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)

Fifth Semester

Course Structure

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-DEE-T301	Career Advancement & Skill Development	2	1	0	3
TIU-DEC-T309	Digital Electronics	2	1	0	3
TIU-DEE-T303	Utilization of Electrical Energy	2	1	0	3
TIU-DEE-T305	Power Electronics & Drives	2	1	0	3
TIU-DEE-T307	Switchgear & Protection	2	1	0	3
Practical					
TIU-DEC-L309	Digital Electronics Lab	0	0	3	2
TIU-DEE-L311	Electrical Machine Design Lab	0	0	3	2
Sessional					
TIU-DES-S399	Entrepreneurship Skill Development	0	0	2	2
TIU-DEE-I399	Industrial Training	0	0	2	2
TIU-DEE-P399	Project Work–I	0	0	2	2
Total Credits					25

Detailed Syllabus

Career Advancement & Skill Development
TIU-DEE-T301
LTP: 2-1-0
Credits: 3

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According to the syllabus of JELET.

Utilization of Electrical energy
TIU-DEE-T303
LTP: 2-1-0
Credits: 3

Module – I Illumination

1.1. Definitions of Terms used in Illumination: Light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Illumination, Lux or Meter Candle, Mean Horizontal Candle Power (MHCP), Mean Spherical Candle Power (MSCP), Mean Hemi-spherical Candle Power (MHSCP), Reduction Factor, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, Utilization Factor, Maintenance Factor, Depreciation Factor, Colour Rendering Index, Waste Light Factor, Absorption Factor, Reflection Factor, Solid Angle, Beam Angle.

1.2. Laws of Illumination:
- Law of Inverse Squares
- Lambert's Cosine Law. (No Numerical)

1.3 Types, basic principle, Details Specifications and application of following sources of light:
- Incandescent Lamps
- Halogen Lamps.
- Low Pressure Mercury Vapour Lamps (Fluorescent Tube).
- High Pressure Mercury Vapour Lamps.
- Sodium Vapour Lamps.
- Compact Fluorescent Lamps (C.F.L.)
- Metal Halide Lamps
- LED Lamps
- Neon Signs

Module – II Electric Heating and Welding:
Electric Heating

2.1. Advantages of Electric Heating.
2.2. Classification of Electric Heating Methods:
2.2.1. Resistance Heating:(Construction, Operationand application)
- Direct Resistance Heating: Salt Bath Furnace.
- Indirect Resistance Heating: Resistance Ovens,

Requirements of Heating Element Material, Name of some common heatingelement materials, Causes of Failure of Heating Elements, Methods of
Temperature Control.
2.2.2. Arc Heating: (Construction, Operation and application)
- Direct Arc Furnace:
- Indirect Arc Furnace.

2.2.3. Induction Heating: (Construction &Operationand application)

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- Core Type Induction Furnaces: Ajax Wyatt Furnace.
- Coreless Induction Furnace.

2.2.4. Dielectric Heating:

- Principle of Dielectric Heating.
- Advantages of Dielectric Heating
- Limitations of Dielectric Heating.
- Applications of Dielectric Heating.

Power supply requirement and simple numerical of above heating methods. (Nodeduction of any formula)

Electric Welding:

2.3. Methods of Electric Welding

2.3.1. Resistance Welding:

- Principle of Resistance Welding.
- Advantages of Resistance Welding.
- Types of Resistance Welding - (Only List)

Spot Welding Machine.

2.3.2. Electric Arc Welding:

- Formation and Characteristics of Electric Arc.
- Effect of Arc Length.
- Arc Blow.

Electrodes for Metal Arc Welding, V-I Characteristics required for of Arc Welding.

2.3.3. Arc Welding Machines:

- DC Welding Machines - MG Set, AC Rectified Welding Unit.
- AC Welding Machines - Welding Transformer.

Module – III Electric Traction:

4.1. Introduction:

- History of electric traction
- Various systems of traction.
- Electric traction Vs other traction systems
- Electric Traction as viable transport strategy for 21st Century
- Choice of traction system: Diesel-electric or Electric.

4.2 Electric Traction:

-Different systems of track electrification (Blockdiagram) DC, AC, Composite. Advantage & disadvantages of each.

-analysis of single phase 25 KV AC system and DC system.

4.3. Traction Mechanics:

- Units Used in Traction Mechanics.
- Types of Services.
- Speed Time Curve.
- Simplified Speed Time Curve (No Derivation)
- Average Speed and Schedule Speed.

