrical Drawing and Design — Jaggi
4. Electrical M/C Design — V.N. Mittal
5. Electrical Engg. Drawing — Surjit singh
6. Electrical Engg. Drawing — J.B.Gupta
7. Handbook of Electrical Engg. — S.L. Bhatia

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ELECTRICAL WORKSHOP - II

CODE DEE 407

L	T	P
2	--	6

RATIONALE

A diploma holder in electrical engineering has to perform supervisory duty in industries and Electricity Corporation. He / She should have adequate knowledge as well as should be able to educate his/her subordinates for electrical wiring installation and full investigation and repair of domestic appliances. This syllabus deals with above topics in details.

CONTENTS

1. Domestic Appliances:

1.1 Introduction
1.2 Appliances making use of thermal effects
1.3 Design of heating elements wire
1.4 Table fan

1.4.1 Construction and its working
1.4.2 Wiring diagram
1.4.3 Assembling
1.4.4 Dismantling
1.4.5 Defects and remedies

1.5 Ceiling fan

1.5.1 Construction and its working
1.5.2 Wiring diagram
1.5.3 Assembling
1.5.4 Dismantling
1.5.5 Defects and remedies

1.6 Voltage regulating devices

1.6.1 Resonant types
1.6.2 UPS (off line)
1.6.3 UPS (On line)
1.6.4 Servos
1.6.5 SMPS

1.7 Electric washing machine

1.7.1 Working principle
1.7.2 Construction and its working
1.7.3 Internal wiring diagram
1.7.4 Characteristics
1.7.5 Assembling and disassembling
1.7.6 Fault, causes and remedies

1.8 Simple telephone

1.8.1 Telephone circuit
1.8.2 Construction

1.9 Water cooler

1.9.1 Wiring diagram
1.9.2 Construction and its working
1.9.3 Assembling and disassembling
1.9.4 Possible fault and their remedies

2. Earth Leakage Circuit Breaker:

2.1 Introduction
2.2 Working principle
2.3 Types of ELCB
2.4 Standard on ELCB

3. Miniature Circuit Breaker:

3.1 Introduction
3.2 Construction of MCB
3.3 Overload protection with MCB
3.4 Safety
3.5 Selectivity
3.6 MCB v/s fuse
3.7 Economic consideration

PRACTICALS

1. Dismantling, identifying of various parts, finding fault, removing the fault, assembling and testing of

1.1 Table fan
1.2 Ceiling fan
1.3 Electric washing machine
1.4 Room cooler
1.5 Voltage regulating device
1.6 Electric toaster and sandwich maker
1.7 Electric mixy
1.8 Water cooler

2. Study the construction of telephone and its circuit
3. To make connection of supply and consumer board
4. Study of contactors and time delay relays

REFERENCE BOOKS:

1. Study of Electric Appliances and Devices — K.B.Bhatia
2. Basic of Practicals in Electrical Engg. — Vinod kumar & K. Vijay
3. Electrical Gadgets — H. Partab
4. Electrical Wiring — Arora, B. Das.
5. Workshop Practices in Electric Engg. — M.L.Gupta

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ELECTRICAL MACHINES - II

CODE DEE 501

L	T	P
3	2/2	2

RATIONALE

An electrical engineer is supposed to handle electrical machines wherever he may work. The requirement and knowledge of electrical machines, such as AC generators, AC motors is quite large. It is expected that an engineer will install, commission, operate, maintain and if required shall test these machines.

The course contents give full knowledge to learn operating principles, performance and testing of various types of electrical machines. The expected achievement shall make an engineer fully competent to handle any problem related with electrical machines.

CONTENTS

1. Induction Motor:

- 1.1 Production of rotating magnetic field by two phase and three-phase supply
- 1.2 Construction of slip ring and squirrel cage motors
- 1.3 Principle of operation
- 1.4 Slip
- 1.5 Torque Production
  - 1.5.1 Gross torque and shaft torque
  - 1.5.2 Starting torque
  - 1.5.3 Running torque
  - 1.5.4 Maximum torque
  - 1.5.5 Full load torque
  - 1.5.6 Relation between starting, maximum and full load torque
- 1.6 Torque-slip characteristics
- 1.7 Power stages and efficiency
- 1.8 Equivalent circuit: approximate and exact
- 1.9 Phasor diagram
- 1.10 No-load and blocked rotor tests
- 1.11 Circle diagram
- 1.12 Methods of starting
- 1.13 Speed control of induction motors
  - 1.13.1 Rotor resistance control
  - 1.13.2 Stator voltage control
  - 1.13.3 Frequency control
  - 1.13.4 Pole changing method
  - 1.13.5 Cascade control
- 1.14 Cogging and crawling
- 1.15 Double cage induction motor
- 1.16 Industrial applications

2. Single Phase Induction Motor:

- 2.1 Double revolving field and cross-filed theory
- 2.2 Different types and their construction
- 2.3 Methods of starting
- 2.4 Characteristics of single-phase motors
- 2.5 Industrial applications

3. Alternators:

- 3.1 Constructional features
- 3.2 Principle of operation
- 3.3 Winding factors

3.4 EMF equation
3.5 Idea of leakage reactance (cylindrical rotor) and armature reaction
3.6 Synchronous impedance
3.7 Phasor diagram at different power factors
3.8 Voltage regulation
3.9 Open circuit and short circuit tests
3.10 Calculation of regulation by synchronous impedance and m.m.f methods
3.11 Parallel operation of three phase alternators
3.12 Effect of variation in excitation and prime mover power on the performance of alternator

4. Synchronous Motors:

4.1 Construction and principle of operation
4.2 Phasor diagram at no load and on load (cylindrical rotor)
4.3 Power equation
4.4 V - curves and inverted V- curves
4.5 Methods of starting
4.6 Synchronous motor operation at

4.6.1 Constant input power and variable excitation
4.6.2 Constant excitation and Variable input power

4.7 Synchronous condenser
4.8 Comparison of induction motor and synchronous motor
4.9 Application of synchronous motor

PRACTICALS

1. Connecting, starting and reversing the direction of rotation of 3-phase squirrel cage induction motor by using

1.1 D.O.L starter
1.2 Star-Delta starter

2. Speed control of 3-phase induction motor by rotor resistance control.
3. Speed control of 3-phase induction motor by stator voltage control
4. No-load and blocked rotor tests on 3-phase induction motor and plotting of circle diagram.
5. Study the various types of single-phase Induction motor with starting and reversing operation.
6. Starting of synchronous motor and plotting V-curves.
7. Determination of load characteristics of alternator at rated speed.
8. Determination of regulation of alternator by direct loading.
9 Determination of magnetisation curve of an alternator at rated speed
10. O.C and S.C tests on alternator and determination of regulation by synchronous impedance method.
11. Synchronisation of alternators.

REFERENCE BOOKS:

1. Electrical Machines — I.J.Nagrath
2. Electrical Technology — B.L.Theraja
3. Electrical Machines — P.S.Bhimbra
4. विद्युत इंजीनियरिंग — डी.आर. नागपाल
5. Electrical Technology — H. Cotton
6. Electrical Machines — M. G. Say

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POWER ELECTRONICS

CODE DEE 502

L	T	P
2	--	3

RATIONALE

This course aims at imparting knowledge about specific electronics aspects, which are of practical importance for an engineer in consumer and industrial applications. Increasing use of electronic gadgets in control of electrical machines makes this course indispensable for having an insight into trouble-shooting techniques.

