MOTOR & TRANSFORMER REWINDING COURSE (602&702) – PCP (THEORY & PRACTICAL) TRAINING SCHEDULE

28/01/2019

Total course duration (400hrs)		
PCP (140hrs)		Self learning (260 hrs)
Practical (90hrs)	Theory (50hrs)	

	Schedule		PCP- Topic				Instruction to instructor	Learning outcomes
Week	Topic	Day	Duration (Hr)	Theory	Duration (Hr)	Practical		
Week 1	Single Phase transformer	DAY 1	1 hr	• Transformer and its main parts. • Principle of transformer • E.M.F. equation.	3 hrs	• Demonstrate the various parts of transformer and their identification. • Identification of the primary and secondary terminals of a single phase transformer. • Dismantling and reassembling of a step-up and step- down transformer.	• With the help of charts and audio-visual aids demonstration of various parts and connections of a single phase transformer should be done.	Learner would be able to -: • identify transformer and its types as per voltage and its main parts. • differentiate between primary and secondary terminals of a single phase transformer. • state the E.M.F equation and transformation ratio. • carry out dismantling and reassembling of the transformer.
	Single Phase transformer	DAY 2	2 hrs	• Construction and working of potential and current transformer. • Clip on meter • Working principle,	3hrs	• Loading the single phase transformer and measuring current and power on both sides. • Finding the efficiency of a	• Safety precaution should be taught before making connection of potential and current transformer. • Observation of efficiency and losses	Learner would be able to -: • identify the parts of potential and current transformer, auto transformer. • carry verification process of

				construction and uses of auto transformer. • Application of different type of single phase transformers. • Transformer losses and efficiency.		transformer. • Verifying transformer ratio, testing of an auto transformer. • Finding iron & copper losses by performing open circuit and short circuit test.	should be recorded by individual and a comparison may be done.	transformer ratio. • carry out dismantling and reassembling of different type of single phase transformers. • carry out measurements of current and power of a single phase transformer. • calculate transformer losses and efficiency.
Week 2	Three phase transformer	DAY 1	1 hrs	• Construction and working of three phase transformer. • Function of its various parts-: conservator, breather and Buchholz relay	3 hrs	• Studying the parts of power transformer and also the function of conservator breather. • Recharging a breather. • Cleaning and maintenance of a transformer.	• Arrange for a dismantle transformer. • Recharging and cleaning of transformer must be practiced.	Learner would be able to-: • identify parts of transmission and distribution transformer. • differentiate between single phase and three phase transformer. • define Working and construction of conservator, breather and Buchholz relay. • carry out assembling & dismantling of transformer. • adopt appropriate maintenance procedure for a transformer.
	Three phase transformer	DAY 2	2hrs	• Different system for coiling of 3 phase transformer.	3hrs	• Connecting three phase transformer as start-star, Delta-	• Safety precaution should be taught before making	Learner would be able to: • differentiate different system of coiling of 3

				• Different method for connecting the winding of 3 phase transformer. • Parallel operation of transformer.		delta, Star-Delta, Delta-Star.	connection.	phase transformer. • make connections for winding of 3 phase transformer. • perform parallel operation of a transformer.
Week 3	Transforme r winding	DAY 1	1.5h rs	• Designing of a small transformer on the basis of output and core area. • Method of preparing bobbins and winding the transformer on machine. • Varnishing, baking and terminating the windings	3 hrs	• Winding a small eliminator transformer and auto transformer of a stabilizer. • Rewinding voltage regulator of a fan.	• Safety precaution should be taught before making connection.	Learner would be able to: • calculate important parameter of design of transformer on the basis of output and core area. • prepare bobbins and winding of the transformer by various methods. • carry out the process of varnishing, baking and terminating the windings.
	Care and maintenan ce of a transform er	DAY 2	1.5 hrs	• Causes of Break down factors affecting the life of a transformer. • Maintenance procedure. • Recommended maintenance schedule for transformers	3 hrs	• Locating and rectifying faults in transformer	• Faulty transformer is to be arranged and learner should be instructed to record the faults and action taken for rectification.	Learner would be able to-: • locate the faults of transformer. • state the factors affecting the life of a transformer. • carry out schedule maintenance for transformers.
Week 4	Winding material	DAY 1	2hrs	• Different types of conductors used in winding. • Various types of insulating papers, tapes, sleeves and wedges used in winding. • Impregnating	3hrs	• Identification of insulating papers, tapes, sleeves and wedges, impregnating varnishes and paints used in winding. • Identification of different types of conductors used in	• Physical display of all winding materials for identification • Use video/ppt/charts for demonstrating the materials.	Learner would be able to -: • identify& use different types of conductors for winding. • identify & use various types of insulating papers, tapes, sleeves and wedges for winding. • identify& use

