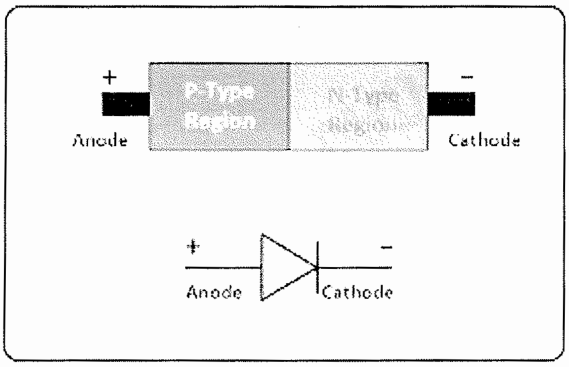
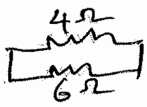
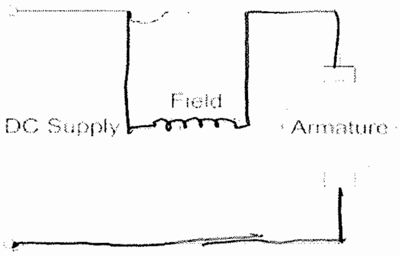
Scoring Indicators

FUNDAMENTALS OF ELECTRICAL ENGINEERING
COURSE CODE : 3024 **QID:2110220152**

Q No	Scoring Indicators	Split score	Sub Total	Total Score
	PART A			9
I. 1	Volt (V)	1	1	
I. 2	I=V/R R=V/I V=IR	1	1	
I. 3	Frequency	1	1	
I. 4	**elevators, steel mills, rolling mills, locomotives, and excavators (any two)**	2*0.5	1	
I. 5	Two point starter	1	1	
I. 6	Stator and rotor	2*0.5	1	
I.7	Mutual induction	1	1	

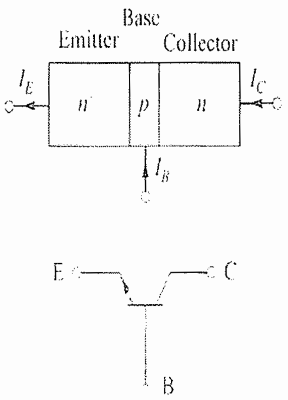
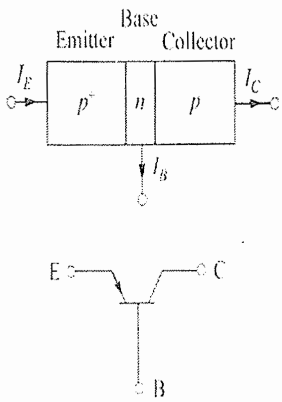
I. 8		1	1	
I. 9	Same polarity	1	1	
	PART B			42
II. 1			3	
	$R_1 = 4\Omega$ $R_2 \quad 6\Omega$  $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ $R_p = \frac{R_1 R_2}{R_1 + R_2} = \frac{4 \times 6}{4+6} = \frac{24}{10} = 2.4\Omega$	8 1 2		
II. 2		3	3	

	Form factor:it is defind as the ratio of rms value to the average value of an alternating quantity Peak factor: it is defind as the ratio of maximum value to the rms value	1.5 1.5		
II. 3			3	
	Power ,P=20W Voltage ,V=220 V Current,I=P/V=20/220=0.333 A	3		
II. 4		3	3	
	1.Stator: The stator of an induction motor consists of a number of overlapping windings offset by an electrical angle of 120°. When the primary winding or stator is connected to a 3 phase A.C. supply, it **establishes a rotating magnetic field which rotates at a synchronous speed.** **2.Rotor:** The rotor winding **drives its voltage and power from the stator winding through electromagnetic induction**	2 1		
II. 5			3	