CONTENTS

1. Introduction:

1.1 Principles, construction , characteristics and ratings of

- 1.1.1 SCR
- 1.1.2 DIAC
- 1.1.3 TRIAC
- 1.1.4 UJT
- 1.1.5 LASCR

1.2 Series connection of SCR
1.3 Parallel connection of SCR
1.4 UJT as a relaxation oscillator
1.5 Snubber circuit
1.6 Transistor analogy of SCR
1.7 Comparison of SCR and TRIAC
1.8 Over voltage and over current protection circuit for SCR.

2. Power Control Rectification:

2.1 Phase control of SCR
2.2 Different phase controlling circuits

- 2.2.1 R
- 2.2.2 RC
- 2.2.3 UJT (Ramp)
- 2.2.4 UJT (Pedestal and Ramp)
- 2.2.5 Transformer circuit

2.3 Different methods of turn off of SCR

2.4 Single-phase and three-phase half wave and full wave rectifier using SCR

- 2.4.1 with resistive load
- 2.4.2 with inductive load
- 2.4.3 with flywheel diode

3. Inverters:

3.1 Basic principle of inverter
3.2 Series inverter
3.3 Parallel inverter
3.4 Single phase voltage source inverter
3.5 Three phase bridge inverter
3.6 Applications

4. Practical Application of SCR:

4.1 Chopper

4.2 Cyclo converter
4.3 UPS
4.4 SMPS

4.4.1 Types of SMPS
4.4.2 Protection circuits
4.4.3 Merits and demerits of SMPS

5. AC Stabilizers:
5.1 Introduction
5.2 Working and basic circuits of
5.2.1 Resonator stabilizer
5.2.2 Electro-mechanical stabilizer
5.2.3 Electronic stabilizer

6. Electronic Motor Speed Control:
6.1 Introduction
6.2 Speed control using SCR for
6.2.1 D.C. shunt motor and series motor
6.2.2 Single phase and three phase induction motor
6.2.3 Slip ring induction motor

7. Timers:
7.1 Types of timer circuits
7.2 Principles and operation
7.3 Electronic timers
7.4 D.C. operated timer
7.5 A.C. operated timer

8. High Frequency Heating:
8.1 Introduction (heating and welding)
8.2 Principle of induction and dielectric heating
8.3 Sources of high frequencies
8.4 Power requirement and application
8.5 Resistance welding types

PRACTICALS

1. Draw characteristics of SCR.
2. Draw characteristics of TRAIC.
3. Draw characteristics of DIAC.
4. Draw characteristics of UJT
5. Study of UJT oscillator
6. Speed control of D.C. Shunt motor.
7. Speed control of D.C series motor.
8. Study of various SCR firing circuits.
9. Study of various commutation circuits.
10. Speed control of A.C 1-phase motor.
11. Speed control of A.C 3-phase induction motor.
12. Use of TRIAC in a dimmer circuit.
13. Study of TRIAC in rectifier mode
14. Study of single phase half wave rectifier using SCR with resistive load
15. Study of (single phase) SCR with inductive load
16. Study of (with free wheeling diode) SCR with inductive load.
17. Study of single phase full wave rectifier using SCR with resistive load.
18. Study of SCR with R-L load and free wheeling diode.

REFERENCE BOOKS:

1. Power Electronics P.C. Sen
2. Motor Control P.S Bhimbra
3. Thyristor Engineering M.S. Berde
4. Industrial Electronics G.K. Mithal
5. Thyristor Control Drive G.K. Dubey
6. पॉवर इलेक्ट्रोनिक्स जलान्धरा, माथुर

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TRANSMISSION AND DISTRIBUTION

CODE DEE 503

L	T	P
3	2/2	--

RATIONALE

Diploma holders are mostly employed in electricity boards and industries where they are supposed to erect low voltage lines, overhead and underground cables and substation and to erect HV and EHV lines and substation. For doing the above job it is expected that the student are made aware and given practice of the above aspects of lines and substations including safety practices, standardised maintenance schedule, Indian Electricity act and relevant Indian Standards.

As regards design aspects of lines are concerned he should be aware of the various consideration taken into account for this and not actual design. For this design of simple distribution system is needed. It is not only sufficient to construct, operate and maintain a power system but to run it efficiently. For this an engineer should be made aware of the prevailing practices in electricity board which may result in efficient and economical working of the system.

CONTENTS

1. Transmission and Distribution:

1.1 Need and basic flow diagram of power system
1.2 Relative advantages and disadvantages of A.C and D.C transmission
1.3 Selection of transmission voltage
1.4 Comparison of A.C. 1-phase, A.C. 3-phase 3 wires and A.C. 3-phase 4 wire on the basis of cost, line efficiency and reliability of supply
1.5 Comparison of D.C. 2-wire and D.C. 3-wire system on the basis of copper volume.

2. Materials used in Overhead Lines:

2.1 Need requirement, construction and special feature
Of line supports
2.2 Types of conductors: hollow, stranded and relative merits and demerits
2.3 Selection of size of conductor, general rules used in RSEB for calculation
2.4 Types of insulators, their construction and application
2.5 Potential distribution over a string of insulators
2.6 String efficiency and methods of improving string efficiency

3. Mechanical Design:

3.1 Sag and span
3.2 Sag calculation in overhead lines with same and different level supports
3.3 Effect of wind, ice and temperature on loading of conductors
3.4 Effect of sag on overhead conductor configuration and their spacing
3.5 Effect of length of span on sag
3.6 Stringing chart
3.7 Transposition of conductors

4. Electrical Design of Lines:

4.1 Overhead line constants
4.2 Classification of lines
4.3 R L, C, of over head lines
(Formula without proof)
4.4 Skin and Ferranti effect
4.5 Corona, its effect, suppression, advantages and disadvantage
4.6 Calculation of efficiency and regulation for short and medium transmission lines by T and π methods
4.7 Causes of low line efficiency and its improvement

5. Distribution Systems:

5.1 Layout of distribution system, feeders, distributors and Service mains
5.2 Radial and ring main distributors
5.3 Voltage drop calculation for LT and HT lines in A.C. and D.C. distributors

6. Construction of Underground Distribution Lines:

6.1 Underground cables - types, construction
6.2 Selection of LT and HT cables
6.3 Laying of underground cables
6.4 Comparison of underground distribution systems
6.5 Cable grading and its analysis

7. Construction of Overhead Distribution Lines:

7.1 Survey of LT lines
7.2 Planning of construction work
7.3 Methods of erection of supports
7.4 Erection of conductors - laying out conductors
7.5 Raising and setting of poles, guys, stays
7.6 Fixing of insulators and cross arms
7.7 Guarding.

REFERENCE BOOKS:

1. Electrical Power — Soni,Gupta & Bhatnager
2. Electrical Power — J.B.Gupta
3. Power System — V.K. Mehta
4. Transmission & Distribution of Electrical Power — Raina & Bhattacharya
5. Electrical Power — S.L. Uppal
6. विद्युत शक्ति — डी.आर. नागपाल

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UTILIZATION OF ELECTRICAL POWER

CODE DEE 504

L	T	P
3	2	–

RATIONALE

The knowledge of utilization of electrical power is important for an electrical engineer. This subject assumes importance in view of the fact that an engineer has to work in a wide spectrum of activities wherein he has to make selections from technical, economical and availability considerations.

The subject contents are designed to meet the above requirements and an engineer after undergoing this course shall be in a position to operate and keep the equipment used in utilization of electrical power.

CONTENTS

1. Industrial Utilisation:

- 1.1 Advantages of electrical drives over mechanical drives
- 1.2 Group and individual drives
- 1.3 Characteristics and application of various types of electric motors
- 1.4 Selection of electrical motors for
  - 1.4.1 Domestic uses - Fans, sewing machines, refrigerators, air conditioners, coolers, mixers and grinders, washing machines, hair dryer
  - 1.4.2 Industrial uses - Lathes, drilling machine, elevators, and cranes lift, conveyors, textile and paper mills.