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- Factors Affecting The Schedule Speed.
- Tractive Effort
- Specific Energy Consumption
- Factors Affecting Specific Energy Consumption.
- (Simple Numerical on Simplified Speed Time Curves and Specific Energy Consumption)

4.4. Mechanics of train movement, Adhesion & coefficient of Adhesion, concept of weight transfer, effect of unsprung mass and wheel diameter.

4.5. Traction Motors:

- Desirable Characteristics of Traction Motors, Special features of traction motor.
- Suitability of DC Series Motor for Traction.
- Suitability of Three Phase Induction Motor for Traction.

Power Electronics & Drives
TIU-DEE-T305
LTP: 2-1-0
Credits: 3

Module – I POWER SEMICONDUCTOR DEVICES

1.1 THYRISTOR (SCR)

1.1.1 Construction, operation & symbol.
1.1.2 V-I characteristics of SCR (Holding current, Latching current, Breakover voltage).
1.1.3 Turn on methods - Voltage triggering, Gate triggering, dv/dt triggering.
1.1.4 Turn off methods – Current reduction, AC line commutation, Forced commutation.
1.1.5 Thyristor specifications – voltage rating, current rating, power rating, dv/dt, di/dt, Gate current, temperature.
1.1.6 Utility of Snubbercircuit , Freewheeling diode.
1.1.7 DIAC, TRIAC, SCS – Principle of operation, characteristics& application.
1.1.8 IGBT - Principle of operation, characteristics & application.

Module – II Switching & Timer Circuits :

2.1 Simple transistor timer using R-C as timing element.
2.2 Classification of multi-vibrators.
2.3 Study of Astable, Monostable&Bistablemultivibrator circuits using OPAMP.
2.4 Internal block diagram, Pin diagram and operating of IC 555.
2.5 Study of Astable, Monostable&Bistablemultivibrator circuits using IC 555 timer.

Module – III Converter and Inverter:

3.1 AC to DC Converter :

3.1.1 Single phase fully controlled Half Wave Converter
- with resistive load,
- with R-L load

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3.1.2 Single phase fully controlled Full Wave Converter
- with resistive load,
- with R-L load

3.1.3 Three phase fully controlled Bridge Converter
- with RL load

3.1.4 Cycloconverter –
Principle of operation of Single phase &
Three phase cycloconverter, Basic circuit diagram, Input &
Output waveforms.

3.2 Inverter :

3.2.1 Classification of Single phase & Three phase Inverter –
Line commutated & Forced commutated Inverters, Series,
Parallel, Bridge Inverter
3.2.2 Operation of basic Series Inverter.
3.2.3 Operation of basic Parallel Inverter.
3.2.4 Operation of Single phase Bridge Inverter -
a) Half Bridge Inverter
b) Full Bridge Inverter
3.2.5 Pulse Width Modulated Inverter –
a) Single pulse width Modulated Inverter.
b) Multiple pulse width Modulated Inverter.
c) Sinusoidal pulse width Modulated Inverter

Module – IV : DC Chopper:

4.1 Principles of chopper.
4.2 Classification –
a) Step-up & Step-down chopper
b) Second quadrant, Two quadrant & Four quadrantoperation.
4.3 Type-A, B, C, D chopper – Operating Principle.
4.4 Commutations methods for choppers –Auxiliary commutation, Load commutation.
4.5 Jones chopper.

Module – VDC & AC Drives:

5.1 Speed control of separately excited DC motor bysinglephase fully controlled converter.
5.2 Speed control of separately excited DC motor with threephase fully controlled converter.
5.3 Speed control of DC series motor with chopper control.
5.4 Speed control of DC servomotor.
5.5 Speed control of Three phase Induction motor with variablefrequency PWM VSI.
5.6 Speed control of Three phase Induction motor with variablevoltage variable frequency control.
5.7 Speed control of AC servomotor.
5.8 Static VAR compensation system - Principle of operation&Block diagram.

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5.9 Uninterrupted power supply – Principle of operation & Blockdiagram of On load & Off load type UPS.

Switchgear & Protection
TIU-DEE-T307
LTP: 2-1-0
Credits: 3

Module – I: Fundamentals

1.1Necessity & functions of protective system.
1.2 Normal & abnormal conditions.
1.3 Types of faults & their causes.
1.4Use of current limiting reactors & theirarrangements.
1.5 Short-circuit KVA calculations for symmetrical faults –problems.

