CBSE – DEPARTMENT OF SKILL EDUCATION

ELECTRICAL TECHNOLOGY (SUBJECT (CODE 819)

MARKING SCHEME

Class XII (Session 2019–2020)

Time: 3 Hours **Max. Marks: 60**

PART A: EMPLOYABILITY SKILLS (10 MARKS)

General Instructions:

1. *This Question Paper consists of two parts viz. Part A: Employability Skills and Part B: Subject Skills.*
2. ***Part A: Employability Skills (10 Marks)***
   - ***i.*** *Answer any 4 questions out of the given 6 questions of 1 mark each.*
   - ***ii.*** *Answer any 3 questions out of the given 5 questions of 2 marks each.*
3. ***Part B: Subject Skills (50 Marks):***
   - ***i.*** *Answer any 10 questions out of the given 12 questions of 1 mark each.*
   - ***ii.*** *Answer any 5 questions from the given 7 questions of 2 marks each.*
   - ***iii.*** *Answer any 5 questions from the given 7 questions of 3 marks each.*
   - ***iv.*** *Answer any 3 questions from the given 5 questions of 5 marks each.*
4. ***This question paper contains 42 questions out of which 30 questions are to be answered.***
5. *All questions of a particular part/section must be attempted in the correct order.*
6. *The maximum time allowed is 3 hrs.*

PART A: EMPLOYABILITY SKILLS

<table>
<tr><th>Q.NO.</th><th>EXPECTED ANSWERS/VALUE POINTS
<u>Answer any 4 questions out of the given 6 questions</u></th><th>MARKS</th><th>TOTAL MARKS</th></tr>
<tr><td>1</td><td>c) Article writing</td><td>1</td><td>1</td></tr>
<tr><td>2</td><td>b)Standard bar</td><td>1</td><td>1</td></tr>
<tr><td>3</td><td>a)Dependent</td><td>1</td><td>1</td></tr>
<tr><td>4</td><td>d)Chief sustainability officers</td><td>1</td><td>1</td></tr>
<tr><td>5</td><td>Entrepreneurship is a process of developing a business plan, launching and running a business using innovation to meet customer needs and to make a profit.</td><td>1</td><td>1</td></tr>
<tr><td>6</td><td>b) Gossip</td><td>1</td><td>1</td></tr>
<tr><td></td><td><u>Answer any 3 questions out of the given 5 questions</u></td><td></td><td></td></tr>
<tr><td>7</td><td>Two points difference between listening and hearing-
<table>
<tr><td>Listening</td><td>Hearing</td></tr>
<tr><td>It is active.</td><td>It is passive.</td></tr>
<tr><td>It requires a conscious effort.</td><td>It does not require a conscious effort.</td></tr>
</table></td><td>½
½
½
½</td><td>2</td></tr>
</table>

	(Any other, any two points)		
8	Four steps to insert a text box in a slide are- 1.Click the text button on the drawing bar 2.The mouse pointer changes to + the sign 3. Place the mouse pointer on the slide where you want to add the text box 4. Click and drag on the side to draw a text box. (Any four points)	½ ½ ½ ½	**2**
9	Two traits of extraversion personality- 1.Gregarious 2.Assertive (Any other, any two points) Two traits of agreeableness personality- 1.Cooperative 2.Agreeable (Any other, any two points)	½ ½ ½ ½	**2**
10	Four green jobs in building and construction field are- 1.Construction worker 2.Concrete labors 3.Highway laborers 4.Builiding planner and coordinators (Any other, any four points)	½ ½ ½ ½	**2**
11	Chemist Shop or Pharmacy is an example for trading as there buying and selling of goods is takes place. Doctor giving a medical consultation is an example of services as here we pay for a doctor's expertise or services	**2**	**2**

PART B: SUBJECT SKILLS (50 MARKS)

Answer any 10 questions out of the given 12 questions:

