TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

3-Year Diploma Engineering Curriculum and
Syllabus for Electrical Engineering (EE)

Fourth Semester

Course Structure

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-DEN-T200	Career Advancement & Skill Development	2	1	0	3
TIU-DEE-T202	Electrical Machines II	2	1	0	3
TIU-DEE-T204	Analog Electronics	2	1	0	3
TIU-DEE-T206	Transmission & Distribution of Electric Power	2	1	0	3
TIU-DEE-T208	Electrical Control Systems	2	1	0	3
TIU-DMG-T206	Engineering Economics, Accountancy & Costing	2	1	0	3
Practical					
TIU-DEE-L210	Computer Aided Electrical Drawing	0	0	3	2
TIU-DEE-L202	Electrical Machines Lab II	0	0	3	2
TIU-DEE-L204	Analog Electronics Lab	0	0	3	2
TIU-DEE-L206	Transmission & Distribution System Design Lab	0	0	3	2
Sessional					
TIU-DES-S298	Entrepreneurship Skill Development	0	0	2	2
Total Credits					28

Detailed Syllabus

Career Advancement & Skill Development
TIU-DEN-T200

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LTP: 2-1-0
Credits: 3

The detailed syllabus to be provided by the department of Humanities

Electrical Machines II
TIU-DEE-T202
LTP: 2-1-0
Credits: 3

Module – I Three Phase Induction Motor:

1.1 Construction of 3-phase induction motor.
1.2 Production of rotating magnetic field.
1.3 Working principle of 3-phase induction motor.
1.4 Concept of Synchronous Speed & Slip.
1.5 Equation of rotor induced emf, current, frequency, reactance & impedance under standstill and running condition. (Numerical)
1.6 Vector diagram (at no-load & running condition)
1.7 Concept of Equivalent circuit (at no-load, at blocked rotor and at running condition).(No Numerical)
1.8 Derivation of Torque equation, Starting torque,Running torque, ????????// condition forMaximum torque and condition for maximum torque. (Numerical)
1.9 Torque- Slip characteristics, Effect of change in rotor circuit resistance and supply voltage on Torque-Slip characteristics.
1.10 Power stages in 3-phase induction motor and their relation, Losses, Efficiency. (Numerical)
1.11 Starting methods of 3-phase induction motor by
- a) Rotor resistance starter.
- b) Direct -On-Line starter.
- c) Autotransformer starter.
- d) Star-Delta starter (Manual & Automatic). (Numerical for all starter)

1.12 Speed control of 3-phase induction motor by –
- a) Changing supply frequency.
- b) Pole changing method.
- c) Changing Rotor circuit resistance & stator reactance.
- d) Changing supply voltage.

1.13 Braking of 3-phase induction motor by –
- a) Plugging.
- b) Rheostatic method.
- c) Regenerative method.

1.14 Cogging &Crawling (simple idea)
1.15 Concept of Double cage rotor & Deep-bar rotor.
1.16 Motor enclosures and specification as per I.S Code.
1.17 Industrial applications of 3-phase induction motor

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Module – II Alternator:

2.1 Construction of 3-phase alternator, Description of salient & non- salient rotor.
2.2 Methods of excitation systems of 3-phase alternator by –
- a) Static excitation.
- b) Brushless excitation.
- c) DC generator.

2.3 Advantages of Stationary armature and Rotating field system.
2.4 Armature winding – Single layer and multilayer, Concentrated and Distributed (Concept only).
2.5 Derivation of E.M.F. equation of 3-phase alternator, Effect of Coil span factor and Distribution factor on emf, Winding factor. (Numerical)
2.6 Factors affecting the terminal voltage of alternator –
- a) Armature resistive drop
- b) Leakage reactance drop.
- c) Armature reaction at various p.f, concept of Synchronous reactance.

2.7 Phasor diagrams of cylindrical rotor alternatorat lagging, leading & unity p.f. loads.
2.8 Voltage regulation of 3-phase alternator by – (Numerical)
- a) Synchronous Impedance Method.

