SYLLABUS BREAKUP OF ELECTRICIAN

SECOND YEAR

WEEK NO.	THEORY	PRACTICAL	WORKSHOP CALCULATION & SCI.	ENGINEERING DRAWING	EMP. SKILL	HOURS
1	General concept of rotating electrical machines. Principle of DC generator. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core etc.	Identify terminals, parts and connections of different types of DC machines. Measure field and armature resistance of DC machines.	Use of Scientific Calculator: Practice on solving different problems like phase angle, etc. with the help of a calculator.	Sign & Symbol Trade related Alternating Current · Drawing of simple electrical circuit using electrical symbols.		
2	E.M.F. equation Separately excited and self excited generators. Series, shunt and compound generators.	Determine build up voltage of DC shunt generator with varying field excitation and performance analysis on load. Test for continuity and insulation resistance of DC machine.	Algebra: Theory of Indices, related problems.	· Drawing of sine square & triangular waves. · Diagram of battery charging circuit.		

		Start, run and reverse direction of rotation of DC series, shunt and compound motors.				
3	Armature reaction, Commutation, inter poles and connection of inter poles. Parallel Operation of DC Generators.	Perform no load and load test and determine characteristics of series and shunt generators. Perform no load and load test and determine characteristics of compound generators (cumulative and differential).	Factorization -different method.	· Practice in reading typical example of circuit containing R, L & C.		
4	Load characteristics of DC generators. Application, losses & efficiency of DC Generators. Routine & maintenance.	Practice dismantling and assembling in DC shunt motor. Practice dismantling and assembling in DC compound generator.	Quadratic equations and solution of simultaneous equations with 2/3 unknowns.	· Reading of electrical drawing.		

5	Principle and types of DC motor. Relation between applied voltage back e.m.f., armature voltage drop, speed and flux of DC motor.	Conduct performance analysis of DC series, shunt and compound motors. Dismantle and identify parts of three point and four point DC motor starters.	Different types of related problems involving equations.	Electronic components · Symbols for electronic components. Diode, Transistor, Zener diode, SCR, UJT, FET, IC, Diac, Triac, Mosfet, IGBT etc.		
6	DC motor Starters, relation between torque, flux and armature current. Changing the direction of rotation. Characteristics, Losses & Efficiency of DC motors. Routine and maintenance.	Assemble, Service and repair three point and four point DC motor starters. Practice maintenance of carbon brushes, brush holders, Commutator and slip-rings.	Trigonometry: Application in calculating height and distances.	· Drawing of half wave, Full wave and Bridge rectifier circuit.		

7	Methods of speed control of DC motors.	Perform speed control of DC motors - field and armature control method. Carry out overhauling of DC machines.	Use of trigonometric formulae in calculating areas of geometrical figures.	· Drawing circuit for a single stage Amplifiers and Multi stage Amplifies and types of signals.		
8	Lap and wave winding and related terms.	Perform DC machine winding by developing connection diagram, test on growler and assemble.	Solution of Triangles.	· Drawing of circuit containing UJT, FET & Simple power control circuits. · Free hand drawing of Logic gates and circuits.		
9	Working principle of three phase induction motor. Squirrel Cage Induction motor, Slip-ring induction motor; construction, characteristics, Slip and Torque.	Identify parts and terminals of three phase AC motors. Make an internal connection of automatic star-delta starter with three contactors.	Mensuration: Volumes and surface areas of solid bodies such as triangular prism, hexagonal prism etc.	Electric wirings & Earthing · Detailed diagram of calling bell, & Buzzers etc		

10	Different types of starters for three phase induction motors, its necessity, basic contactor circuit, parts and their functions	Connect, start and run three phase induction motors by using DOL, stardelta and auto-transformer starters. Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic.	Mensuration: Volumes and surface areas of solid bodies such as triangular prism, hexagonal prism etc.	· Free hand sketching of Staircase wiring.		
11	Single phasing prevention. No load test and blocked rotor test of induction motor. Losses & efficiency.	Determine the efficiency of squirrel cage induction motor by brake test. Determine the efficiency of three phase squirrel cage induction motor by no load test and blocked rotor test.	Volumes and surface area of pyramids including cone.	· Drawing the schematic diagram of plate and pipe earthing.		