12	Quality factor is also known as _____ a) Voltage magnification b) Current magnification c) Resistance magnification d) Impedance magnification Ans (a)	**(1)**
13	**Efficiency of a transformer is maximum at** **a.** Leading power factor **b.** Lagging power factor **c.** Unity power factor **d.** None of these Ans(c)	**(1)**
14	The starting torque of a capacitor start motor is a) zero b) low c) same as rated torque	**(1)**

	d) more than rated torque. Ans (c)	
15	What will happen if DC shunt motor is connected across AC supply? a) Will run at normal speed b) Will not run c) Will Run at lower speed d) Burn due to heat produced in the field winding Ans(d)	**(1)**
16	**A good heating element should have** **a)** High resistivity and low melting point **b)** Low resistivity and high melting point **c)** High resistivity and high melting point **d)** Low resistivity and low melting point Ans (c)	**(1)**
17	RMS stands for ____ a) Root Mean Square b) Root Mean Sum c) Root Maximum sum d) Root Minimum Sum Ans (a)	**(1)**
18	The efficiency of an induction motor is about a)100% b)80-90% c)50-60% d)Less than 50% Ans (b)	**(1)**
19	A transformer oil used in an electrical transformer must be free from _____ a) Gases b) Odour c) Sludge d) Moisture Ans(d)	**(1)**
20	Speed of the universal motor is a) Dependent on frequency of supply b) Proportional to frequency of supply b) Independent of frequency of supply c) None of the above Ans (c)	**(1)**
21	The household energy meter is a)An indicating instrument b)A recording instrument c)An integrating instrument d)None of the above Ans (c)	**(1)**
22	Resistance of multimeter is measured using _____ a) constant current source b) constant voltage source c) variable current source d) variable voltage source Ans (a)	**(1)**
23	**The following class of fire occur in electrical equipment** a) Class-A fires b) Class-B fires c) Class-C fires	**(1)**

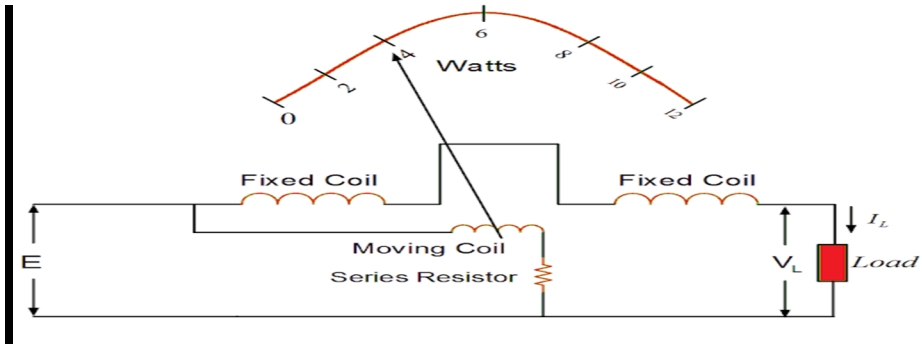
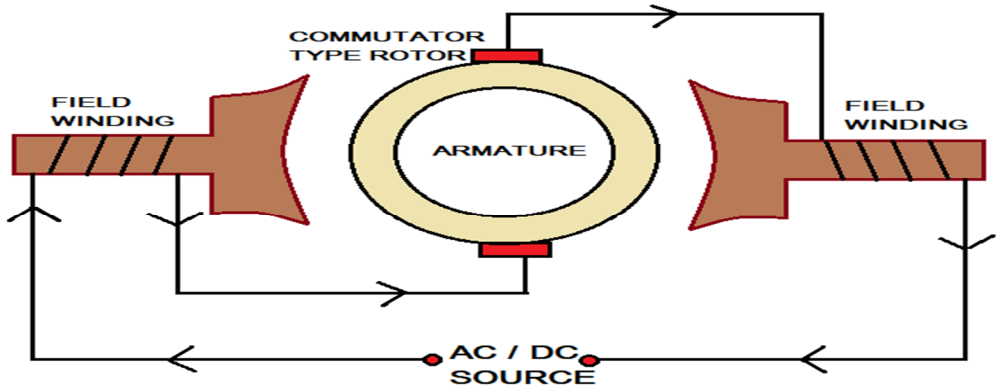
	d) All of the above Ans (c)		