2. Electric Heating:

- 2.1 Principle of electric heating
- 2.2 Advantages of electric heating
- 2.3 Methods of heating
  - 2.3.1 Resistance heating
  - 2.3.2 Induction heating
  - 2.3.3 Dielectric heating

3. Electric Welding:

- 3.1 Principle of electrical welding
- 3.2 Classification of electric welding
- 3.3 Resistance welding
  - 3.3.1 Spot welding
  - 3.3.2 Butt welding
  - 3.3.3 Seam welding
- 3.4 Arc Welding
  - 3.4.1 Metal arc welding
  - 3.4.2 Carbon arc welding
- 3.5 Comparison between resistance and arc welding

4. Illumination:

- 4.1 Terms used in illumination
- 4.2 Law of illumination
  - 4.2.1 Inverse square law
  - 4.2.2 Lambert's cosine law
- 4.3 Electrical sources of light

4.3.1 Design of lighting schemes for domestic, commercial and industrial premises based upon illumination level required for various works.

4.4 Types of lamps
4.5 Comparison of fluorescent tubes and filament lamps
4.6 Requirement of good lighting
4.7 Lighting schemes for flood light

5. Electric Traction:

5.1 Advantages and disadvantages of electric traction
5.2 Comparison between A.C. and D.C. track electrification
5.3 Block diagram of A.C. locomotives
5.4 Traction effort
5.5 Crest speed, average speed and schedule speed
5.6 Factor affecting schedule speed
5.7 Simplified speed time trapezoidal curve
5.8 Mechanics of train movement

REFERENCE BOOKS:

1.	Electric Drives	G.K. Dubbey
2.	Art & Science of Utilisation of Electrical Energy	H. Partab
3.	Electrical Power	J.B.Gupta
4.	Utilization of Electrical Power & Electric Traction	G.C. Garg
5.	विद्युत संकर्षण	यश, बसन्त

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ELECTRICAL MAINTENANCE AND REPAIR

CODE DEE 505

L	T	P
2	--	6

RATIONALE

Many of electrical technicians employed in state electricity boards or other industries are engaged in installation, maintenance and repair of a variety of electrical machines. Such areas may include generation, transmission and distribution systems and different types of electric drive used with a variety of mechanical gadgets. Normally manufacturers of heavy electrical machines provide service manuals, instructions for installation, maintenance and fault location. This syllabus has been designed to provide certain guidelines and broad principles regarding the above activities and after undergoing this course the technician shall be fit to undertake repairs and maintenance of electrical equipments.

CONTENTS

1. Introduction:

1.1 Fundamental of electrical maintenance and repair
1.2 Classification, scope and frequency of electrical Maintenance and repair work
1.3 General structure and equipment of electrical repairs shop
1.4 Repair records and maintenance schedule.

2. Study and Uses of Meters:

2.1 Multimeter
2.2 Tong tester
2.3 Growler (internal and external)
2.4 Phase sequence indicator
2.5 Earth tester
2.6 Minor adjustments of above meters

3. Maintenance and Repair of Storage Batteries:

3.1 Introduction to storage batteries
3.2 Types of storage batteries
3.3 Inspection and checking of storage batteries
3.4 Trouble and its shootings
3.5 Repair of storage batteries

4. Maintenance and Repair of Transformers:

4.1 Introduction
4.2 Transformer inspection
4.3 Periodical overhauling of transformer
4.4 Location of transformer defects
4.5 Winding and core repairs
4.6 Bushing repairs
4.7 Repair and maintenance of conservator
4.8 Dismantling and assembling of transformer
4.9 Transformer drying out
4.10 Maintenance of Buchholz's relay
4.11 Maintenance of transformers while in services.
4.12 Electrical characteristics of transformer oil
4.13 Transformer oil purification methods

5. Maintenance and Repair of D.C. Motors:

5.1 Identification of terminals of D.C. compound motors
5.2 Testing of armature and commutator
5.3 Over hauling of D.C. Machine
5.4 Repairing of field winding
5.5 Sparking at brushes and its remedies
5.6 Commutators and brush mechanism and its defect.

6. Maintenance and Repair of A.C Motors:

6.1 Different tests on 1- ϕ capacitor type A.C. motor

6.1.1 Open capacitor
6.1.2 Short capacitor
6.1.3 Change of value
6.1.4 Test for open and short circuits faults
6.1.5 Checking of centrifugal switch

6.2 Over hauling, dismantling and assembling of ceiling fan and table fan
6.3 Identification of terminals of 3-phase squirrel cage induction motor
6.4 Electrical fault location
6.5 Mechanical fault location
6.6 Drying and testing of insulation
6.7 Abnormal heating at bearing
6.8 Greasing, degreasing and impregnating
6.9 Alignment and rotor balancing

7. Maintenance and Repairs of Circuit Breakers:

7.1 Maintenance and troubleshooting of

7.1.1 Oil circuit breakers
7.1.2 Air blast circuit breakers
7.1.3 SF_6 circuit breakers

7.2 Preventive maintenance of relays

8. Maintenance and Repairs of Overhead Lines:

8.1 General inspection of line
8.2 Ground inspection
8.3 Support head inspection
8.4 Maintenance of supporting structure
8.5 Testing and cleaning of insulators
8.6 Repairs of conductor
8.7 Economic consideration of transmission line maintenance

9. Safety Measures:

9.1 Study of various safety devices and appliances in an Electrical workshop
9.2 Safety measures for working on low, medium and high voltage main and the study the apparatus used
9.3 Use of fire fighting, electric shock treatment, first aid, and safety posters etc.

PRACTICALS

1. Soldering practice and lugs jointing.
2. Tracing the terminal of D.C. machine with the help of AVO meter.
3. Dismantling and assembling of D.C Machine.
4. Perform the following test on 1-phase transformer

4.1 Insulation resistance test.
4.2 Ratio test.
4.3 Polarity and phasing out test.

5. Transformer oil dielectric strength test.
6. Fire point, flash point and sludge test of transformer oil
7. Study of choke winding.
8. Different test for capacitor

8.1 Open
8.2 Short
8.3 Change in the value of capacitor

9. Tracing the terminals of a given 3-phase squirrel cage induction motor.
10. Prepare coil winding of a small transformer.

11. Rewinding of a ceiling fan.
12. Fault location and remedies in star-delta starter.
13. Fault location and remedies in rotor-resistance starter.
14. Preparation of periodical maintenance schedule for a power transformer.
15. Connecting and reversing of three-phase squirrel cage/slip ring motor with different types of starters.
16. Study of fire fighting equipments
17. Study of electric shock treatment, preparation of treatment chart.

REFERENCE BOOKS:

1.	Installation, Fault Location & Maintenance	T.T.T.I,Bhopal.
2.	Operation & Maintenance of Electrical Equipment (Vol. I & II)	B.V.S.Rao
3.	Preventive Maintenance of Electrical Equipment	Charles I Hubert.
4.	विद्युत मशीन का अनुरक्षण एवं मरम्मत	वाई.पी. जग्गी
5.	Electrical Maintenance & Repair	Mahendra, Bhardwaj

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ELECTROMAGNETIC FIELD THEORY

CODE DEE 5061

L	T	P
2	2	--

RATIONALE

A diploma engineer may have to work with various equipments and instruments whose principle belongs to electronic and magnetic fields. The syllabus gives idea about relative terms and theorems.