				varnishes and paints used in winding.		winding		impregnating varnishes and paints for winding.
	DC Generator and alternator	DAY 2	2 hrs	• Principle of generator. • Construction, types and their applications • Alternator its construction and working. • Working of an excitor.	3hrs	• Dismantling and reassembling of a DC Generator • Connecting a DC generator and alternator & building their voltage	• Learner should identify different parts of DC generator. • Learner should understand the connections of a DC generator and alternator.	Learner would be able to -: • identify parts of a D.C generator. • differentiate between D.C generator and alternator. • make connections of a DC Generator and alternator. • carry out dismantling and reassembling of a DC Generator.
Week 5	DC motor	Day 1	1.5 hr	• Principle, construction, torque and speed. • Types of DC motors, starting & speed control. • Armature reaction & dismantling procedure of DC motors.	3hrs	• Identification of terminals of DC motors • Connecting a DC Motor with starter and changing its D.O.R.	• Dismantling of a DC motor should be performed. • Proper tools and equipments must be used for dismantling (spanner set, pulley puller) • Study parts of DC motors. • Starting and speed control of the motor must be practiced.	Learner would be able to -: • identify parts of a D.C motor and its functions. • carry out procedure for controlling speed of the motors. • make Connections of a DC Motor with starter • carry out assembling and dismantling of a DC motor.
	DC Machine winding	Day 2	1.5hr	• Fundamental terms • Different types of pitches,	3hrs	• Field winding, making field coils, taping, inserting the coils and giving end	• Learner should practice winding and rewinding procedure of D.C machine.	Learner would be able to -: • identify connection and layers in winding.

				connection and layers used in winding. • Types of armature winding as per armature core • Classification of DC winding		connections. Testing of polarity. • Rewinding an armature for simple lap and wave winding of a stripped out armature. • Testing of faults by voltage drop test and using growlers.	• Safety precaution should be taught before winding and rewinding.	• choose proper armature winding as per armature core. • carry out polarity test. • carry out rewinding of an armature. • arry out voltage drop test by using growlers. • locate faults in winding.
Week 6	AC Three phase motors	Day 1	1 hr	• Constructional features. • Working principle, production of rotating magnetic field.	3 hrs	• Measuring line and phase voltage/current in Star-Delta connections. • Study of oil immersed type starter.	• Safety precaution should be taught before winding and rewinding. • Record the observation of voltage and current and compare.	Learner would be able to -: • explain functioning of A.C. motors. • define individual parts of the A.C. motors. • judge the rotating magnetic field.
		Day 2	2hrs	• Torque, synchronous speed rotor speed and slip in induction motor • Types of induction motors and their working. • Starting with different types of starters and reversing.	2hrs	• Testing of phase sequence and starting squirrel cage induction motor with D.O.L. and Star-Delta starter.	• Practice the testing and starting of the induction motor. • Knowledge of each part of induction motor.	Learner would be able to -: • Identify the parts & types of induction motors.. • calculate Torque, synchronous speed rotor speed and slip. • Carry out the task of starting and reversing the motor.
Week 7	AC winding	Day 1	1 hr	• Terms & definition used in winding. • Different connections used in winding. • Types of winding. • Balanced and	3 hrs	• Identification of type of winding. • Noting the data from name plate and stator before stripping out old	• Arrangement should be done for showing connections used in AC winding.	Learner would be able to -: • identify different types of A.C winding. • make connections of A.C winding.

				unbalanced winding & method of calculating electrical degree per slot.		winding.		• calculate electrical degree per slot. • Note the data from name plate and stator.
	AC winding	Day 2	2hrs	• Procedure for rewinding old motors. • Preparing winding table & development diagram. • Procedure for rewinding a double voltage and double speed motor. • Method of testing of motor after rewinding.	3hrs	• Taking measurement of forms. • Preparing coils on forms. • Inserting of coils and wedging. • Winding connections & terminal connections. • Rewinding three phase motor stator with simple winding.	• Learner should understand different data for rewinding stator. • Assembling of three phase motor and trial should be done.	Learner would be able to -: • carry out rewinding of old motors. • prepare winding table & development diagram. • carry out rewinding of a double voltage and double speed motor. • test motor after rewinding for proper functioning.
Week 8	Baking and Vanishing	Day 1	1 hr	• Method of baking and varnishing the stator windings by different methods and use of insulating paints. • Baking the winding in baking oven.	3 hrs	• Baking, impregnating and varnishing of winding with paints. • Assembling and starting the motor	• Practice for Baking, impregnating and varnishing of winding with paints. must be carried out. • Use of proper tools and equipment must be done for assembling the motor.	Learner would be able to -: • bake and apply varnish to the stator windings by different methods. • apply insulating paints on winding. • Carry out winding by using baking oven.