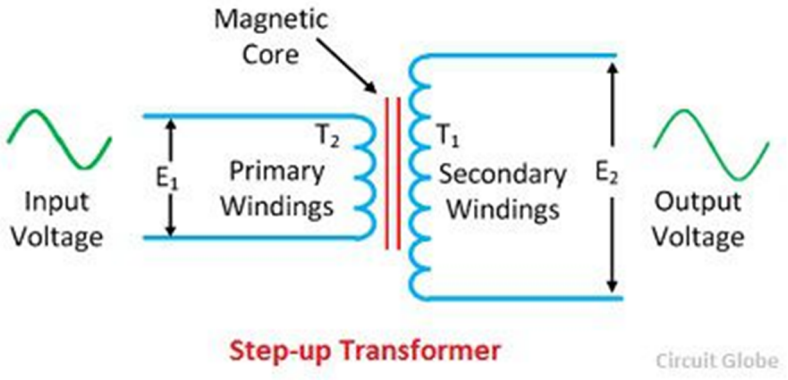
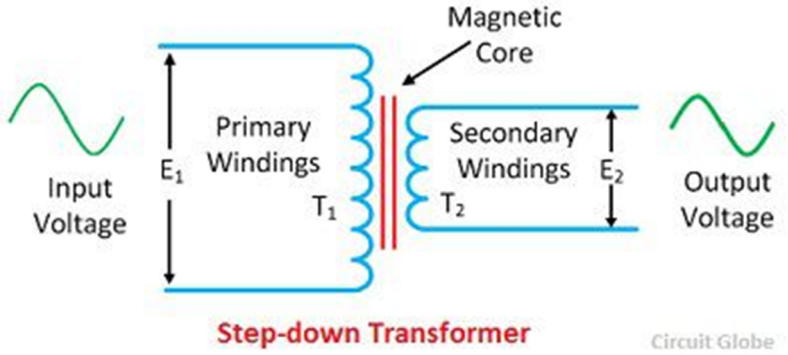
Answer any 5 questions out of the given 7 questions of 2 marks each:

24	What is Q factor of RLC circuit? What is its significance? The **quality factor** relates the maximum or peak energy stored in the circuit (the reactance) to the energy dissipated (the resistance) during each cycle of oscillation meaning that it is a ratio of resonant frequency to bandwidth Q factor series RLC is $Q = w_0 L/R = 1/w_0 RC$ where w_0 is the resonanat frequency. Significance: Higher the circuit **Q**, the smaller the bandwidth	**1** **1**	**(2)**
25	What are the precautions while installation of dc motors? • Use the driver power supply correctly. • Do not exceed the input voltage range. • Do not exceed the input voltage range. • Take noise cancellation measures.	 ½ ½ ½ ½	**(2)**
26.	What is an auto transformer? An **Auto Transformer** is a **transformer** with only one winding wound on a laminated core. An **auto transformer**is similar to a two winding **transformer** but differ in the way the primary and secondary winding are interrelated. A part of the winding is common to both primary and secondary sides.	 **2**	
27.	What are the steps to rescue a person from live wire? • Turn off or separate the victim from the electrical source • Inform doctor. • Check his breathing and heartbeat. If the person is not breathing, begin mouth-to-mouth resuscitation. ... • Do not move the victim if you suspect neck or spine injury. • Treat burn by immersing in cold water. Do not apply grease or oil.	 ½ ½ ½ ½	**(2)**
28.	What is the difference between room cooler and desert cooler? Room coolers and desert coolers work on the same principle. They both work through the evaporation of water which adds moisture to your room, making it cooler. Desert coolers are usually kept on the window and suck air from the outside while room coolers are kept inside the room, recirculating the air in the room.	 **1** **1**	**(2)**
29.	What is reverse motor? Since each wire consists of a positive and negative current within the magnetic fields, the flip-flopping of main and starter wires causes the **motor** to run in **reverse** rotation. This easy switching of wires works because the polarity of the magnetic field is **reversed**, thus **reversing** the **motor**	 **2**	**(2)**
30.	What are Safety measures precautions from operational point of view of single phase transformer? 1. Monitor your transformer before it is installed, checking for any burning smell, cracked or unsuitable power cords or plugs, and loose or misaligned parts. 2. Regularly inspect your transformer to minimize system failure or breakdown.	 **1** **1**	**(2)**

Answer any 5 questions out of the given 7 questions of 3 marks each:

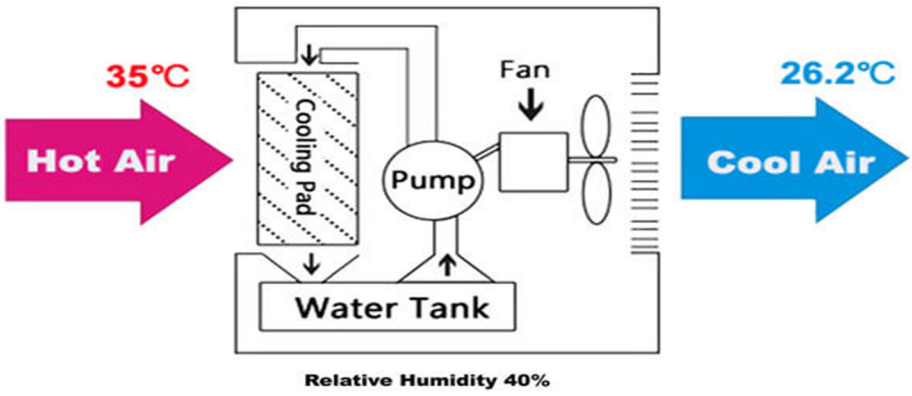
31	Compare series motor, shunt motor and compound motors.					**(3)**
	Characteristics	Series Motor	Shunt Motor	Compound Motor	**1**	
	Speed	Variable Speed	Constant Speed	Variable Speed	**1**	
	Starting torque	High	medium	high		
	Example	Trolley, conveyers,cranes	Lathe, blowers, fans	Elevators, rolling mills	**1**	

32	Explain the working principle of dynamometer type wattmeter. **Dynamometer type wattmeter** works on very simple **principle** and this **principle** can be stated as when any current carrying conductor is placed inside a magnetic field, it experiences a mechanical force and due to this mechanical force deflection of conductor takes  	**$1^{1/2}$** **$1^{1/2}$**	**(3)**
33	Explain the construction and operation of universal motor. **Universal motor** is used in such applications, where you can use AC supply and DC Supply both to run the motor. In a series wound motor, the same current flows through the field winding and armature winding. Same way, in an **universal motor**, both winding are connected in series with each other. When the motor is supplied from ac or dc voltage source, magnetic fields are developed in the armature and field winding both. They react on each other to produce an unidirectional torque  UNIVERSAL MOTOR	**2** **1**	**(3)**
34.	Explain the operation of step-up and step-down transformer using diagram. Step-up Transformer A transformer in which the output (secondary) voltage is greater than its input (primary) voltage is called a step-up transformer. The step-up transformer decreases the output current for keeping the input and output power of the system equal.	**1** **½**	**(3)**

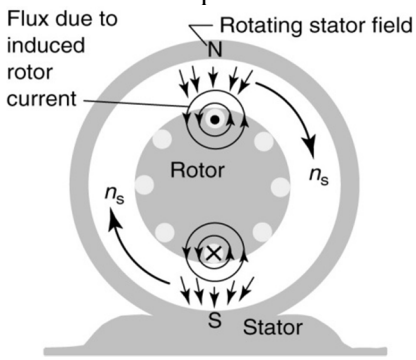
	 Step-down Transformer A transformer in which the output (secondary) voltage is less than its input (primary) voltage is called a step-down transformer. The number of turns on the primary of the transformer is greater than the turn on the secondary of the transformer 	**1** **½**	
35	Write the steps of starting of 3 phase induction motor The three phase induction motor may be started by connecting the motor directly to the full voltage of the supply. The motor can also be started by applying a reduced voltage to the motor when the motor is started. The torque of the induction motor is proportional to the square of the applied voltage.Thus, a greater torque is exerted by a motor when it is started on full voltage than when it is started on the reduced voltage. The three methods to start the 3 phase inducton motor are: • Direct on line • Star delta starter • Autotransformer starter	**2** **1**	**(3)**
36.	Describe Schafer's Method of artificial respiration. The subject is laid in prone position and a small pillow is placed underneath the chest and epigastrium. The head is turned to one side. The operator kneels down by the side of the subject facing towards his head. Two hands are placed on the two sides of the lower part of the chest and then the operator slowly puts his body weight leaning forwards and pressing upon the loins of the subject. Intra-abdominal pressure rises, the diaphragm is pushed up and air is forced out of the lungs. After this the operator releases the pressure and comes back to his original erect position. The abdominal pressure falls, diaphragm descends and air is drawn in. These movements are repeated about twelve times a minute	**3**	**(3)**
37.	What are Common faults of electric mixer? **1**. Leaking mixer grinder Leaking proves to be one of the most common mixer grinder problems. To correct it, you first need to check the blade assembly and ensure that it is tightly screwed onto the jar. Another reason for a leaking mixer could be problem with the rubber gasket. 2. Stuck buttons of the mixer grinder Another one of the common mixer grinder problems is stuck buttons. This usually happens	**1** **1**	**(3)**