CONTENTS

1. Introduction:

1.1 Various co-ordinate system
1.2 Coulomb's law and electric field intensity
1.3 Gauss's law
1.4 Divergence and divergence theorem
1.5 Potential and potential difference
1.6 Potential field of a system of charge
1.7 Potential gradient
1.8 Energy density in electrostatic field

2. Conductors in Electric Field:

2.1 Point form of Ohm's law
2.2 Boundary condition for conductors
2.3 Capacitance
2.4 Dielectric material and polarisation
2.5 Spontaneous polarisation
2.6 Piezo electric materials
2.7 Boundary condition between perfect dielectric
2.8 Poisson's and Laplace's equation
2.9 Uniqueness theorem and its significance
2.10 Solution of Poisson's and Laplace's equation

3. Steady Magnetic Fields:

3.1 Bio-Savart law
3.2 Ampere's circuital law
3.3 Curl
3.4 Stoke's theorem
3.5 Magnetic flux density
3.6 Vector magnetic potential
3.7 Potential energy of magnetic field

4. Time Varying Fields:

4.1 Maxwell's equation (point and integral form) and its application
4.2 Laws of circuit theory
4.3 Skin effect
4.4 Wave equations

REFERENCE BOOKS:

1. Electro Magnetic Field Theory — Hayt
2. Electro Magnetic — Kraus
3. Electro Magnetic — Gupta & Seth

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ELECTRIC TRACTION SYSTEM

CODE DEE 5062

L	T	P
2	2	--

RATIONALE

The knowledge of Electrical Traction System is important for an electrical engineers for this a technician should be made aware of the prevailing practise in railway department. Which may result in efficient and economical working of the system.

CONTENTS

1. Traction Systems:

1.1 Ideal traction system
1.2 Different systems of traction
1.3 Systems of electric traction
1.4 Systems of track electrification
1.5 Comparison between D.C. and A.C. systems of railway electrification form the point of view of main line and suburban line railway service.

2. Train Movement and Energy Consumption:

2.1 Speed time curves
2.2 Typical speed time curves
2.3 Definition of crest speed, average speed and schedule speed
2.4 Factors affecting schedule speed
2.5 Simplified quadrilaterals speed time curves
2.6 Tractive effort for propulsion of train
2.7 Determination of specific energy output using simplified speed time curves
2.8 Factors affecting energy consumption
2.9 Definition of dead weight, accelerating weight and adhesion weight

3. Electric Traction Motors:

3.1 General features of traction motor
3.2 Characteristics of D.C. Motors
3.3 D.C. Series motor
3.4 D.C. shunt motor
3.5 A.C. Series motor
3.6 Rating and ventilation

4. Power Supply:

4.1 System of supply of power for electric traction
4.2 Current collector for overhead systems
4.3 Overhead construction for tramways trolley buses and railway
4.4 Sag and tension calculation for a trolley wire
4.5 Transmission lines to feed substations
4.6 Location of substations
4.7 Feeding and distribution systems
4.8 Protective device

REFERENCE BOOKS:

1. A Course in Electrical Power — J .B. Gupta
2. Utilisation of Electric Power & Electric traction — G.C. Gay
3. Art & Science of utilisation of Electrical Energy — H. Partab
4. Electrical Utilization & Traction — Yash & Basant

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'C' PROGRAMMING

CODE DEE 5071	L	T	P
Common for All Branches of Engineering Except CS & IT	2	--	2

RATIONALE

'C' is computer programming language and also structured programming language. In 'C' programming language we consider various syntax used in programming. By having good knowledge of 'C', students can write modular application and system programs. 'C' can be used in the engineering applications. By acquiring a sound knowledge of 'C' students will be able to understand the concept of all the application areas. This course is specially designed for engineering students of all diploma streams.

CONTENTS

1. Introduction:
- 1.1 Scope of 'C' Language
- 1.2 Distinction and similarities with other HLLs
- 1.3 Special features and Application areas

2. Elements of 'C':
- 2.1 Character set
- 2.2 Key words
- 2.3 Data types
- 2.4 Constants and Variables
- 2.5 Operators: unary, binary, ternary
- 2.6 Operator precedence

3. Console Input-Output:
- 3.1 Types of I-O
- 3.2 Console I-O
- 3.3 Unformatted console I-O: getchar (), putchar (), gets (), puts (),Getch (), getche ()
- 3.4 Formatted I-O: scanf (), printf ()

4. Control Flow:
- 4.1 Statements and blocks
- 4.2 if
- 4.3 switch
- 4.4 Loops: for, while, do-while
- 4.5 goto and labels
- 4.6 break, continue, and exit
- 4.7 Nesting control statements

5. Arrays:
- 5.1 Basic concepts
- 5.2 Memory representation
- 5.3 One dimensional array
- 5.4 Two dimensional array

6. Functions:
- 6.1 Basic concepts
- 6.2 Declaration and prototypes
- 6.3 Calling
- 6.4 Arguments
- 6.5 Scope rules
- 6.6 Recursion
- 6.7 Storage classes types
- 6.8 Library of functions: math, string, system

7. Pointers:
- 7.1 Basic concepts
- 7.2 &, * operator
- 7.3 Pointer expression: assignment, arithmetic, comparison
- 7.4 Dynamic memory allocation
- 7.5 Pointer v/s Arrays

8. Structure and Enumerated Data Types:
- 8.1 Basic concepts
- 8.2 Declaration and memory map
- 8.3 Elements of structures
- 8.4 Enumerated data types: typedef, enum
- 8.5 Union

PRACTICALS

1. Problems based on arithmetic expression, fixed mode arithmetic.
2. Problems based on conditional statements and control structures.
3. Problems based on arrays (1-D, 2-D), functions and pointers.
4. Problems based on engineering applications.

REFERENCE BOOKS:

1. 'C' Programming — Stephen Kochan
2. Programming with 'C' — Schaum's Series
3. 'C' Programming — V.Balguru Swami
4. 'C' Programming — Kernighan & Ritchie
5. Let us 'C' — Yashwant Kanetkar

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COMPUTER IN BUSINESS SYSTEMS

CODE DEE 5072 L T P

Common for All Branches of Engineering 2 -- 2

RATIONALE

Computer is a tool, which can be applied to any field. It is not necessary to apply it in only engineering application but can be applied to various commercial applications equally. The student from engineering streams must have some knowledge about commercial application, as these are basic need for every one. This course is aimed to fulfill all the requirements of some one in commercial applications using FoxPro.

CONTENTS:

1 Business Data Processing:
- 1.1 Business System
- 1.2 Management Functions
- 1.3 Levels of Management
- 1.4 Information Requirement
- 1.5 Basic tasks in business data processing
- 1.6 Examples of business data processing Payroll, Financial, Accounting, Inventory

2 Business Files:
- 2.1 Files, Records, Fields, Elements
- 2.2 Fixed and Variable Length Records
- 2.3 Master File, Transaction File
- 2.4 Record Updating in Sequential File and Direct File

3 Design, Analysis and Development of:
- 3.1 Computerized Invoicing
  - 3.1.1 Data Entry Screens
  - 3.1.2 Validations
  - 3.1.3 Receipt Data Entry
  - 3.1.4 Reports
- 3.2 Computerized Payroll
  - 3.2.1 Factors Involved in Payroll
  - 3.2.2 Exposure to structure, processing and reports
  - 3.2.3 File maintenance
- 3.3 Computerized Inventory Control
  - 3.3.1 Introduction and Aim of Inventory
  - 3.3.2 Inventory Costs
  - 3.3.3 Inventory Control Process
  - 3.3.4 Inventory transactions
  - 3.3.5 Inventory reports

4 FoxPro (A tool for Business System) :
- 4.1 Starting FoxPro
- 4.2 FoxPro Menus and Menu Options, Elementary Level
- 4.3 Creating Data Base File (DBF)
- 4.4 Adding and Editing Records : Browse, Append
- 4.5 Viewing Records
- 4.6 SET commands : Talk, Date, Century, Default, Printer, Deleted, Safety
- 4.7 Querying DBF : Simple and RQBE
- 4.8 Updating, Deleting and recalling records
- 4.9 Sorting, Indexing and Searching
- 4.10 Screen, Label, Menu, Report Generator

PRACTICALS

1. Hands on Experience with FoxPro
2. Creating Simple DBF, adding record, viewing data
3. Creating a simple DBF for Invoice
4. Querying Invoice DBF
5. Creating a simple DBF for Payroll
6. Report Generation for Payroll
7. Creating Inventory DBF
8. Inventory Report Generation

REFERENCE BOOKS :

1. FoxPro Made Simple R.K.Taxali
2. Business Systems Satish Jain
3. Computer Fundamentals V.K.Kapoor
4. FoxPro Programming Michael P.Antonovich, Galgotia Pub.