2.9 Open circuit characteristics, Short circuit characteristics of alternator and determination of synchronous reactance.
2.10 Active & Reactive power equations in terms of load angle at steady state for non-salient pole alternator.
2.11 Steady-state characteristics of Alternator –
- a) Terminal voltage vs. Load current, at different p.f,
- b) Field current vs. Load current at different p.f,
- c) Active & Reactive Power vs. load angle (non-salient alternator).

2.12 Short circuit ratio (SCR) – concept & significance.
2.13 Method of control of Active & Reactive Power of an alternator.
2.14 Reasons & advantages of Parallel operation.
2.15 Synchronization of two or more alternators by
- a) Three lamps method.
- b) Synchroscope.

2.16 Parallel operation of (i) an alternator & infinite bus and (ii) Between two alternators & Load sharing between them.(Numerical)

Module-III Synchronous Motor:

3.1 Construction and working principle.
3.2 Methods of starting by –
- a) An auxiliary motor.
- b) Damper winding.

3.3 Effect of variation of Load – Speed vs. Torque characteristics.
3.4 Effect of variation of excitation at infinite bus (over and under excitation) – V curves & inverted V-curves.
3.5 Hunting, George's phenomenon.

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3.6 Applications of synchronous motor, Synchronous condenser

Module - IV: Single phase motors:

4.1 Double-revolving field theory.

4.2 Construction, Principle of operation and Applications of different types of single-ph Induction motors –

a) Split phase (resistance) type.
b) Capacitor start type.
c) Capacitor run type.
d) Shaded pole motors.

Module - V. Special Machines:

5.1 Linear induction motor.
5.2 Induction generator.
5.3 A.C series motor.
5.4 Reluctance Motor.

Electrical Control Systems
TIU-DEE-T208
LTP: 2-1-0
Credits: 3

Introduction to control system, classification of control system, Feedback control system. Properties of control system: idea on stability, steady state and transient error. (no mathematical deduction) Control system components: Synchro, D.C Servomotor, A.C. Servo motor, A.C. Tachometer (only basic operating principle & construction and diagram, no deduction) Concept of transfer function, poles and zeroes,transfer function of first & second order system (no deduction), time response characteristics of first and second order system to unit step excitation (no deduction). Block diagram representation of control system,Transfer function from Block diagram reduction technique, Signal flow graph. Application ofMason gain formula (maximum two non touching loops). Stability concept: characteristic equation, Deciding stability from pole zero concept, Routh criteria. (Numerical)Control action of a system with ON/OFF, P, PI, PD, PID controller, Practical application of these controllers (with block diagram only). Stability analysis using Root Locus, Frequency response analysis: Bode Plots

Transmission & Distribution of Electric Power
TIU-DEE-T206
LTP: 2-1-0
Credits: 3

Module – I Basics of Transmission

1.1 Layout of a Power System by single line concept.
1.2 Concept of Primary & Secondary transmission & distribution.
1.3 Advantages and limitations of using high voltage for power transmission.

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1.4 Comparison between AC & DC power transmission systems.
1.5 Kelvin's laws for the economic choice of conductor size – related problem.

Module – II Transmission Line Components:

2.1 Main components of Overhead lines (names & functions only).
2.2 Types of conductors-Copper, Aluminum& state their trade names.
2.3 Solid, Stranded & bundled conductors.
2.4 types of supports – RCC/PCC poles, steel tower
2.5 Comparison between single circuit and double circuit design
2.6 Conception of ground wire.
2.7 Line insulators – requirements, types, and field of applications.
2.8 Failure of insulators, creepage distance (definition & significance only)
2.9 Distribution of potential over a string of three suspension insulators. --- Problems.
2.10 Concept of string efficiency, Methods of improving string efficiency. ---- Problems.
2.11 Corona – corona formation, advantages & disadvantages, factors affecting corona, important terms related to corona.
2.12 Calculation of Span length & sag Calculation ,effect of wind pressure, temperature and ice deposition----- Problems.
2.13 Stringing chart and its uses.
2.14 Spacing of conductors, length of span,
Relevant I.E. Rules

