Integral University, Lucknow
Department of Polytechnic
Study and Evaluation Scheme

Program: Diploma in Electrical Engineering

Semester III[rd]

S. No.	Course Code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credits	Attributes						
				L	T	P	CT	TA	Total	ESE				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics
THEORIES																				
1	DMA-301	Applied Mathematics-II (A)	Core	03	01	00	40	20	60	40	100	3: 1 :0	4	Y		Y				
2	DEE-301	Electrical Design Drawing & Estimating-I	Core	03	01	00	40	20	60	40	100	3: 1: 0	4		Y	Y				
3	DEE-302	Electrical Instrument & Measurements-I	Core	03	01	00	40	20	60	40	100	3 :1: 0	4	Y	Y	Y				
4	DEE-303	Elementary Mechanical & Civil Engineering	Core	03	01	00	40	20	60	40	100	3: 1: 0	4	Y	Y	Y				
5	DEE-306	Power System	Core	03	01	00	40	20	60	40	100	3: 1: 0	4	Y		Y				
6	DEE-307	Circuit Theory	Core	03	01	00	40	20	60	40	100	3: 1: 0	4	Y		Y				
PRACTICAL																				
1	DEE-351	Electrical Wiring & Fabrication Shop	Core	00	00	03	40	20	60	40	100	0: 0: 1.5	1.5	Y	Y	Y				
2	DEE-352	Electrical Instruments & Measurement Lab	Core	00	00	03	40	20	60	40	100	0 :0: 1.5	1.5	Y	Y	Y				
3	DEE-353	Elementary Mechanical Engineering Lab	Core	00	00	03	40	20	60	40	100	0: 0: 1.5	1.5	Y		Y				
4	GP-351	General Proficiency		-	-	-	-	-	60	-	60								Y	Y
Total				18	06	09	-	-	-	-	**960**		**28.5**							

APPLIED MATHEMATICS-II (A)

(DMA-301)

(Common to All Diploma Engineering Courses)

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UNIT-1 [10]

Matrix-I

Type of matrix: Null matrix, unit matrix, square matrix, symmetric and skew-symmetric matrix, orthogonal matrix, diagonal and triangular matrix, Hermitian and Skew-Hermitian matrix, unitary matrix.

Algebra of Matrix: Addition, subtraction and multiplication.

Determinant of matrix, cofactor of matrix, computing inverse through determinant and cofactor.

Elementary row/column transformation: meaning and use in computing inverse of matrix.

UNIT-2 [8]

Matrix-II

Linear dependence/independence of vectors. Definition and computation of rank of matrix through determinants, elementary row and column transformation (Echelon and Normal form of matrix), consistency of equations.

UNIT-3 [6]

Eigen Values and Eigen Vectors, Cayley-Hamiltom Theorem

Definition and evaluation of Eigen values and Eigen vectors of a matrix of order 2 and 3. Cayley-Hamilton theorem (without proof) and its verification, use of Cayley-Hamilton theorem in finding inverse.

UNIT-4 [8]

Ordinary Differential Equation

Introduction, formation, order, degree of ordinary differential equation. Formation of ordinary differential equations through physical, geometrical, mechanical, electrical consideration.

Solution of differential equations of first order and first degree by variable separable, reducible to variable separable forms, linear and Bernoulli form and exact differential equation.

UNIT-5 **[8]**

Second Order Differential Equation

Properties of solution, linear differential equation of second order with constant coefficients, complimentary function and particular integral, equation reducible to linear form with constant coefficients.

Simple Applications

LCR circuit, Motion under gravity, Newton's law of cooling, Radioactive decay, Population growth, Oscillations of a string, Equivalence of electrical mechanical system.

References:

1. Applied Mathematics: Kailash Sinha, Meerut publication.
2. Applied Mathematics: P.K Gupta, Asian Publication.
3. Applied Mathematics: H.R Luthra, Bharat Bharti Prakashan.
4. Applied Mathematics: H.K Das, C.B.S Publication.
5. Mathematics for Polytechnic: S.P Deshpande, Pune Vidyarthi Griha.
6. Calculus: Single Variable: Robert T. Smith, Tata McGraw Hill.
7. Mathematics I: Ane Books India. Z. Khan, Q.S Ahmad & S.A. Khan.