ELECTRICAL MACHINES - III

CODE DEE 601

L	T	P
3	2	--

RATIONALE

With increasing automation of specific routine jobs the use of specialised electrical machines developed for special purposes is on the rise.

The course content gives full knowledge to learn operating principles, performance and testing of various types of special electrical machines.

CONTENTS

1. Special Machines:

1.1 Basic principles, operation and characteristics of -

- 1.1.1 Linear induction motor
- 1.1.2 Reluctance motor
- 1.1.3 Hysteresis motor
- 1.1.4 Stepper motor
- 1.1.5 Induction regulator
- 1.1.6 Brush less D.C. motor

1.2 Industrial applications

2. Cross Field Machines:

2.1 Construction and working of -

- 2.1.1 Metadyne
- 2.1.2 Amplidyne

2.2 Operating characteristics

2.3 Applications of amplidyne and metadyne

3. A.C. Commutator Motors:

3.1 Action of commutator in an A.C. machines

3.2 Functions of brushes

3.3 Concept of phase advancing

3.4 The e.m.f. of a single phase commutator motor

- 3.4.1 e.m.f. produced by rotating field
- 3.4.2 e.m.f. produced by pulsating field

3.5 Commutation in A.C. machines

3.6 The single phase A.C. series motor

- 3.6.1 Constructional features
- 3.6.2 Torque equation
- 3.6.3 Phasor diagram
- 3.6.4 Characteristics and Applications

3.7 Repulsion motor

- 3.7.1 Mechanics of torque production
- 3.7.2 Compensated repulsion motor
- 3.7.3 Vector diagram

3.8 Repulsion induction motor

3.9 Schrage motor

3.9.1 Construction
3.9.2 Characteristics
3.9.3 Application

4. D.C. Machines:

4.1 Load sharing in parallel operation of D.C. shunts generators
4.2 Load sharing in parallel operation of D.C. Compound generators
4.3 Load sharing in parallel operation of D.C. series generators

5. Synchronous Machines:

5.1 Transient behaviour
5.2 Reactance
5.3 Symmetrical short circuit
5.4 Power angle (cylindrical rotor) characteristics
5.5 Swing equation and curve, M and H constants
5.6 Steady state stability
5.7 Transient stability

5.8 Equal area criterion of stability

5.8.1 One of the parallel lines suddenly switched off
5.8.2 System fault and subsequent circuit isolation

5.9 Hunting phenomenon in synchronous machines

REFERENCE BOOKS:

1. Generalised Theory of Electrical Machines P.S.Bhimbra
2. A.C. Commutator Machines A.E.Clayton

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MICROPROCESSOR AND ITS APPLICATION

CODE DEE 602

L	T	P
3	--	2

RATIONALE

Now a day's the use of computer is very wide so for a diploma holder the knowledge of computer is essentials. As the microprocessor is heart of computer, the knowledge of it is necessary. This subject provides the brief idea of microprocessor.

CONTENTS

1. Introduction:

- 1.1 Evolution of microprocessor
- 1.2 Digital computer
- 1.3 Organisation of computer
- 1.4 Definition of
  - 1.4.1 Instruction
  - 1.4.2 Program
  - 1.4.3 Machine language
  - 1.4.4 Assembly language
  - 1.4.5 High level language
- 1.5 Complier and Assembler

2. Number Systems:

- 2.1 Decimal, hexadecimal, binary and octal numbers and conversion of one number system to another
- 2.2 1's complement
- 2.3 2's complement
- 2.4 Binary addition
- 2.5 Binary subtraction using 1's complement and 2's complement

3. Microprocessors Architecture (Intel 8085):

- 3.1 Functional block diagram
- 3.2 Pin-Out diagram with description
- 3.3 Buses
  - 3.3.1 Address bus
  - 3.3.2 Data bus
  - 3.3.3 Control bus
- 3.4 Registers
- 3.5 Arithmetic and logic unit
- 3.6 Timing and control unit
- 3.7 Types of instructions and classification into groups
- 3.8 Types of addressing modes
- 3.9 Status flags

4. Programming and Application of Microprocessor:

- 4.1 Some examples of assembly language programme
- 4.2 Introduction to circuits (block diagram only) used in electrical application
  - 4.2.1 ADC
  - 4.2.2 DAC
  - 4.2.3 Analog Multiplexer
  - 4.2.4 Sample and Hold
  - 4.2.5 Programmable peripheral interface (PPI)

4.3 Microprocessor based Protective Relay

- 4.3.1 over current relay
- 4.3.2 Impedance relay
- 4.3.3 Reactance relay
- 4.3.4 MHO relay
- 4.3.5 Directional relay

4.4 Measurement of Electrical Quantities:

- 4.4.1 Frequency measurement
- 4.4.2 Phase angle and power factor measurement
- 4.4.3 Voltage and current measurement
- 4.4.4 Power and energy measurement

4.5 Measurement of Physical Quantities:

- 4.5.1 Temperature measurement
- 4.5.2 Deflection measurement
- 4.5.3 Water level indicator
- 4.5.4 Angular speed

4.6 Traffic Control.

PRACTICALS

1. Study of Intel 8085 microprocessors
2. Program to add two 8-bit numbers
3. Program to subtract two 8-bit numbers
4. Program to find 1's complement of an 8-bit numbers
5. Program to find 2's complement of a 8-bit numbers
6. Program to shift an 8-bit number left by one bit
7. Program to mask of least significant 4 bits of an 8 bit number
8. Program to mask of most significant 4 bits of an 8 bit number
9. Program to find square from look up table
10. Program to find largest of two numbers
11. Program to find smallest of two numbers
12. Program to arrange a series of numbers in descending order
13. Program to arrange a series of numbers in ascending order

REFERENCE BOOKS:

1. Microprocessor & Micro Computer — B. Ram
2. Microprocessor, Architecture Programming & Applications — Ramesh & Gaonkar
3. An Introduction to Microprocessors — A.P. Mathur

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SWITCHGEAR AND PROTECTION

CODE DEE 603

L	T	P
3	2	--

RATIONALE

The course is designed to develop the understanding of the principles and working of protective switchgears so that one can handle, install and maintain them and also take decisions at his level in different situations.

After undergoing this course the engineer is suitable to work at power station, high voltage lab and sub station etc.