	when foods and liquids spill a little bit and enter the space in between the buttons. To correct this issue, you must unplug the appliance and give it a nice thorough cleaning. 3. Slow moving blades Out of the many common mixer grinder problems, one is slow moving blades. This can prove irritating because in this case the foods and liquids take a long time to get mixed or churned. In most of the cases, this problem is caused due to food particles clogging the blade assembly.	**1**	

Answer any 3 questions out of the given 5 questions of 5 marks each:

38	Give construction and working details of room cooler. Explain it with a neat diagram. Air coolers work on the priciple of cooling by the evaporation of water which is present in them. These coolers are also called desert coolers or swamp coolers and they require water, which is filled in these coolers. The cooling effect is produced due to the transition in phase from liquid state to vapour state. Various parts that are needed to make an evaporative cooler or a simple air cooler are: **1)Fan and vents**- A fan is needed to direct the cool air towards the room. These fans continuously flow cool air in the rooms. **2)Water source**- Evaporative cooler uses water so it is necessary to fill the cooler with water so that the cooling can take place. **3)Cooling pads**- The purpose of cooling pads is to absorb water and to pass air through them. **4)Distributor**- Water needs to be distributed properly to these cooling pads. This is done by cooling pumps and various pipes that interconnect the cooling pads. These cooling pads should aways be in saturated state otherwise the water will evaporate away from these pads. **Working Principle:** Water, when evaporates it needs heat called 'latent heat of evaporation'. In the cooler the water that is sprayed over the pads when evaporates takes the required latent heat from the atmospheric air surrounding them which on losing its heat cools down. This cooled air is blown inside the room by the exhaust fan fitted on the cooler and thus the room temperature drops making the ambiance inside comfortable. The main parts of the cooler are 1)Fan 2)Pump with water distribution flexible pipe lines 3)Porous pads normally made of special grass or shavings of synthetic material and a box made of steel sheets on which the above mentioned items are mounted securely.  	**2** **1** **2**	**(5)**
39	Explain the construction of digital multi meter and describe its operation in details. **Digital multimeter** is a test equipment which offers several electronic measurement task in one tool. It is also known as the voltmeter or Ohm meter or Volt Ohm meter. The standard and basic measurements performed by multimeter are the measurements of amps, volts, and ohms Operation of Digital Multimeter: Install a battery to power it. When using the meter it is possible to follow a number of simple	**1** **2**	**(5)**