	Single phase motors	Day 2	2 hrs	• Principle , classification • Working principle and method of rewinding of a stator and a capacitor type induction motor	2hrs	• Identification of terminal of single phase motors, starting running & reversing of capacitor motor. • Winding the fan motor by machine or hand, trial and testing.	• Physical display of single phase motors. • Use of charts/ppt/video to demonstrate the method of rewinding. • Practicing of rewinding and winding.	Learner would be able to -: • identify parts of single phase motors. • Carry out running & reversing of capacitor motor. • Carry out rewinding of a stator and a capacitor type induction motor.
Week 9	Single phase motors	Day 1	2 hrs	• Working principle, construction of universal motor, shaded pole motor and repulsion motor. • Brief rewinding procedure of universal motor, shaded pole motor and repulsion motor.	3hrs	• Connecting, starting, running of universal and repulsion motor. • Testing and rectifying faults. • Demonstration of rewinding and testing of Universal Motors Shaded pole Motor Repulsion Motor.	• Physical display of universal motor, shaded pole motor and repulsion motors. • Use of charts/ppt/video to demonstrate the method of rewinding. • Practicing of rewinding and winding	Learner would be able to -: • differentiate & identify parts of universal motor, shaded pole motor and repulsion motor. • perform rewinding procedure of universal motor, shaded pole motor and repulsion. • Carry out fault finding test in the motors. • Perform rectification procedure on faulty motors.
	Trouble shooting and repairing	Day 2	1hr	• Method of fault finding and rectification in motor with megger and test lamp. • Method of fault finding and rectification in control gears with the help of megger and test lamp.	3 hrs	• Practice in detecting faults in motors and control gears with megger and test lamp. • Making concrete foundation for motor. • Preparing main switch board for connecting a 10 HP motor.	• Installation of motor should be practiced with proper precaution and testing with megger and test lamp must be performed.	Learner would be able to -: • Locate the faults in motor like -: overheat, more current on starting,vibration e.t.c & rectify them. • use megger and test lamp for testing and fault finding in motors.

								• Locate and rectify the faults in control gears.
Week 10	Installation of motors	Day 1	2hrs	• Process of laying foundation for motors. • Preparing and installing main switch board. • Controlling gears method of Installing Motor.	3hrs	• Practice in laying concrete foundation and fixing of foundation bolts for motors. • Practice in installing main switch boards, controlling gear and conduit wiring.	• Arrangements should be made in the workshop for installation of motors.	Learner will be able to -: • identify different type of starters used for starting and protecting the motors. • prepare foundation base for motor installation.
	Preventive maintenance	Day 2	1hr	• Procedure for periodical checking-: i. Insulation resistance ii. Phase to phase insulation iii. Winding continuity iv. Voltage v. Temperature rise vi. Vibration on motors • Schedule maintenance	3hrs	• Check periodically and record observations of different test of megger and temperature gauge. • Lubricating and greasing ball bearing and other parts like foundation bolts and check earthing.	• During periodic checking record of observation should be maintained by individuals and comparison of observation should be done.	Learner will be able to -: • explain the importance of preventive maintenance. • follow procedure for periodical checking. • carry out scheduled maintenance which includes: daily maintenance, weekly maintenance, monthly maintenance & yearly maintenance.
Week 11	Basic principle & classification of pump	Day 1	2 hrs	• Types of Pump. • Principle, construction and description of reciprocating pump and	2 hrs	• Identification of different types of pumps. • Identification of different parts of	• Physical display of different types of pumps. • Physical display of dismantle pump must be provided.	Learner will be able to -: • differentiate between reciprocating pump and centrifugal pump. • identify the main parts of reciprocating pump