ELECTRICAL DESIGN, DRAWING & ESTIMATING-I
(DEE-301)

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UNIT-I **[8]**

Electrical Symbols and Diagrams:
Need of symbols; List of symbols for electrical equipments and accessories used in electrical light, fan and power circuits, alarm and indicating circuit , contactor control circuits as per I.S.S. Type of diagrams - Wiring diagrams (multiple and single line representation) and schematic diagrams as per I.S.S.
* One Drawing Sheet for atleast - 50 symbols.

UNIT-II **[8]**

Wiring materials and accessories :
Brief description, general specifications (as per I.S.S.) and approximate cost of different types of wires, cables, switches, distribution board, switch board, boxes, batten and its accessories, conduit and its accessories, lamp holders, socket out lets, plug ceiling roses. fuse amd energy meter used in domestic and power wiring installations. Brief description, general specifications and approximate cost of switches,push buttons, bells, indicating lights, indicating panels, relays etc.used in alarm circuits. * Study of materials and accessaries in work shop.

UNIT-III **[8]**

Light and Fan Circuits :
Schematic and wiring diagrams (multiline and single line both) using junction boxes and looping systems
for the following types of circuits:-
(i) Light and fan controlled by necessary switches and regulators.
(ii) Stair case wiring
(iii) Corridor lighting
(iv) One lamp controlled by three or more switches.
* One drawing sheet for atleast 4- problems.
* Wiring practice for atleast 3-circuits.

UNIT-IV **[8]**

Estimation of Domestic Internal Wiring Circuits :
(Small Houses)
(i) Description of various wiring systems and methods.
(ii) Need of earthing and point to be earthed in internal wiring system as per IE rules.
(iii) I.S. specifications, calculation of No. of points (light, fan, socket outlet), calculation of total load including domestic power, determination of no. of circuits, size of wires and cables, switches and
main switch, distribution board and switch board, batten conduit and other wiring accessories.

UNIT-V **[8]**

Layout of installation plan, single line wiring diagram,
calculation of length of batten/conduit of differant sizes and wire length; schedule of materials. Estimating for small houses using PWD/CPWD electrical schedule rates (E.S.R.)
* The drawing sheet for atleast 4-layouts and circuits
* Estimation practice for atleast - 2 installations each for small houses.

Reference Books:

1. Electrical Engg. Drawing Design & Estimating - K.B.Raina & S.K. Bhattacharya –Willey Eastern Publication
2. Electrical Engg. Drawing Desing & Estimating – Jaggi & Pal & Lal – Nav Bharat Prakashan, Meerut

ELECTRICAL INSTRUMENTS AND MEASUREMENTS-I

(DEE-302)

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UNIT-I **[6]**

Introduction to electrical measuring instruments:

Concept of measurement and instruments. Electrical quantities and instruments for their measurements.

UNIT-II **[10]**

Measurement and Errors. Accuracy, precision, types of errors, probability of errors and Gaussian Errors curve, sensitivity, resolution and stability. Classification of errors. Types of electrical measuring instruments, indicating, integrating and recording instruments. Essentials of indicating instruments , deflecting, controlling and damping torques. Measurement of dielectric strength of insulating oil and dielectric loss.

UNIT-III **[8]**

Ammeters and voltmeters (moving coil and moving iron type) Concept of ammeters and voltmeters and difference between them. Construction and working principle of moving coil and moving iron instruments.

UNIT-IV **[8]**

Merits and demerits, sources of errors and application of these instruments. Extension of range, use of C.T. & P.T. simple problems theorem for d.c. circuits.

UNIT-V **[8]**

Wattmeters (Dynamometer type) and Maximum Demand Indicator: Construction, working principle, merits and demerits of dynamometer type wattmeter. Sources of errors. Power measurement in three phase circuit by Two wattmeter and three wattmeter methods, simple problems. Construction and working principle of maximum demand indicators.