Module – III Transmission Line Parameters

3.1 R,L& C of 1-ph & 3-ph transmission line & their effects on line.(No deduction and Problems)
3.2 Skin effect, proximity effect & Ferranti effect.
3.3 Concept of transposition of conductors & necessity
3.4 Reactive Power compensation

Module- IV Underground Cables:

4.1 Classification of cables and Comparison with overhead lines.
4.2 Cable construction.
4.3 Description of (i) PVC, (ii) PILC (iii) FRLS (Fire Retardant Low Smoke), (iv) XLPE cables & (v) Gas filled (SF6) cables
4.4 Cable Rating and De-rating factor.
4.5 Cable laying

Module – V Performance Of Transmission Line:

5.1 Classification of transmission lines.
5.2 Losses, Efficiency & Regulation of line.
5.3 Performance of single phase short transmission line(Numerical based on it)
5.4 Effect of load power factor on performance. Power Factor Improvement Using Static condenser and Synchronous condenser – related problems.
5.5 Medium transmission lines-End condenser,

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Nominal T & Nominal Pi Network with vector diagram.---- no problem

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Module – VI Extra High Voltage Transmission:

6.1 EHVAC Transmission, Reasons for adoption & limitations.
6.2 Regional Grid System (Conception only).
6.3 Concept about FACTS and its applications.
6.4 HVDC Transmission – Advantages, Limitations.
6.5 Discussion on few HVDC system in Indian scenario

Module – VII Components of Distribution System:

7.1 Introduction.
7.2 Classification of distribution system.
7.3 A.C distribution.
7.4 Connection schemes of distribution system.
7.5 Requirements of Distribution systems.
7.6 Design consideration.
7.7 A.C. distribution calculations.
7.8 Methods of solving A.C.-1 phase & 3 Ø -phase connection (balanced) distribution system. (Numerical based on 1-ph & 3-ph balanced distribution system.

Module – VIII Substations:

8.1 Introduction.
8.2 Classification of indoor & outdoor sub-stations
8.3 Advantages & Disadvantages.
8.4 Selection & location of site.
8.5 Main connection schemes.
8.6 Equipments and circuit element of substations –their symbols & function.
8.6.1 Bus bar's material, types in detail.
8.6.2 Connection diagram and layout of sub-stationswith proper notation
8.6.3 Earthing and Safety

Analog Electronics
TIU-DEE-T204
LTP: 2-1-0
Credits: 3

Elementary Solid State Physics: Semiconductor Materials; Intrinsic and Extrinsic Type; Characteristics of P-N Junction. Basic Semiconductor Devices: P-N Junction Diode; Schottky Diode; Zener Diode; Bipolar Transistor; JFET; MOSFET. Modeling of Semiconductor Devices: Hybrid parameters. Biasing: CE, CB and CC Transistor Configuration; JFET and MOSFET. Feedback amplifiers: Characteristics of Negative and Positive Feedback. Transistor Power Amplifiers: Class A, AB, and Complimentary Symmetry. Operational Amplifiers: Characteristics; Inverting, Non-Inverting, Summing and Differentiating Amplifiers; Integrator and Differentiator; Voltage Comparator; Precision Rectifier; Sample and Hold;

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Study and application of integrated circuit like 741. Waveform generators: Sine, Square, Triangular and Sawtooth. Opto-Electronics:

Advance Solid State Physics: LED; LCD; Photo-Diodes; Photo-Transistors; LDR; 7-Segment and Alpha-Numeric Displays; Opto-Isolators and Interrupters. Oscillators: Wien bridge, Colpitts, Hartley, Phase Shift and Quadrature; VCO; Applications using Op-amp. Multivibrators: Monostable, Bistable and Astable; Implementation using 555 Timer. Special Connections: Darlington Pair; Bootstrap; Schmitt Trigger; Constant Current Sources and Sinks. Transistor Voltage Regulators: Series and Shunt Circuits; Study of integrated circuit like 7805.

Engineering Economics, Accountancy & Costing
TIU-DMG-T206
LTP: 2-1-0
Credits: 3

The detailed syllabus to be provided by the Department of Management.