CONTENTS

1. Faults in Power System:

- 1.1 Sources of faults
- 1.2 Percentage reactance and base KVA
- 1.3 3-phase short circuits on alternator
- 1.4 Calculations of short-circuit KVA current
- 1.5 Construction of reactors
- 1.6 Limitations of fault current
- 1.7 Location of reactor

2. Symmetrical Components:

- 2.1 Operator 'a'
- 2.2 Determination of sequence components
- 2.3 Sequence impedance and sequence network
- 2.4 Types of faults at the terminals of unloaded alternator
- 2.5 Determination of fault current

3. Fuses:

- 3.1 Definition of various related terms
- 3.2 Selection of fuse materials
- 3.3 Types of fuses
- 3.4 Application of H.R.C. fuses
- 3.5 Drop out fuse
- 3.6 Advantage and disadvantage of fuses

4. Circuit Breakers:

- 4.1 Basic construction of circuit breaker
- 4.2 Arc phenomenon
- 4.3 Arc extinction methods
- 4.4 Interruption of capacitive current
- 4.5 Current chopping
- 4.6 Resistance switches
- 4.7 Construction, working and application of
  - 4.7.1 Oil circuit breaker
    - 4.7.1.1 Bulk oil C.B.
    - 4.7.1.2 Minimum oil C.B.
  - 4.7.2 Air Circuit breaker
  - 4.7.3 Air blast circuit breaker
  - 4.7.4 Vacuum circuit breaker
  - 4.7.5 SF_6 circuit breaker
- 4.8 Ratings of circuit breakers

5. Protection:

5.1 Principle of protection systems
5.2 Basic requirement of relays
5.3 Classification of relays according to construction, uses And operating time
5.4 Types o f relays (construction, setting and applications)

5.4.1 Thermal relay
5.4.2 Electromagnetic relay
5.4.3 Induction type relay
5.4.4 Differential type relay
5.4.5 Distance relay

5.5 Over current, reverse power and earth leakage protection
5.6 Static relays

5.6.1 Basic elements
5.6.2 Applications

6. Protection of Alternator:

6.1 Field failure
6.2 Field earth fault
6.3 Over current
6.4 Phase unbalance and insulation protection
6.5 Differential and restricted earth fault schemes
6.6 Protection against prime mover failure

7. Transformer Protection:

7.1 Over current
7.2 Earth fault
7.3 Differential protection
7.4 Buchholz relay
7.5 Differential scheme for the protection of generator - transformer units.

8. Line Protection:

8.1 Differential pilot wire systems
8.2 Time graded directional over current and earth fault protection
8.3 Elements of distance protection and power line carrier protection

9. over Voltage Protection:

9.1 Causes of over voltage
9.2 Lightning surges
9.3 Protection of line against over voltage
9.4 Function of ground wire
9.5 Horn gap
9.6 Lightening arrestors
9.7 Insulation coordination

REFERENCE BOOKS:

1. Switchgear & Protection — Sunil S.Rao
2. A Course in Electrical Power — Soni, Gupta & Bhatnagar
3. Switchgear & Protection — M.Chander & Ravindranath
4. Electrical Power System — C.L. Wadhwa.

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ELECTRICAL INSTALLATION AND DESIGN

CODE DEE 604

L	T	P
2	--	6

RATIONALE

A diploma holder in electrical engineering is usually employed in state electricity boards, industries etc. Where they have to design, prepare estimates and prepare drawings for residential buildings, small workshop, distribution substation, grid substation, overhead and underground systems.

The course contents gives the knowledge to learn installation design principles. The expected achievements shall make an engineer fully competent to handle any problem related with installation.

CONTENTS

1. Design of Distribution Mains:

1.1 Design and estimate the material required for the following with specifications -

1.1.1 L.T. Overhead distribution main.
1.1.2 11 KV H.T. Overhead distribution main.
1.1.3 11 KV H.T. underground distribution main.

2. Sub Station:

2.1 Classification of substations

2.1.1 Indoor and Outdoor substation
2.1.2 Pole mounted substation
2.1.3 Platform type substation
2.1.4 Industrial substation

2.2 Selection of site for distribution substation
2.3 Estimation of required materials of distribution substation

3. Description and Layout of Grid Substation 33/11 and 220/132 KV:

3.1 Selection of site
3.2 Equipment used in G.S.S. with specification
3.3 Layout of G.S.S.
3.4 Single line diagram
3.5 Connection diagram of 33/11 and 220/132 KV G.S.S.
3.6 Estimate of materials
3.7 Determination of cost as per given rate schedule
3.8 G.S.S. Earthing

4. Design of a Distribution Scheme for a Small Colony:

4.1 Load survey
4.2 Load curve
4.3 Rating of sub-station transformer
4.4 Conductor size
4.5 Arrangement of street lighting
4.6 Arrangement of conductors on poles
4.7 Plan of distribution route

PRACTICALS

Design and estimate the list of materials for the following:

1. H.T. Overhead distribution main up to 20 Km.
2. L.T. Overhead distribution main up to 5 Km
3 Pole mounted substation.
4. Single line diagram of 220/132 KV G.S.S. and 33/11 KV substation

5. Three line diagram of 33/11 KV substation.
6. Design of distribution scheme for a small colony including load survey, load charts, load curves etc.
7. Idea of method used in RSEB to calculate the voltage regulation of LT line.
8. G.S.S. Earthing.

REFERENCE BOOKS:

1. Electrical Estimating & Costing S.L.Uppal
2. Electrical Estimating & Costing J.B.Gupta
3. Electrical Estimating & Costing J.P. Jaggi
4. Installation, Design & Drawing J.B. Gupta
5. Electrical Engg. Drawing Surjeet Singh

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CONTROL SYSTEM ENGINEERING

CODE DEE 605

L	T	P
3	2	--

RATIONALE

This course aims at imparting the basic concept of control systems. Now a days automated industries are growing at a fast speed. A diploma holder must have knowledge of control procedure. After studying this course the students will be capable of implementation of these principles in process industries as well as engineering industries.

CONTENTS

1. Control System:

- 1.1 Basic definition
- 1.2 Open loop and Closed loop systems
- 1.3 Transfer function
- 1.4 Transfer function of physical system (RC ladder network)
- 1.5 Block diagram and its reduction technique
- 1.6 Signal flow graph and Mason's gain formula

2. Control System Components:

- 2.1 D.C. Servo motor
- 2.2 A.C. Servo motor
- 2.3 Synchro pair
- 2.4 Tachogenerator

3. Time Domain Analysis:

- 3.1 Impulse response function
- 3.2 First and second order systems
- 3.3 Step response of second order system
- 3.4 Stability of control system
- 3.5 Routh's stability criterion
- 3.6 Static and dynamic error coefficients

4. Frequency Response:

- 4.1 Frequency domains analysis
- 4.2 Frequency response representation
- 4.3 Bode plot
- 4.4 Polar plots
- 4.5 Nyquist stability criterion

5. Root Locus:

- 5.1 Introduction
- 5.2 Rules for constructing root loci
- 5.3 Root locus plots
- 5.4 Effect of Zeros and Poles on root locus

REFERENCE BOOKS:

1. Control System Engg. Nagrath & Kothari
2. Control System B.C. Kuo
3. Control System Engg. Ogata

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BASIC DIGITAL ELECTRONICS

CODE DEE 6061

L	T	P
2	--	2

RATIONALE

Basic digital electronic is the requirement of modern computer, microprocessor and digital communication system. On account of reliability and accuracy digital electronic system are replacing conventional analog systems. A diploma holder having knowledge of digital system will be useful to the industries.