12	Various methods of speed control. Braking system of motor. Maintenance and repair.	Measure slip and power factor to draw speedtorque (slip/torque) characteristics. Test for continuity and insulation resistance of three phase induction motors. Perform speed control of three phase induction motors by various methods like rheostatic control, autotransformer etc.	Volumes and surface area of pyramids including cone.	· Diagram for electroplating from A.C / D.C source.		
13	Concentric/ distributed, single/ double layer winding and related terms.	Perform winding of three phase AC motor by developing connection diagram, test and assemble. Maintain, service and troubleshoot the AC motor starter.	Matter, forms, specific properties related to solids, liquids and gases.	DC machines · Graphic symbols for Rotating machines. · Sketching of brush and brush gear of D.C. machines.		

14	Working principle, different method of starting and running of various single phase AC motors.	Identify parts and terminals of different types of single phase AC motors. Install, connect and determine performance of single phase AC motors.	Matter, forms, specific properties related to solids, liquids and gases.	· Sketching of D.C. 3-point and 4-point starter .		
15	Domestic and industrial applications of different single phase AC motors. Characteristics, losses and efficiency.	Start, run and reverse the direction of rotation of single phase AC motors. Practice on speed control of single phase AC motors. Compare starting and running winding currents of a capacitor run motor at various loads and measure the speed.	The atom, molecule. Difference between an element and compound.	· Layout arrangement of D.C. Generators & motors, control panel.		

16	Concentric/ distributed, single/ double layer winding and related terms.	Carry out maintenance, service and repair of single phase AC motors. Practice on single/double layer and concentric winding for AC motors, testing and assembling.	Electrical Engineering materials: Properties and uses in electrical field of important materials to be selected from 3 categories as conducting materials, semiconducting materials, Insulating materials.	· Exercises on connection to motors through Ammeter, voltmeter & K.W. meters of electrical wiring diagram.		
17	Troubleshooting of single phase AC induction motors and universal motor.	Connect, start, run and reverse the direction of rotation of universal motor. Carry out maintenance and servicing of universal motor.	Electrical Engineering materials: Properties and uses in electrical field of important materials to be selected from 3 categories as conducting materials, semiconducting materials, Insulating materials.	· Drawing the schematic diagram of D.C. motor speed control by Thyristor / DC Drive.		

18	Principle of alternator, e.m.f. equation, relation between poles, speed and frequency. Types and construction.	Install an alternator, identify parts and terminals of alternator. Test for continuity and insulation resistance of alternator. Connect, start and run an alternator and build up the voltage.	Insulating materials including transformer oils.	Transformer · Graphic symbols for Transformers.		
19	Efficiency, characteristics, regulation, phase sequence and parallel operation. Effect of changing the field excitation and power factor correction.	Determine the load performance and voltage regulation of three phase alternator. Parallel operation and synchronization of three phase alternators.	Magnetism: Introduction Magnetic Material for permanent magnet, temporary magnet etc.	· Free hand sketching of transformer and auxiliary parts and sectional views.		

20	Working principle of synchronous motor. Effect of change of excitation and load. V and anti V curve. Power factor improvement.	Install a synchronous motor, identify its parts and terminals. Connect, start and plot Vcurves for synchronous motor under different excitation and load conditions.	Magnetic field, flux density, permeability,	· Sketching a breather.		
21	Rotary Converter, MG Set description and Maintenance.	Identify parts and terminals of MG set. Start and load MG set with 3 phase induction motor coupled to DC shunt generator.	susceptibility – explanation and units of the above terms.	· Drawing the diagram of typical marking plate of a distribution transformer.		
22	Project Work					
23	Project Work Industrial Visits					