	 Series Excited DC Motor The field coils of **DC series motor** are wound with relatively fewer turns as the current through the field is its armature current and hence for required mmf less numbers of turns are required. he wire is heavier, as the diameter is considerable increased to provide minimum to the flow of full armature current.	1 1 1		
II. 6		3	3	
	. 1. Conduction. 2. Convection. 3. Radiation.	1 1 1		
II. 7		3	3	

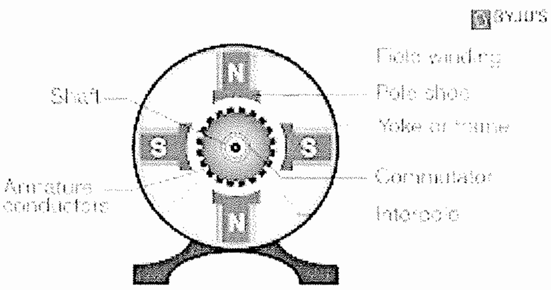
	Electric Arc Furnace An electric furnace is the furnace that heats materials by means of an electric arc is called an **electric arc furnace (EAF)**. Electric arc furnaces are mainly used for melting or extracting of ferrous or non-ferrous metals which need a high temperature operation. The electric arc furnace produces an electric arc which gives an arc temperature between 3000 °C and 3500 °C on L.T. (Low Tension) operation. Basically, the **electric arc** is nothing but the flow electric current through an air gap between two conducting electrodes. Working of Electric Arc Furnace From the working of an electric arc furnace simply means how to create the electric arc and hence the heat produced in the furnace. The electric arc between two electrodes can be created by any of the following two methods – • H. T. (High Tension) method of striking an electric arc • L. T. (Low Tension) method of striking an electric arc	3		
II. 8		3	3	

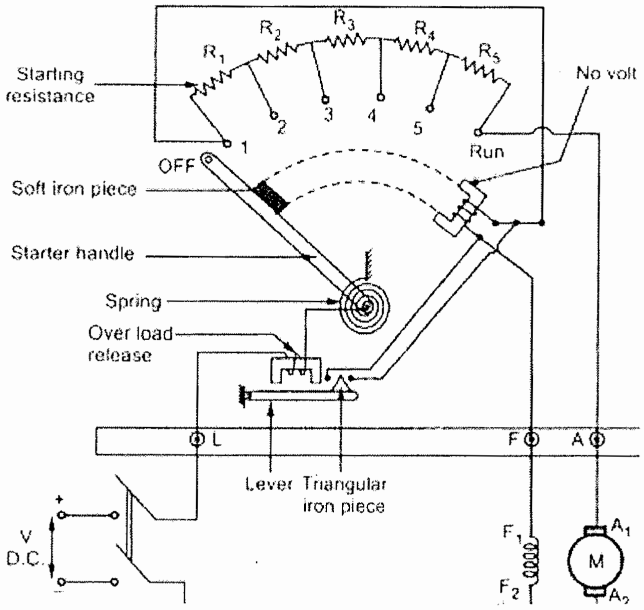
	N1=500 N2=40 Trnasformation ratio ,K=N2/N1=40/500=0.08.	3		
II.9		3	3	
	Voltage sources. Current sources. Generators (such as alternators and DC generators) All different types of transistors (such as bipolar junction transistors, MOSFETS, FETs, and JFET) Diodes (such as Zener diodes, photodiodes, Schottky diodes, and LEDs)	3		
II.10		3	3	

	 Base Emitter Collector I_E n^+ p n I_C I_B E C B  Base Emitter Collector I_E p^+ n p I_C I_B E C B	3		