CONTENTS

1. Introduction:

1.1 Digital signal and its representation
1.2 Advantages of digital techniques

2. Logic Gates:

2.1 Introduction
2.2 Symbol and truth table of NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR gates
2.3 Universal gates and realization of other gates
2.4 Positive, negative logic

3. Boolean Algebra:

3.1 Basic laws of Boolean algebra
3.2 Proof by perfect induction
3.3 De'Morgen's theorem and its applications
3.4 Simplification of expression by Boolean algebra
3.5 Realization of simplified expression by logic gates

4. Flip - Flops:

4.1 Introduction to R-S, D, J-K, T, M/s J-K and their truth table
4.2 Race problem
4.3 Concept of edge and level triggering

5. Counters:

5.1 Asynchronous and synchronous counters – up, down and up-down
5.2 Mode counters – Mod - 3, Mod - 5, decade counter
5.3 Ring counter, Johnson counter

6. Shift Register:

6.1 Left, right and bi-direction
6.2 Series and parallel
6.3 Universal
6.4 Use of shift register for binary multiplication and division

7. Combinational Logic Design:

7.1 Binary half and full adder
7.2 Binary half and full subtractor
7.3 Binary serial, parallel and BCD adder
7.4 Parity bit generator and checker
7.5 Binary comparator
7.6 Basic idea of multiplexer, demultiplexer, encoder and decoder

PRACTICALS

1. Verify the truth table of NOT, AND, OR gates
2. Verify the truth table of NAND, NOR, EX-OR, EX-NOR gates
3. Design an NOT, AND, OR gates using universal gates
4. Design a EX-OR, EX-NOR gates using universal gates
5. Design a binary half and full adder
6. Design a binary half and full subtractor
7. Verify the truth table of R-S, J-K, D, T, flip flops
8. Design a Mod – 9 counters
9. Study of ring counter using flip flop
10. Study of shift register using flip flops

REFERENCE BOOKS:

1. Digital Principles & Application — Malvino Leach
2. Digital Electronics — T.C. Bartee
3. Modern Digital Electronics — R.P.Jain
4. Digital Logic Design — Morris Mano
5. Digital Electronics — Saroj Rangnekar (ISTE)

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ELECTRICAL MACHINE DESIGN

CODE DEE 6062

L	T	P
2	2	--

RATIONALE

Basic design concepts are essential for a diploma holder student. The must aware about various factors, which governs the design of electrical machines. It will help the students in industrial and project work.

The subject includes the brief study of design of transformer rotating machines.

CONTENTS

1. Basic Design Principles:

1.1 Basic considerations
1.2 Limitations in design
1.3 Electrical conductive materials (Aluminum, copper and super conductor)
1.4 Magnetic materials (Diamagnetic, Paramagnet, ferromagnetic and CROS)
1.5 Insulating materials (Fibrous materials, Liquid insulating materials, ceramic, adhesive and enameled)

2. Heating, Cooling and Ventilation of Electrical Machines:

2.1 Mode of heat transfer

2.1.1 Conduction
2.1.2 Convection
2.1.3 Radiation

2.2 Equation of Heating and Cooling of Machine
2.3 Heating and cooling time constant
2.4 Types of enclosures
2.5 Methods of ventilation and cooling
2.7 Cooling air circuit

2.7.1 Radial
2.7.2 Axial
2.7.3 Combined
2.7.4 Multiple inlets

2.8 Closed circuit hydrogen cooling
2.9 Quantity of coolants required
2.10 Electric machine duty cycles
2.11 Calculation of motor rating

2.11.1 Average loss method
2.11.2 Equivalent current method
2.11.3 Equivalent power method

2.12 Characteristics of different cooling media like oil, air, hydrogen and water

3. D.C. Machine Design:

3.1 Choice of specific magnetic and specific electric loading
3.2 Output equation (Armature Design)
3.3 Calculation of main dimensions
3.4 Output coefficients
3.5 Choice of number of poles
3.6 Design of shunt field winding

4. 3-Phase Induction Motor Design:

4.1 Choice of specific magnetic and specific electric loading

4.2 Output equations
4.3 Calculation of main dimensions
4.4 Relation between D and L
4.5 Effect of length of air gap on motor performance
4.6 Calculation of no load current

5. 3-Phase Alternator Design:

5.1 Choice of specific magnetic and specific electric loading
5.2 Output equation
5.3 Calculation of main dimensions
5.4 Cooling of alternator

6. Transformer Design:

6.1 Choice of specific magnetic and specific electric loading
6.2 Output equation for 3-phase transformer
6.3 Main dimensions of 3-phase transformer
6.4 Winding design
6.5 Magnetising current calculation
6.6 Design of tank and cooling tubes

7. Design of Motor Starters:

7.1 D.C. shunt motor starter
7.2 D.C. series motor starter

REFERENCE BOOKS:

1. Electrical Machine Design — R.K. Agarwal
2. Design of Electrical Machines — V.N. Mittle & A. Mittal
3. A Course in Electrical Machine Design — A.K. Sawhney

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POWER SYSTEM ANALYSIS

CODE DEE 6063

L	T	P
2	2	--

RATIONALE

A diploma holder in electrical engineering has to adopt the cheapest and most convenient scheme for generation and transmission of electrical power. The course content gives full knowledge to learn economic aspects of generation, voltage regulation methods in power system and performance of EHV and HVDC transmission.

CONTENTS

1. Economic Aspects of Generation:
1.1 Factor affecting the cost of generation
1.2 Cost reduction by power station inter connection
1.3 Load curves, load duration curves, calculation of cost per unit
1.4 Need of improvement of power factor
1.5 Incremental rate of generation and condition for economic loading

2. Combined Operation of Power Stations:
2.1 Advantage of interconnection
2.2 Base load, peak load and load allocation among different power station
2.3 Effect of change in excitation and change in fuel supply on load sharing of alternator
2.4 Load frequency control

3. Voltage Regulation in Power System:
3.1 Control of generator voltage
3.2 Tap changing transformer
3.3 Shunt capacitors and synchronous phase modifier
3.4 Series capacitors, shunt reactors and static VAR compensators

4. Power System Stability:
4.1 Power angle diagram and maximum steady state power
4.2 Steady state stability and its improvement
4.3 Transient stability, swing equation and introduction to equal area criterion

5. EHV Transmission:
5.1 Requirement and design consideration of EHV lines
5.2 Selection and spacing of conductor
5.3 Corona and radio interference
5.4 Insulation requirement

6. HVDC Transmission:
6.1 Limitation of high voltage ac transmission
6.2 Advantages and limitation of HVDC transmission
6.3 Principal parts of generating station
6.4 Application of HVDC system
6.5 HVDC system in India

REFERENCE BOOKS:

1. Generation of Electrical Power — B.R. Gupta
2. Power System Design — M.V. Despandey
3. Electrical Power System — Nagrath & Kothari
4. Elements of Power system — Stevension

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MANAGEMENT

CODE DEE 6071 L T P
Common for All Branches of Engineering 2 2 --

RATIONALE

To achieve the target and goals in an organisation it is essential to co-ordinate the entire system. For this purpose the knowledge of principles of management, human resources development, material management and financial management is required.

CONTENTS

1. Principles of Management:

1.1 Management, administration and organisation, difference between them.
1.2 Scientific management: Meaning, characteristics, object and advantage: Taylor's scientific management – Fayol's principles of management, functions of management
1.3 Types of ownership, sole trading, partnership, joint stock, co-operative and public enterprise
1.4 Types of organisation, different types and their charts.
1.5 Importance of human relation professional ethics
1.6 Need for leadership, leadership qualities
1.7 Motivation

2. Human Resources Development:

2.1 Introduction, object and functions of human resource development department
2.2 Recruitment, sources and methods of selection, need for effective training, method of training, duties of supervisor / Formen, role of HRD in industries.

3. Wages and Incentives:

3.1 Definition and requirements of a good wage system methods of wage payment
3.2 Wage incentives - type of incentive, difference in wage incentive and bonus incentive to supervisor.

