## SCHEME OF VALUATION

### (Scoring Indicators)

| Revision:2015 | | Course Code:3021 | | |
|---|---|---|---|---|
| **Course Title: Electrical and Electronics Engineering** | | | | |
| **Qst No** | **Scoring Indicators** | **Split up score** | **Sub total** | **Total** |
| I(1) | **Form factor** of an alternating current waveform is the ratio of the RMS (root mean square) value to the average value. | **2** | **2** | **2** |
| I(2) | 1. Ampere hour efficiency<br>2. Watt-hour efficiency | **2** | **2** | **2** |
| I(3) | **1.** Star delta starter<br>**2.** DOL starter | **2** | **2** | **2** |
| I(4) | 1. Used in the production of artificial fibers<br>**2.** Wood gluing<br>**3.** food processing<br>4. Sterilisation of food and medical instruments<br>5. Welding of PVC<br>6. Drying of tobacco, paper and wood | **2**<br>**(Any two)** | **2** | **2** |
| I(5) | Rectifier is used to convert AC into DC | **2** | **2** | **2** |
| II(i) | Ohm's Law states that the current flowing through a conductor is directly proportional to the potential difference applied across its ends, provided the temperature and other physical conditions remain unchanged. Mathematically it can be represented as,<br>**Potential difference ∝ Current**<br>$V \propto I$<br>$V = IR$<br>Where,<br>• $V$ is Voltage in volts (V)<br>• $R$ is Resistance in ohm (Ω)<br>• $I$ is Current in Ampere (A) | **6**<br>**(Definition -3 marks + Equation -3 marks)** | **6** | **6** |

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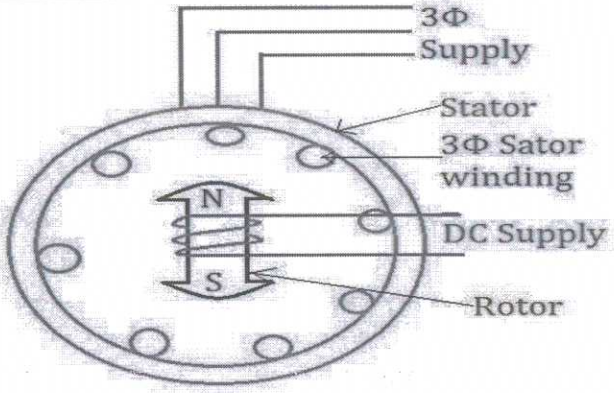
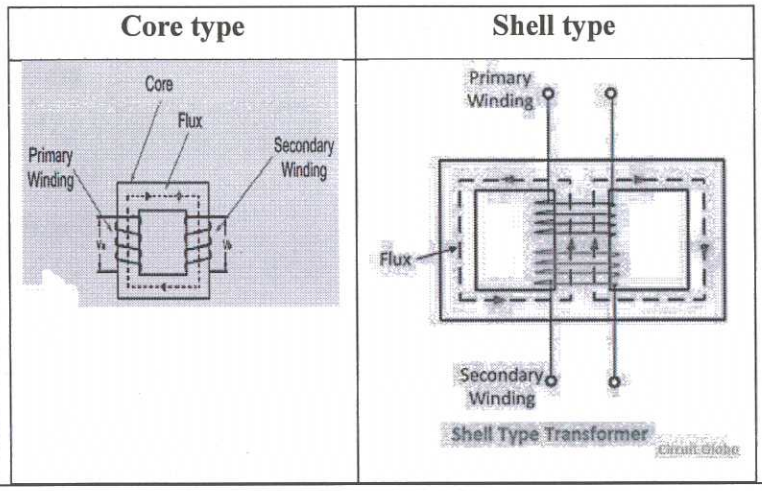
|---|---|---|---|---|
| II(ii) |  <br>Alternator consists of armature winding rotates on stator and field winding on rotor. The rotor winding is energized from the DC supply and alternate N and S poles are developed on the rotor.<br>When the rotor is rotated with the help of prime-mover, the stator conductors are cut by the magnetic flux. Hence an emf will be induced in the stator conductors according to faradays law of electromagnetic induction.<br>The induced e.m.f is alternating since N and S poles of rotor alternately cuts the stator conductors. The direction of induced e.m.f. can be found by **Fleming right-hand rule** and frequency is given by;<br>$f = PN / 120$<br>where N = speed of the rotor in r.p.m.<br>P = number of rotor poles | **6**<br>**(fig-3 marks + Explain-3 marks)** | **6** | **6** |
| II(iii) |  | **6**<br>**(Any 4 points)** | **6** | **6** |