				centrifugal pump.		pumps		and centrifugal pump. • carry out dismantling & reassembling of these pumps
	Basic principle & classification of pump	Day 2	2 hrs	• Description of rotary pump and jet pump.	3 hrs	• Identification of different parts of rotary pump and jet pump.	• Learner should differentiate different parts of pump.	Learner will be able to -: • Identify main parts of rotary pump and jet pump. • Carry out dismantling & reassembling of these pumps.
Week 12	Pump performance and calculations	Day 1	1hr	• Performance of pump suction head, discharge head and pressure head • Diesel engine pump and mono-block pump.	3hrs	• Fixing of bend, elbow, valves and pressure gauge • Method of minimizing the loss of head • Leakage prevention	• Learner should understand the essentials for better performance of Pump. • Able to define all the heads of cylinder. • Know how electric energy is converted to hydraulic energy. • Working of mono-block pump.	Learner will be able to -: • calculate performance of pump suction head, discharge head and pressure head. • Identify parts of diesel engine pump and mono-block pump. • Carry out procedures for minimizing the loss of head in pumps.
	Basic type of motors and starters	Day 2	2hrs	• Construction, principle and working of single phase motors. • Construction, principle and working of Three phase motors.	3 hrs	• Identification of different types of motors and starters single phase & three phase. • Practice in connecting and running of motors.	• Connections of Shaded pole motor, capacitor start induction motor and squirrel cage motor should be known and practiced.	Learner will be able to -: • identify parts of single phase motors & three phase motors. • make connections of shaded pole motor & capacitor start induction motor. • carry out connections and perform running of motors. • Identify parts of

								squirrel cage motor.
Week 13	Basic type of motors and starters	Day 1	1 hr	• Purpose , construction and working of electric motor starters	3 hrs	• Identification of different types of motors and starters electric motor. • Practice in connecting and running of electric motors.	• Connections of electric motor starters should be known and practiced.	Learner would be able to -: • enumerates the construction and explain the working of electric motor starters. • identify parts of motors and starters. • distinguish between different types of motors and starters electric motor. • carry out connections and perform running of electric motors.
	Efficiency of pump & maintenanc e.	Day 2	1hr	• Efficiency of pumps. • Preventive, routine and break-down maintenance of pump. • Overhauling and lubrication of pump sets.	3 hrs	• Dismantling and studying of different parts. • Reassembling and running of pumps, checking temperature rise, • Practice in dismantling cleaning parts, changing lubricants • Gland packing replacement.	• Learner should know all the parts of pumps and their arrangements. • Should understand how to dismantle and Re-assemble the Pump.	Learner would be able to -: • calculate hydraulic efficiency. • examine points for performing preventive maintenance. • interpret and apply preventive maintenance chart. • perform overhauling procedure for Pump set.
Week 14	Main faults and trouble shooting in pumps	Day 1	2hrs	• Checking impeller & DOR of motor. • Inspecting pump, installation Ball bearing and coupling • Examining of glands seals bush and vibrations.	3 hrs	• Arrangements of tools and tackles. • Repairing of float & foot valves and leakages. • Changing of ball bearings, seals, bushes, glands,	• Arrange Visit to pump house	Learner would be able to-: • Check the Impeller and clean it. • Check the direction of rotation. • undertake pump installation, and check for correct alignment.

						impellers, couplings.		
	Main faults and trouble shooting in pumps	Day 2	2 hrs	• Different types of pressure gauges and their uses in pump houses. • Examining electrical connections of motor controllers and overloading of motor. • Trouble shooting in pumps.	3 hrs	• General practical at pump house. • Repairing of faulty starters of pumps. • Installation of pressure gauges in lines and taking readings e.t.c.	Examine the pump for -: • No deliver of liquid, • Too low discharge pressure. • pump deliveries for a while • pump require too much power. • Overheating of pump.	Learner would be able to-: • use different type of gauges for measuring pressure. • carry out electrical connections –connection of motor with starter. • Inatall pressure gauges in pipe lines. • carry out trouble shooting in pump.
Week 15	Entreprene ur ship	Day 1	1hrs	• Project formulation. • Budgeting	3 hrs	• Preparation of sample project • Budget preparation	• A dummy project should be shown by instructor.	• Learner would be able to prepare documents related to key elements of entrepreneurship like budgeting, arranging loans, market survey e.t.c.
	Entreprene urship	Day 2	2 hr	• Finance and arranging of loans • Marketing • Store keeping	3 hrs	• Account keeping. • Practice in market survey. • Stock taking & verification		
Week 16	First aid	Day 1	3 hrs	• Handling of emergencies like electric shock , cut fracture	3 hrs	• Demonstration and practice of artificial respiration. • Demonstration of First-aid box.	• Charts/ppts/video may be used for demonstration. • Physical display of First-Aid box	Leaner would be able to • identify and handle emergency situations at work site. • Carry out CPR. • identify use components properly from a first-aid box.