Reference Book :

A course in Electrical & Electronics Measurement & Instrumentation – A.K. Shahney Dhanpat Rai & Sons Publication.

ELEMENTARY MECH. & CIVIL ENGG.
(DEE-303)

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UNIT-I **[8]**

Applied Mechanics
General condition of equilibrium of a rigid body under coplaner forces. Concept of tie, strut, beam and trusses. Shear force and bending moment diagram of simply supported beam and cantilever for point load. Concept of centre of gravity, moment of inertia and friction. Mechanical advantage, velocity ratio, mechanical efficiency of simple machines: Lifting machines much as pulley, differential pulley, wheel and axle, simple screw jack, worm and worm wheel.

UNIT-II **[8]**

Strength of Materials & Power Transmission:
Stress, strain, elastic constraints, stress in circular shaft subjected to pure torsion only. Rivetted and bolted joints. Power transmission by solid and hollow shaft. Gear trains - simple and compound, fly wheel. Rope and belts - velocity ratio, length, size of belt and power transmited. Hydraulics & Hydraulic
Machines:

UNIT-III **[8]**

Properties of fluids, pressure of fluid and its
measurement. Flow of fluids velocity and discharge, Bernaulli's theorem and its application in venturimeter, flow through pipe, head loss due to friction. water turbines- Pelton and Reaction, reciprocating and centrifugal pump.

UNIT-IV **[8]**
Heat Engines:
External & internal combustion engines, working of diesel and petrol engine, horse power of IC engines, steam generator, constrcution and working of Bobcock & Wilcox boiler, Cochran boiler, condenser, steam turbine classifcation and principle of operation, gas turbine.
Civil Engineering Materials:
General idea of raw materials, manufacturing process, properties and uses of Bricks, lime, cement and Timber.

UNIT-V **[8]**
Foundation
(i) Bearing capacity of soil and its importance, need of foundation for electrical machines.
(ii) Foundations for heavy, light and vibrating machines.
(iii) Concrete proportion, mixing w/c ratio, workability RCC and its use. Surveying
(i) Basics of chaining and leveling
(ii) Description of Instruments used
Reference Book
Basic Mechanical Engineering – R.S. Khurmi

POWER SYSTEM
DEE-306

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UNIT I **8**

SUPPLY SYSTEM
Layout of electrical power system from generating station to consumer end, Component of electrical power system from generating station to consumer end. Advantages of high voltage transmission. Requirement of interconnection, Advantages of interconnection. Concept of grid interconnection

UNIT II **8**

CONDUCTORS AND POWER CABLES
Types of conductors. Comparison of conductor cost in various systems. Comparison of overhead/under ground systems. Power cable construction. Oil filled, gas filled and SF6 gas cables. Testing of cables

UNIT III **8**

MECHANICAL CHARACTERISTICS
Types of insulators. Voltage distribution and string efficiency. Improvement of voltage distribution. Line support. Parabolic method of sag calculation at level support. Ice and wind loading of conductors. Factors affecting sag
.

UNIT IV **8**

PERFORMANCES OF LINES
Line parameters. Expression for line inductances and line capacitances. Performances of short and medium lines. Normal tee and л-method of calculation of voltage regulation and efficiency. Elementary idea of long transmission line

UNIT V **8**

SUBSTATIONS
Layout of substation, substation equipment and their functions, gas insulated substation (GIS)

REACTORS
Types of reactors, current limiting reactors, uses of reactors

Reference Books:

1. Electrical power system by “Ashfaq Hussain”
2.Electrical power system by “Nagrath and Kothari”

CIRCUIT THEORY
DEE-307

L T P
3 1 0

UNIT I **8**

CIRCUIT ANALYSIS AND DC TRANSIENTS
Ideal and practical voltage and current sources. **Source transformation:** Voltage Sources to Current Source and vice versa. Mesh and nodal analysis of DC circuits with voltage sources, current sources and combination of these two. Growth of current in an inductive circuit, time constant of R-L circuit , decay of current in an inductive circuit. Charging of a capacitor, time constant of RC circuit, initial and final values. Discharge of a capacitor

UNIT II **8**

TWO PORT NETWORK
Various two port circuit parameter: their interrelationship, evaluation of Z,Y,h and transmission (ABCD) parameters, cascading of two port network

UNIT III **8**

AC CIRCUITS
Definition and explanation of alternating current, voltage and their relative terms, phasor diagrams of alternating current and voltage in series and parallel A.C. circuit containing purely resistive, capacitive, inductive elements (a combination of two elements and a combination of all three elements). Mesh analysis for A.C. circuits, nodal analysis for A.C. circuits, choice between mesh and node analysis.