Module – II: Circuit interrupting devices:

2.1Basic fuse terminology: fuse element, ratedcurrent, fusing current, fusing factor, prospectivecurrent, cut-off current, arcing time, rupturingcapacity, total operating time. Fuse Characteristics

2.1.1HRC fuses – construction, types, working,characteristics, selection and applications

2.2Isolators- vertical break, horizontal break & pantograph type
2.3Arc formation process, methods of arc extinction,related terms.
2.4 Circuit breakers- Concept, Classification, Workingprinciple, Construction, Specification & Applications of

2.4.1 E.H.V/H.V – Minimum oil circuit breakers(M.O.C.B.), Air Blast Circuit Breaker (A.B.C.B), SulphurHexa Fluoride circuit breaker (SF6). Vacuumcircuit breaker.

2.4.2 L.V.- Air circuit breakers (ACB),miniature circuitbreakers (M C B) , Moulded case circuit breakers(M C C B) , Earth leakage circuit breaker (E L C B or RCCB), Comparison of fuse & MCCB

2.5Selection of MCCB for motor.
2.6 Selection and rating of circuit breakers – breakingcapacity, making capacity, rated operating duty, ratedvoltage.
2.7 Elementary idea of Auto-reclosing.

Module – III : Protective Relaying:

3.1 Zones of protection, primary & back-up protection, Essential qualities of protection, classification of protective schemes, basic relay terminology.
3.2 CT & PT used in protection: Requirements, Basic circuit diagram, working principle & application of CVT and CCVT.
3.3 Operating principles and construction (in brief) of Electromagnetic relays, thermal relays, static relays (with merits and demerits), and
Microprocessor based relays, Auxiliary switch Flags– conception only.
3.4Over current relay : Time-current characteristics of definite time, instantaneous, inverse time and IDMT Relays.

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Use of very inverse-type O/C relay and extremely inverse type O/C relay
Time-setting, current-setting, PSM – problems

3.5 Directional Relay -
Introduction, Characteristics: Constant product characteristics,
Polar characteristics, Concept of dead zone

3.6 Distance Protection Scheme:
Area of applications, Impedance relays, Reactance relay, MHO relay: operating characteristics, effect of arc resistance on their characteristics.

3.7 Differential Relay: Introduction, Current differential protection for an internal fault – fedfrom single & both end. Voltage balance differential protection – Schematicdiagram& operation (in brief). Mention the position ofoperating coil and the restraining coil for both thecases.

3.8 Static over current relays

Module – IV: Equipment Protection:

4.1Generator protection

– Percentage differentialstator protection, brief idea of: - rotor protection dueto loss of excitation, protection against rotoroverheating because of unbalance in load, over-speed protection, protection against motoring andfield suppression.

4.2Transformer protection

- Percentagedifferential protection – problems, Buchholz Relay,rate of rise of pressure relay, over-fluxing protection,O/C protection.

4.3Protection of Motor:
Abnormalities & faults.
Short circuit protection, Overload protection, Singlephase preventer.

4.4Protection of Busbar& transmission line

Module – V Over voltage Protection:

5.1Causes of over voltages.
5.2 Lighting phenomena & over voltage due tolightning.
5.3 Protection of transmission line & substation fromdirect stroke.
5.4 Types of lightning arresters & surge absorbers&their Construction & principle of operation.
5.5 Protection against traveling waves.
5.6 Insulation co-ordination**.**

Digital Electronics
TIU-DEC-T309
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Module – I Boolean Algebra & Combinational Logic Circuits: Number Systems – Decimal, Binary, Octal, Hexadecimal, BCD number system & their inter-conversion. Symbolic representation & Truth tables for logic gates - NOT, OR, AND, NAND, NOR, XNOR, XOR. Rules & laws of Boolean algebra, Demorgan's Theorems. Max. term& Min. term, Simplification of Boolean expression using karnaugh map (upto 4 variable). Realisation of Boolean expression with Logic gates. Half adder, Full adder, Half subtractor, Full subtractor, Parity Generator and checker, Digital comparator, Code converter, Encoder, Decoder, Multiplexer, Demultiplexer.

Module – II Sequential Logic Circuits: Flip-flops – RS, D, T, JK, JK Master Slave FlipFlops using basic gates, preset and clear signals. Counters - Asynchronous & Synchronous Counter,Mod-N counter, Up Down Counter, Ring counter, Registers - Shift register, Serial in Serial out, Serial in Parallel out, Parallel in serial out, Parallel in Parallel out.

Module – III Data Converters & Memory Devices: D/A Converter: Basic concepts, Weighted Resistor D/A converter, R-2R Ladder D/A converter. A/D Converter:Successive approximation method, Dual slope method. Concept of - Static Memory & Dynamic Memory, SDRAM, DDR RAM, PROM, EEROM, EPROM. Comparison of Logic families – DTL,TTL and ECLGates