24		Project work/Industrial visit (optional) Broad Areas: a) Phase sequence checker for 3 phase supply b) Induction motor protection system c) Motor starters with protection d) Solar/wind power generation	Electromagnet (Solenoid) – practical applications.	Illumination · Free hand sketching of Mercury vapour lamp		
25	Resistors – colour code, types and characteristics. Active and passive components. Atomic structure and semiconductor theory	Determine the value of resistance by colour code and identify types. Test active and passive electronic components and its applications.	Concept of terms like pressure, atmospheric pressure, gauge pressure.	sodium vapour lamp		
26	P-N junction, classification, specifications, biasing and characteristics of diodes. Rectifier circuit - half wave, full wave, bridge rectifiers and filters.	Determine V-I characteristics of semiconductor diode. Construct half wave, full wave and bridge rectifiers using semiconductor diode.	Heat treatment – Necessity – different methods.	fluorescent tube (Single & Twine)		

27	Principle of operation, types, characteristics and various configuration of transistor. Application of transistor as a switch, voltage regulator and amplifier.	Check transistors for their functioning by identifying its type and terminals. Bias the transistor and determine its characteristics. Use transistor as an electronic switch and series voltage regulator.	Number system: decimal and binary,	MHL lamp and their connection.		
28	Basic concept of power electronics devices. IC voltage regulators	Operate and set the required frequency using function generator. Make a printed circuit board for power supply.	Octal, Hexa decimal.	Three phase Induction motor · Free hand sketching of Slip-ring and Squirrel cage Induction motor.		
29	Digital Electronics - Binary numbers, logic gates and	Construct simple circuits containing UJT for	BCD code	· Typical wiring diagram for drum controller operation of A.C. wound rotor motor.		

	combinational circuits.	triggering and FET as an amplifier. Troubleshoot defects in simple power supplies.				
30	Working principle and uses of oscilloscope.	Construct power control circuit by SCR, Diac, Triac and IGBT. Construct variable DC stabilized power supply using IC.	conversion from decimal to binary and vice-versa	· Drawing the schematic diagram of Autotransformer starter, DOL starter and Star Delta Starter.		
31	Construction and working of SCR, DIAC, TRIAC and IGBT. Principle, types and applications of various multivibrators.	Practice on various logics by use of logic gates and circuits. Generate and demonstrate wave shapes for voltage and current of rectifier, single stage amplifier and oscillator using CRO.	all other conversions. Practice on conversions.	· Drawing the schematic diagram of A.C. motor speed control by SCR /AC Drive.		

32	Study and understand Layout drawing of control cabinet, power and control circuits.	Design layout of control cabinet, assemble control elements and wiring accessories for: (i) Local and remote control of induction motor. (ii) Forward and reverse operation of induction motor.	Estimation & costing: Simple estimation of the requirement of materials etc. as applicable to the trade.	Alternator · Tracing of panel wiring diagram of an alternator.		
33	Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc.	(iii) Automatic star-delta starter with change of direction of rotation. (iv) Sequential control of three motors.	Problems on estimation and costing.	· Drawing the schematic diagram of automatic voltage regulators of A.C. generators.		

34	Wiring accessories: Race ways/ cable channel, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable binding strap, buttons, cable ties, sleeves, gromats and clips etc.	Carry out wiring of control cabinet as per wiring diagram, bunching of XLPE cables, channeling, tying and checking etc. Mount various control elements e.g. circuit breakers, relays, contactors and timers etc.	Further Mensuration: Volumes of frustums including conical frustums.	Winding · Drawing the development diagram for D.C. Simplex Lap & Wave winding		
35	Testing of various control elements and circuits.	Identify and install required measuring instruments and sensors in control panel. Test the control panel for its performance.	Graph- Basics, abscissa, co-ordinate etc. Y = mz and Y= mx + c graph	· with brush position. Drawing the development diagram of A.C 3 – Phase, 4 Pole 24 slots single layer winding.		
36	Working, parameters and applications of AC / DC drive.	Perform speed control of DC motor using thyristors / DC drive.	Simple Problems on Profit & Loss.	Control Panel · Practice in reading panel diagram.		