UNIT IV **8**

THREE PHASE CIRCUITS
Generation of three phase voltages, phase sequence, star and delta connection, line and phase values, phasor diagrams, power in a three phase balanced and solution of three phase balanced circuits

UNIT V **8**

RESONANCE
Series resonance: definition, derivation of expression for resonant frequency, quality factor, voltage and current, resonance curve, lower and upper half power frequency, bandwidth and selectivity, dependence of band width and selectivity on quality factor (problems based on the above). **Parallel resonance circuit** (same as for series resonance)

Reference Books

1. Network and systems: Ashfaq Husain
2. Electrical technology: B.L.Theraja

ELECTRICAL WIRING & FABRICATION SHOP

(DEE-351)

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1. To prepare a folder/display board of accessories used in domestic wiring with complete specifications.

2. To prepare a display board of tools used in wiring and fabrication shop.

3. Batten wiring containing light, ceiling fan, socket points.

4. Staircase wiring using two way switches.

5. Connection of a fluorescent tube using starter, choke and single way switch and its fault detection.

6. Practice of domestic conduit wiring.

7. Testing of wiring installation by meggar.

8. Connection of mercury lamp along with accessories.

9. Making of an extension board containing two 5 A and 15 Amp plug points controlled by individual switches using MCB/ELCB (Earth Leakage Circuit Braker).

Ref. Book :

A Course in General Electrical Design & Drawing – Surjeet Singh – Katson Publication,N.Delhi

ELECTRICAL INSTRUMENTS AND MEASUREMENT LAB

(DEE-352)

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0 0 3

Perform any 10 experiments:

1. To extend the range of an ammeter

2. To extend the range of an Voltmeter

3. To convert an ammeter into voltmeter.

4. To calibrate 1-phase energy meter by direct loading method.

5. To make proper connections of indicating/integrating instruments in a circuit e.g. wattmeter, frequency meter, power factor meter, 1-phase and 3-phase energy meter (Analog type/Digital Type) etc.

6. To measure power, power factor in a l-phase circuit using wattmeter and power factor meter and verify results with calculations.

7. Measurement of power and power factor of a 3-phase balanced load by 2-wattmeter method.

8. Measurement of voltage, frequency of a sinusoidal signal with C.R.O.

9. Measurement of resistance, voltage, current with electronic multimeters (Analog & Digital) and compare the reading.

10. To measure strain by transducer.

11. To measure inductance by maxwell's bridge.

12. To measure capacitance by Wein's/Schering bridge.

13. To calibrate three phase energy meter with the help of standard 3 phase energy meter.

14. To connect a Trivector meter in a three phase circuit and make measurement of different quantities.

Ref. Books:

A Text Book of Laboratory Course in Electrical Engg. – Kharbanda – S.Chand Publication

ELEMENTRY MECH. ENGINEERING LAB

(DEE-353)

L T P

0 0 3

1. To operate a diesel engine (starting, running and shutting down) and to study lubricating and cooling system of the engine.
2. To determine BHP of diesel or petrol engine and show that BHP is directly proportional to revolution per minute of engine shaft.
3. To determine mechanical advantage, velocity ratio, efficiency and effort loss due to friction in screw jack.
4. To verify Bernoulli's theorem with the help of Bernoulli's appratus.
5. To determine head loss due to friction in GI pipes.
6. To operate the Pelton wheel and Francis Turbine and to understand its construction and working.
7. To perform tensile test on mild steel and aluminium wire specimen and compare the result.
8. To do alignement and coupling of a motor generator set.