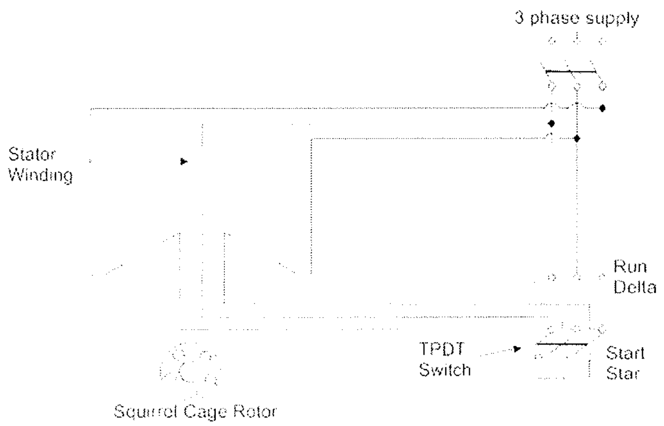
	PART C			42
III		7	7	
	Applying Kirchoff's rule to the point P in the circuit, The arrows pointing towards P are positive and away from P are negative. Therefore, 0.2A – 0.4A + 0.6A – 0.5A + 0.7A – I = 0 1.5A – 0.9A – I = 0 0.6A – I = 0 I = 0.6 A	4+3		

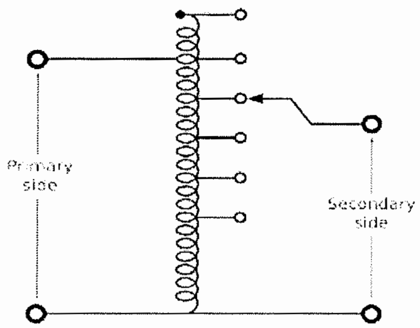
IV	Given load i) Six lamps of 25W working for 8 hrs a day $E_1 = \frac{W \times t}{1000} = \frac{6 \times 25 \times 8}{1000} = 1.2$ kwh ii) 4 fans of 60W working for 8 hrs a day $E_2 = \frac{4 \times 60 \times 8}{1000} = \frac{1920}{1000} = 1.92$ kwh iii) 1 pump motor of 750W running for 1 hrs a day $E_3 = \frac{750 \times 1}{1000} = 0.75$ kwh Total Energy for one day $E = E_1 + E_2 + E_3$ $E = 1.2 + 1.92 + 0.75 = 3.87$ kwh Total Energy for one month $= 30 \times E$ $= 30 \times 3.87$ 116.1 Energy bill $= 116.1 \times 3 = 348.3/-$	3 3 1 3 1	7	
V		4+3	7	

	Working principle of DC motor When the DC motor is connected to an external source of DC supply, the field coils are excited developing alternate N and S poles and a current flows through the armature windings. All the armature conductors under N pole carry current in one direction,whereas all the conductors under S pole carry current in the opposite direction As each conductor carrying a current and is placed in a magnetic field, hence a mechanical force acts on it.	4		
	By applying Fleming's left hand rule, it can be seen that the force on each conductor is tending to move the armature in anticlockwise direction. The force on all the conductors add together to exert a torque which make the armature rotating. When the conductor moves from one side of a brush to the other, the current in the conductor is reversed and at the same time it comes under the influence of next pole of opposite polarity. As a result of this, the direction of force on the conductor remains the same. Therefore, the motor being rotating in the same direction.  DC motor construction parts	3		
VI		7	7	

		4		
	➢ To start the motor handle is moved from OFF position to the first contact. The full starting resistance is placed in series with the armature and field is connected directly to the supply line through no volt coil. As the motor takes speed, the armature develops back e.m.f and the current falls. As the handle is further moved and the starting resistance is gradually cut out till, when the handle reaches the running position, all the resistance is cut out. ➢ There is a soft iron piece attached to the handle which in the running position is attracted and held by an electromagnet energized by the shunt field current ➢ If the motor becomes over loaded the over load release attract D, thus short – circuiting the no- volt release coil. The no- volt coil is demagnetized and the starting handle is pulled to the OFF position by the spring. Thus the motor is automatically disconnected from the supply.	3		
VII		2+2+3	7	