37	Speed control of 3 phase induction motor by using VVVF/AC Drive.	Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive. Construct and test a universal motor speed controller using SCR.	Simple and compound interest.			
38	Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS.	Assemble circuits of voltage stabilizer and UPS. Prepare an emergency light. Assemble circuits of battery charger and inverter.	Friction: Laws of friction	· Local & Remote control of Induction motor with inching.		
39	Preventive and breakdown maintenance.	Test, analyze defects and repair voltage stabilizer, emergency light and UPS.	co- efficient of friction, angle of friction, simple problems related to friction.	· Forward & Reverse operation of Induction motor		

		Maintain, service and troubleshoot battery charger and inverter. Install an Inverter with battery and connect it in domestic wiring for operation.				
40	Conventional and nonconventional sources of energy and their comparison.	Draw layout of thermal power plant and identify function of different layout elements. Draw layout of hydel power plant and identify functions of different layout elements.	Lubrication	· Automatic Star Delta Starter		
41	Power generation by thermal and hydel power plants.	Visit to transmission / distribution substation. Draw actual circuit diagram of substation visited and indicate various components.	Rectifier: RMS. Maximum, Average values of voltage and current in rectifiers form factor, ripple factor.	· Automatic star delta starter with change of direction of rotation		

42	Various ways of electrical power generation by non-conventional methods.	Prepare layout plan and Identify different elements of solar power system. Prepare layout plan and Identify different elements of wind power system.	Forces: Resolution and composition of forces.	· Sequential control of three motors.		
43	Power generation by solar and wind energy. Principle and operation of solar panel.	Assemble and connect solar panel for illumination.	Representation of force by vectors,	Domestic Appliances · Fire, Alarms, Electric Iron,		
44	Transmission and distribution networks.	Practice installation of insulators used in HT/LT line for a given voltage range. Draw single line diagram of transmission and distribution system. Measure current carrying capacity of conductor for given power supply.	simple problems on lifting tackles like jib wall, crane-	Heater, Electric Kettle, Heater / Immersion Heater, Hot Plate, etc.		

45	Line insulators, overhead poles and method of joining aluminum conductors.	Fasten jumper in pin, shackle and suspension type insulators.	Solution of problems with the aid of vectors.	Distribution of Power · Types of insulator used in over head line. (Half sectional views)		
46	Safety precautions and IE rules pertaining to domestic service connections.	Erect an overhead service line pole for single phase 230 V distribution system in open space.	General condition of equilibriums for series of forces on a body.	· Different type of distribution systems and methods of connections.		
47	Various substations. Various terms like – maximum demand, average demand, load factor, diversity factor, plant utility factor etc.	Practice on laying of domestic service line. Install bus bar and bus coupler on LT line.	Law of parallelogram, Triangle Law,	· Layout diagram of a substation.		
48	Types of relays and its operation. Types of circuit breakers, their applications and functioning.	Identify various parts of relay and ascertain the operation. (5 Hrs)	Lami's Law theorem.	· Single line diagram of substation feeders.		

	applications and functioning.	204. Practice setting of pick up current and time setting multiplier for relay operation. Identify the parts of circuit breaker, check its operation.				
49	Production of arc and quenching.	Identify the parts of circuit breaker, check its operation. Test tripping characteristic of circuit breaker for over current and short circuit current. Practice on repair and maintenance of circuit breaker.	Centre of gravity: Centre of gravity concept and C.G. of different lamina. Equilibrium different kinds stable, unstable and neutral.	Revision		
50-51		Project work / Industrial visit Broad Areas: a) Battery charger/Emergency light	Law of parallelogram force. Triangle law, Lami's theorem stable, unstable and neutral equilibrium.	Revision		

		b) Control of motor pump with tank level c) DC voltage converter using SCRs d) Logic control circuits using relays e) Alarm/indicator circuits using sensors				
52	Revision	Revision	Revision	Revision		