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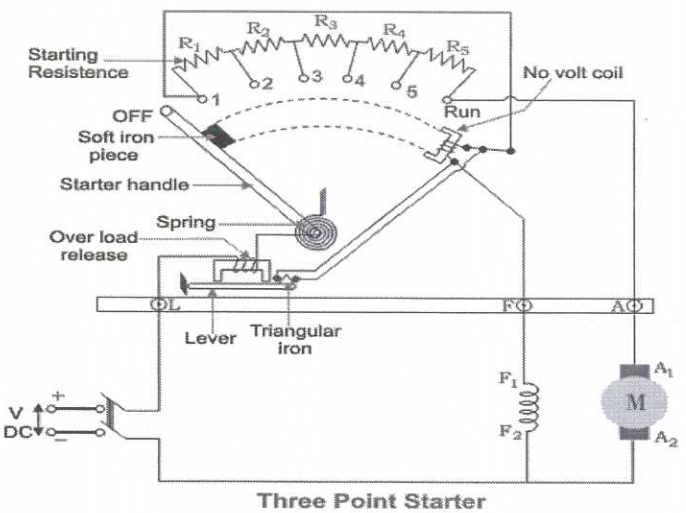
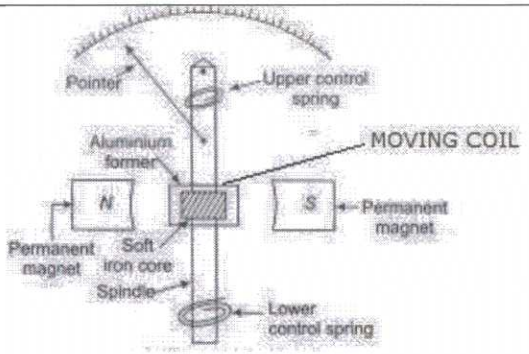
|---|---|---|---|---|---|---|
| | Winding surrounds the core | Core surrounds the winding | | | | |
| | It's core have 2 limbs only | It's c ore have 3 limbs | | | | |
| | Windings are placed on two opposite limbs | Windings are present in the central limb only | | | | |
| | Construction is difficult | Construction is simple | | | | |
| | Cross sectional area of each limb is same | Cross sectional area of central limb is larger than limbs on opposite side | | | | |
| | Rate of heat dissipation is low | Rate of heat dissipation is high | | | | |
| | Rarely used | Widely used | | | | |
| | Overall cost is high | Overall cost is low | | | | |
| | Overall transformer losses are more | Losses are less compared to shell type transformer | | | | |
| II(iv) |  <br>Three Point Starter | | 6<br>(fig-4 marks + | 6 | 6 |

| | | | | |
|---|---|---|---|---|
| | | **marking-2 marks)** | | |
| II(v) |  <br>PMMC instrument consist of following major components<br>1. Moving coil<br>• It is made up of copper. It has many numbers of turns and it is wound around rectangular shaped aluminium former. this moving coil and former is placed in the magnetic field produced by the permanent magnet.<br>2. Magnet system<br>• Magnet used in this instrument is permanent magnet. U shaped permanent magnet made of ALNICO is used commonly.<br>3. Control torque system<br>• Control torque is provided in this instrument using spring.<br>4. Pointer<br>• Pointer used is light in weight. It is connected to the spindle to which the pointer is attached. Pointer moves on the scale to show the value of measured quantity. The end of the pointer has an arrow shape.<br>5. Scale<br>• Scale used in this instrument is uniform type. Scale normally printed with black marking on white background<br>6. Bearing<br>• Jewel bearing is used in this instrument<br>7. Dust proof case<br>• The whole of the instrument is placed in this dust proof case. | **6**<br>**(Fig-3 marks + Explain-3 marks (Any three parts)** | **6** | **6** |
| II(vi) | 1. Diode<br>2. SCR | **6** | **6** | **6** |