	steps: 1. Turn the meter on 2. Insert the probes into the correct connections - this is required because there may be a number of different connections that can be used. 3. Set switch to the correct measurement type and range for the measurement to be made. When selecting the range, ensure that the maximum range is above that anticipated. The range on the DMM can then be reduced as necessary. However by selecting a range that is too high, it prevents the meter being overloaded. 4. Optimise the range for the best reading. If possible enable all the leading digits to not read zero, and in this way the greatest number of significant digits can be read. 5. Once the reading is complete, it is a wise precaution to place the probes into the voltage measurement sockets and turn the range to maximum voltage. In this way if the meter is accidentally connected without thought for the range used, there is little chance of damage to the meter. This may not be true if it left set for a current reading, and the meter is accidentally connected across a high voltage point! Construction: Display screen-It has illuminated display screen for better visualization. It has five digits display screen; one represent sign value and the other four are for number representation. Selection knob- As we know a single multimeter performs so many tasks like reading <u>voltage</u>, <u>resistance</u>, and <u>current</u>. The selection knob allows the user to select the different job. Port- There are two ports on the front of the unit. One is the mAVΩ port which allows the measurement of all the three units: current up to 200 mA, voltage, and resistance. The red probe is plugged into this port. The other is COM port which means common and it normally connected to –ev of a circuit and black probe is plugged into it. There is one particular port is 10A, which is use to measures large current in the circuit.	**2**	
40	Explain construction and working principle of immersion heater. Also explain its defects and steps to repair. Immersion heaters are used to quickly and reliably heat liquids that they are immersed in either from the top of an open vessel, or through the side of the vessel into the liquid with a liquid and pressure tight fitting. Immersion heaters are available in many physical configurations, materials and temperature ranges to cover a wide range of applications in industry, science, utilities, domestic and appliances. While most immersion heaters are relatively inexpensive to purchase, they are not particularly energy efficient since they employ a direct electric heating. **Principle of Operation** Immersion heaters are made by encasing a nichrome resistance heating wire in a ceramic jacket which is then surrounded by an Inconel sheath. Inconel is a highly corrosion- and heat-resistant form of stainless steel used for the electric heating elements on electric stoves. As electricity flows through the nichrome wire, it gets hot to the point of glowing and spews heat at a high rate through the ceramic and through the Inconel, until its temperature is high. If it were not immersed, it would glow red just like stove heating elements. **<u>Common Problems of Immersion heater and remedies:</u>** If the water is not heating up efficiently or not heating up at all, then it could be a sign of a faulty thermostat or element. This will need to be tested by a proficient plumber or electrician. If the water is heating up to an extreme, the thermostat may be stuck on the 'on' position and will need replacing. Another common problem can be the timer switch burning out, which would also require replacement.	**1** **2** **2**	**(5)**
41	Classify AC motors and explain them briefly. • Classification Based On ***<u>Principle Of Operation</u>***: ***<u>(a) Synchronous Motors.</u>*** These motors have the rotor (which is connected to the load) rotating at the same speed as the speed of rotation of the stator current. 1. Plain 2. Super ***<u>(b) Asynchronous Motors.</u>*** These motors are very flexible to use and matches the load demand almost for everything.	**2**	**(5)**

	1. ***Induction Motors:*** (a) Squirrel Cage (b) Slip-Ring (external resistance). 2. ***Commutator Motors:*** (a) Series (b) Compensated (c) Shunt (d) Repulsion (e) Repulsion-start induction (f) Repulsion induction • Classification ***Based On Type Of Current:*** 1. Single Phase- The single phase motors are generally found their use in low power requirements/domestic appliances like ceiling fans, mixer grinders, portable power tools etc 2. Three Phase- The three phase motors are generally found for high power requirements like power drives for compressors, hydraulic pumps, air conditioning compressors, irrigation pumps and many more. • Classification Based On ***Speed Of Operation:*** 1. Constant Speed-There are motors which should be run at a constant speed for air compressors. 2. Variable Speed- Certain cooling water pumps driven by a.c.motors can be run at two or three speeds by just switching the number of poles used. If the number of poles are changed then the speed also changes. 3. Adjustable Speed. • Classification Based On ***Structural Features:*** 1. Open 2. Enclosed 3. Semi-enclosed 4. Ventilated 5.Pipe-ventilated 6. Riveted frame-eye	**1** **1** **1**	
42	Explain working of three phase induction motor in details using diagram. Consider the simplified view of a 3 phase induction motor shown below.  The stator hosts a three phase winding distributed symmetrically on its inner periphery. This stator winding is energised from a three phase supply. The rotor also hosts a 3 phase winding on its periphery. But, the rotor winding is not energised from any source and is short- circuited on itself. <u>Three phase Induction motor working principle</u> (1) When the 3 phase stator winding is energised from a 3 phase supply, a <u>rotating magnetic field</u> is produced which rotates around the stator at synchronous speed.	**2** **1** **2**	**(5)**

	(2) The rotating magnetic field cuts the rotor conductors, which as yet, are stationary. Due to this flux cutting, emfs are induced in the rotor conductors. As rotor circuit is short circuited, therefore, currents start flowing in it. (3) Now, as per Lenz's law , "the direction of induced current will be such that it opposes the very cause that produced it " . (4) Here, the cause of emf induction is the relative motion between the rotating field and the stationary rotor conductors. Hence, to reduce this relative motion, the rotor starts rotating in the same direction as that of the stator field and tries to catch it but, can never catch it due to friction and windage and therefore emf induction continues and motor keeps rotating. Thus, ***principle of 3 phase induction motor*** also explains why rotor rotates in same direction as the rotating field and why *induction motor is self-starting*. When rotor winding is short-circuited with no resistance in series, it is called a ***squirrel cage induction motor*** and when rotor winding is shorted through a resistance in series, it is called ***slip ring induction motor***.		