	Working Single phase induction motor ➢ A single phase induction motor is very similar to a 3-phase squirrel cage induction motor. ➢ It has a squirrel cage rotor and single-phase winding on the stator, but a single phase winding cannot produce rotating field when is energized by single phase supply. ➢ In order to produce rotating field in single phase induction motor we converting a single phase supply into two phase supply through the use of an additional winding. ➢ When the motor attains sufficient speed, the additional winding may be removed depending upon the type of the motor. ➢ Rotating field produced by the stator cut the stationary rotor conductors and an e.m.f is induced and current flows through the rotor conductors, direction of this current is to oppose the cause producing them (by Lenz's law). Now the cause producing the rotor currents is relative speed between the rotating field and the stationary rotor conductor. Hence to reduce this relative speed, the rotor starts running in the same direction as that of stator field.	2 2 3		
VIII		3+2+2	7	

	 A **star delta starter** is the most commonly used method for the starting of a 3 phase induction motor. In star delta starting an induction motor is connected in through a star connection throughout the starting period. Then once the motor reaches the required speed, the motor is connected in through a delta connection. A star delta starter will start a motor with a star connected stator winding. When motor reaches about 80% of its full load speed, it will begin to run in a delta connected stator winding.	3 2 2		
IX		4+3	7	

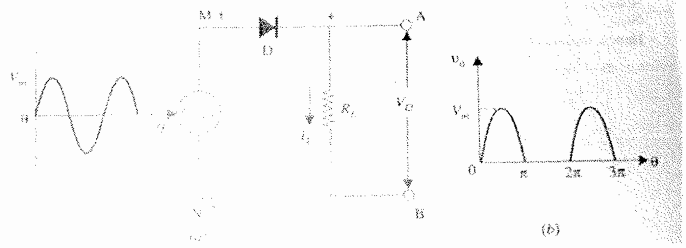
<table>
<tr><td></td><td>

i. An **autotransformer** is a type of electrical transformer with only one winding.
ii. An auto transformer is similar to a two winding transformer but varies in the way the primary and secondary winding of the transformer are interrelated.
iii. The primary voltage is applied across two of the terminals. The secondary voltage is taken from two terminals, one terminal of which is usually in common with a primary voltage terminal
Since the volts-per-turn is the same in both windings, each develops a voltage in proportion to its number of turns. In an autotransformer, part of the output current flows directly from the input to the output (through the series section), and only part is transferred inductively (through the common section), allowing a smaller, lighter, cheaper core to be used as well as requiring only a single winding</td><td>2

3

2</td><td></td><td></td></tr>
<tr><td>X</td><td></td><td>3+4</td><td>7</td><td></td></tr>
</table>

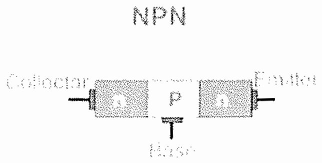
	Heating is required for both industrial and domestic purposes. In industries, heating is required for the melting of metals, moulding of glass, enamelling of copper, baking of insulator and welding etc. In domestic purposes the heating is required for cooking, water heating, room heating in winter, pressing clothes and many more. Heating is required for both industrial and domestic purposes. In industries, heating is required for the melting of metals, moulding of glass, enamelling of copper, baking of insulator and welding etc. In domestic purposes the heating is required for cooking, water heating, room heating in winter, pressing clothes and many more. Different types of electric heating can be categorised as ▪ Resistance Heating (indirect & direct) ▪ Infrared Heating ▪ Induction Heating ▪ Dielectric Heating ▪ Electric Arc and Plasma Heating ▪ Electron Beam Heating . Resistance heating- When a current flow through a resistor, resistor converts this electrical energy into heat energy. That is when a current =I flow through a resistor having resistance=R for a duration of t seconds, then heat produced by resistor= $I\ 2Rt$ 2. Induction heating-Induction heating takes place due to the flow of eddy current through the material to be heated. Due to this eddy current flow, heating of the material takes place ▪ 3. Dielectric heating- when a dielectric material is applied by AC supply, dielectric loss will be produced. This loss appears as heat and heating take place	3 4		
X1				7