4. Material Management:

4.1 Purchasing Functions and duties of purchase department organisation of purchase department, methods of purchasing, purchase order contracts, legality of contracts types of contracts i.e. piece work contract, lumpsum contract, item rate contract, percentage contract, merits and limitation of each contract system, departmental execution of works, rate contract - D.G.S & D and C.S.P.O. tender, necessity, types of tenders, tendering procedure, earnest money and security money
4.2 Store and store keeping: Functions and duties of store department, location and layout of store, bin cards, store ledger, receipt and issue procedure of materials, physical verification of stores, disposal method of unserviceable articles and protection of stores.
4.3 Sales: function and duties of sales department sales promotion advertisement service after sales.

5. Financial Management:

5.1 Function and duties of finance department
5.2 Brief idea of journal, ledger, trial balance, trading account, profit and loss account, and balance sheet.
5.3 Cheques (crossed and bearer), draft, promissory note, letter of credit, brief idea of cost accounting.
5.4 Numerical problems.

6. Marketing Management:

6.1 Concept of Marketing
6.2 Problems of Marketing
6.3 Pricing policy
6.4 Distribution channels and methods of marketing

7. Tax System and Insurance:

7.1 Idea of income tax, sales tax, excise duty and custom duty
7.2 Industrial and fire insurance, procedure for industrial insurance.

8. Labour Legislation and Pollution Control Acts:

8.1 Industrial acts: factory act 1948
8.2 Workmen's compensation act 1923
8.3 Apprentices act 1961
8.4 Water pollution contract act 1974 and 1981
8.5 Air pollution contract act 1981
8.6 Environmental protection act 1986
8.7 Forest (animal conservation act 1972)
8.8 Pollution control provisions in motor vehicle act.

9. Entrepreneurship Development:

9.1 Role of entrepreneurship and its advantages
9.2 Distinction between an entrepreneur and a manager
9.3 Project identification and selection
9.4 Project formulation
9.5 Project appraisal

REFERENCE BOOKS:

1. Industrial Management V.K. Sharma & O.P. Harkut
2. Industrial Engg. & Management O.P. Khanana
3. Industrial Engg. & Management T.R. Banga

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ENTREPRENEURSHIP DEVELOPMENT

CODE DEE 6072	L	T	P
Common for All Branches of Engineering	2	2	--

RATIONALE

This subject will introduce the students about how to set up a small-scale industry. The subject includes the procedure for how to select, proceed and start the SSI, which also involves a concrete market survey report and project formulation.

CONTENTS

1. Entrepreneurship:

1.1 Role of entrepreneurship and its advantage
1.2 Classification of industries (based on scale)
1.3 Classification of industries (based on type)

2. Industrial Policy:

2.1 New industrial policy
2.2 M.R.T.P. act.

3. Entrepreneurial Development:

3.1 Product identification/ selection
3.2 Site selection
3.3 Plant layout
3.4 Institutional support needed
3.5 Pre-market survey

4. Entrepreneurship Support System:

4.1 Role of District Industries Centre in setting up industry
4.2 Function of NSIC, SISI, NISIET, NRDC, SSIC, SIDO, NMTC, KVIC, RSMDC
4.3 Role of state finance corporation, state electricity board, pollution control board, RAJCON, BIS, I.S.O. etc.

5. Setting up SSI:

5.1 Registration of SSI
5.2 Allotment of land by RIICO
5.3 Preparation of project report
5.4 Structure of organisation
5.5 Building construction
5.6 Establishment of machines

6. Raw Material Management:

6.1 Allotment of iron and steel, coke/ coal
6.2 Allotment of other indigenous raw material from NSIC
6.3 Allotment of imported raw material and parts

7. Marketing Facilities:

7.1 Supply of product to state govt, to defence, to railways, to CSPO, to CSD
7.2 Participation in international exhibition and fairs, trade centres, state emporium and departmental stores
7.3 Quality consciousness and its effect on product sales

8. Financial Sources for SSI:

8.1 Various institutions providing loans for industries
8.2 Various types of loans
8.3 Subsidies

9. Contracts and Tenders:

9.1 Type of contracts
9.2 Necessity of contract and tenders
9.3 Type of tenders
9.4 Tendering procedure

10. Project Report:

10.1 Procedure of preparing a project report
10.2 Format of project report
10.3 Preparation of project report for some SSI items

11. ISO: 9000 Series of Quality System:

11.1 Definition of few important terms related to ISO quality system
11.2 Various models for quality assurance in ISO: 9000 series
11.3 Various elements of ISO: 9001 model (20 points)
11.4 Benefits by becoming an ISO: 9000 company
11.5 Introduction to total quality management (TQM)

REFERENCE BOOKS:

1. Hand Book of Small Scale Industry — P.M. Bhandari
2. Hand Book on Entrepreneurship Development — O.P. Harkut
3. Entrepreneurial Development — S.S. Khanka
4. Statistical Quality Control — Mahohar Mahajan
5. ISO: 9000 Quality System — S. Dalela

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PRODUCTION SYSTEM MANAGEMENT

	L	T	P
CODE DEE 6073			
Common for All Branches of Engineering	2	2	--

RATIONALE

Diploma holders are responsible for controlling various production activities, which are not directly related to shop floor. These activities are new product design, Demand forecasting, capacity planning, material requirement planning etc. A diploma engineer should also be aware about new techniques used for manufacturing like group technology and JIT manufacturing.

CONTENTS

1. Introduction:

1.1 Production and production management
1.2 Objectives of production management
1.3 Functions and scope of production management

2. New Product Design:

2.1 Product life cycle
2.2 Product policy of an organisation
2.3 Selection of a profitable product
2.4 Product design process and product analysis

3. Demand Forecasting:

3.1 Need for demand forecasting
3.2 Long term and short term forecasts
3.3 Classification of forecasting methods
3.4 Various forecasting methods

4. Production Planning and Control:

4.1 Objective and function of PPC
4.2 Comparison between production planning and production control
4.3 Information requirement of PPC
4.4 Organisation for PPC
4.5 Manufacturing method and PPC
4.6 Problems of PPC

5. Capacity Planning:

5.1 Measurement of capacity
5.2 Capacity planning
5.3 Estimating future capacity needs
5.4 Aggregate planning
5.5 Master production schedule

6. Material Requirement Planning:

6.1 Objectives and functions of MRP
6.2 MRP system
6.3 Management information from MRP
6.4 Lot sizing consideration
6.5 Manufacturing resource planning (MRP – II)

7. Process Planning:

7.1 Process and equipment selection
7.2 Machine requirement

7.3 Machine output
7.4 Manpower planning
7.5 Line balancing
7.6 Process planning

8. Production Control:

8.1 Loading
8.2 Sequencing
8.3 Assignment model
8.4 Scheduling
8.5 Despatching

9. Make or Buy Decision

9.1 Make or buy decision making
9.2 Factors influencing make or buy decision
9.3 Functional aspects of make or buy decision

10. Application of LPP in Production Management:

10.1 Product mix decision
10.2 Standard form of linear programming problem
10.3 Formulation of L.P. problem
10.4 Graphical method (only) for solving problems

11. Group Technology:

11.1 Concept of group technology
11.2 Group layout
11.3 Stages in group technology manufacturing
11.4 Benefits of G.T.

12. Just in Time Manufacturing:

12.1 Concept of JIT
12.2 Seven wastes
12.3 Basic element of JIT
12.4 Benefits of JIT

REFERENCE BOOKS:

1. Industrial Engg. & Production Management — Martand Telsang,
2. Production Management — Jain & Agarwal
3. Production Management System — S.C. Sharma

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