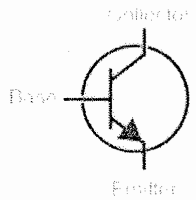
	28.3. Half-wave Rectifier Though such a circuit is not much used, yet we will discuss it here for the sake of explaining the basic principle involved in the working of a rectifier. The simple circuit of a half-wave rectifier is shown in Fig. 28.6 along with the input and output voltage waveforms. An a.c. voltage is applied to a single diode connected in series with a load resistor R_L. Working During the positive half cycle of the input a.c. voltage i.e., when point M is positive, the diode D is forward-biased (ON) and conducts. While conducting, the diode acts as a short-circuit so that circuit current flows and hence, positive half-cycle of the input a.c. voltage is dropped across R_L. It constitutes the output voltage v_0 as shown in Fig. 28.6 (b). Waveform of the diode current (which equals load current) is similar to the voltage waveform.  (b)	2 5		
XII		3+4	7	

3

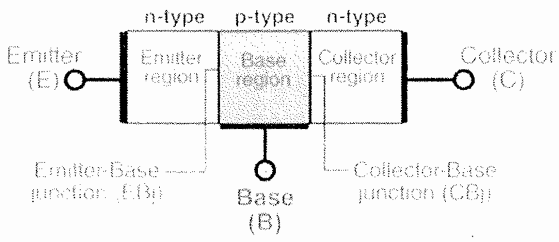
NPN Transistor

The NPN transistor consists of two n-type semiconductors that sandwich a p-type semiconductor. Here, electrons are the majority charge carriers, while holes are the minority charge carriers. The NPN transistor is represented, as shown below.





4



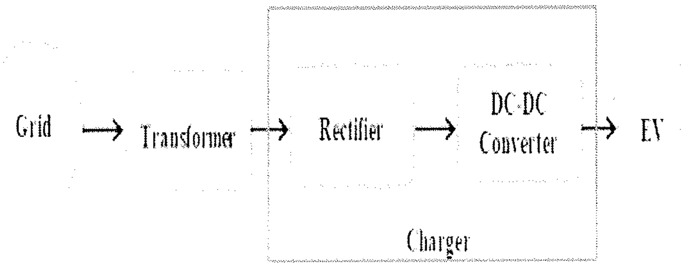
The NPN transistor is made of semiconductor materials like silicon or germanium. When a p-type semiconductor material is fused between two n-type semiconductor materials, an NPN transistor is formed.

When the emitter-base junction is forward biased, a small voltage VBE is seen. Reverse bias voltage VCE. Due to the forward bias, the majority charge carriers in the emitter are repelled towards the base. The electron-hole recombination is very small in the base region since the base is lightly doped. Most of the electrons cross into the collector region.

When the emitter is forward biased, electrons move towards the base and create the emitter current IE. Here, the majority charge carriers in the P-type material combine with the holes. 3

Since the base of the NPN transistor is lightly doped, it lets only a few electrons to combine and the remaining current is known as the base current IB. When the collector region is reverse biased, it applies a greater force on the electrons reaching the collector junction and hence attracts the electrons at the collector.

XIII			7	
	Resistors: Fixed Resistors. The fixed resistor type is the most common resistor. ... Variable Resistors. There are several variable resistor types, their general property is that the resistance value is adjustable. ... Thermistors. Carbon Film Resistors. ... Metal Film Resistors. ... Wirewound Resistors. ... Metal Oxide Resistors. ... Metal Strip Resistors. Capacitors" Ceramic capacitor. Electrolytic capacitor. Film and paper capacitors. Super capacitors. Silver Mica capacitor. Glass capacitor. Tantalum capacitor. Polycarbonate capacitor. **Wet tantalum capacitors**	3 4		
XIV		4+3	7	

	 5: Block diagram of an Electric Vehicle Charging Station	4		
	EV charging **involves supply of direct current (DC) to the battery pack**. As electricity distribution systems supply alternate current (AC) power, a converter is required to provide DC power to the battery. Conductive charging can be AC or DC. Ttransformer used to stepdown the supply voltage Rectifier used to convert AC to DC	3		