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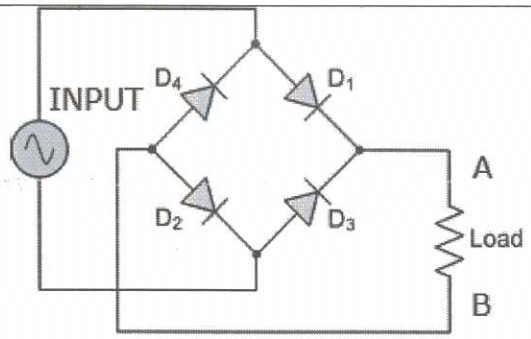
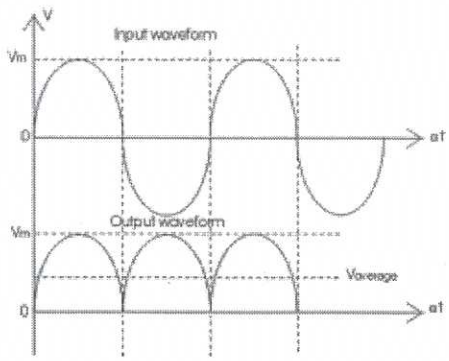
|---|---|---|---|---|
| | 3. Transistor<br>4. IC<br>5. MOSFET<br>6. MESFET<br>7. FET<br>8. TRIAC | **(Any 6 numbers)** | | |
| II(vii) |  <br>• During positive half cycle of input supply, both diode D1 and D2 are forward biased and D3 and D4 are reverse biased. So current flows in the path of D1-A-B-D2.<br>• During negative half cycle of input supply, both diode D3 and D4 are forward biased and D1 and D2 are reverse biased. So current flows in the path of D3-A-B-D4<br>• <u>Waveform</u><br>  | **6 (Circuit diagram-2 marks+ Explanation -2 marks+ Waveform-2 marks)** | **6** | **6** |

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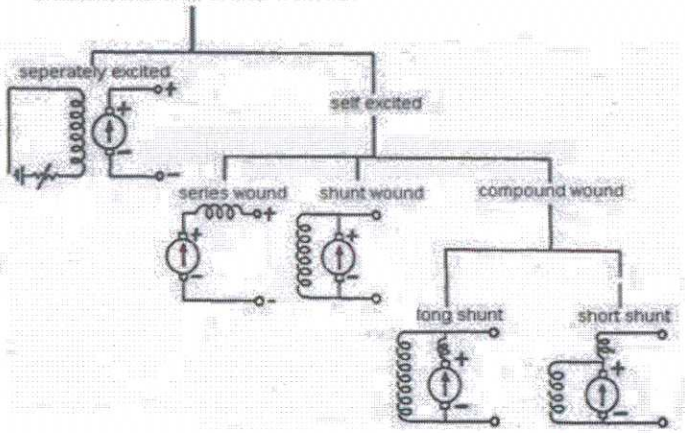
|---|---|---|---|---|
| III(a) | I. ***Frequency***: - the number of cycles in one second is called frequency. Its unit is hertz.<br>II. ***Maximum value***:- the maximum value attained by an alternating quantity is called maximum value.<br>III. ***Average value***:- it is the average of all instantaneous values over a period of time.<br>IV. **R.M.S value** :- the R.M.S value of an alternating quantity is that steady current (d.c) which when flowing through a given resistance for a given time produces the same amount of heat as produced by the alternating current when flowing through the same resistance for the same time. | 7<br>(1+2+2+2<br>) | 7 | 7 |
| III(b) | Classification of DC machines<br>  <br><br>▪ **Separately excited DC generator:** In separately excited DC generator, the field winding is supplied from a separate power source.<br>▪ **Self-excited DC generator:** In a **self-excited type of DC generator**, the field winding is energized by the current produced by itself.<br><br>**Self-excited machines** can be further classified as –<br>▪ **Series wound DC generator** – In this type, field winding is connected in series with the armature winding. Therefore, the field winding carries whole of the load current (armature current).<br><br>▪ **Shunt wound DC generator** – Here, field winding is connected in parallel with the armature winding. Hence, the full voltage is applied across the field winding. | 8 | 8 | 8 |

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<ul>
<li>Compound wound DC generator – In this type, there are two sets of field winding. One is connected in series and the other is connected in parallel with the armature winding. Compound wound machines are further divided as –
<ul>
<li>Short shunt – field winding is connected in parallel with only the armature winding</li>
<li>Long shunt – field winding is connected in parallel with the combination of series field winding and armature winding</li>
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<td>IV(a)</td>
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<table>
<tr><th>Single phase system</th><th>Three phase system</th></tr>
<tr><td>• Use two wires</td><td>• Use three wires</td></tr>
<tr><td>• It has only one phase</td><td>• It has three phases</td></tr>
<tr><td>• Can take only single Phase supply</td><td>• Can take both single and three phase supply</td></tr>
<tr><td>• High Cost to install and maintain</td><td>• Low Cost to install and maintain</td></tr>
<tr><td>• Carry less power</td><td>• can carry More power</td></tr>
<tr><td>• Domestic consumers Are mainly used</td><td>• Industrial consumers Are mainly used</td></tr>
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<td>8 (Any 4 comparisons)</td>
<td>8</td>
<td>8</td>
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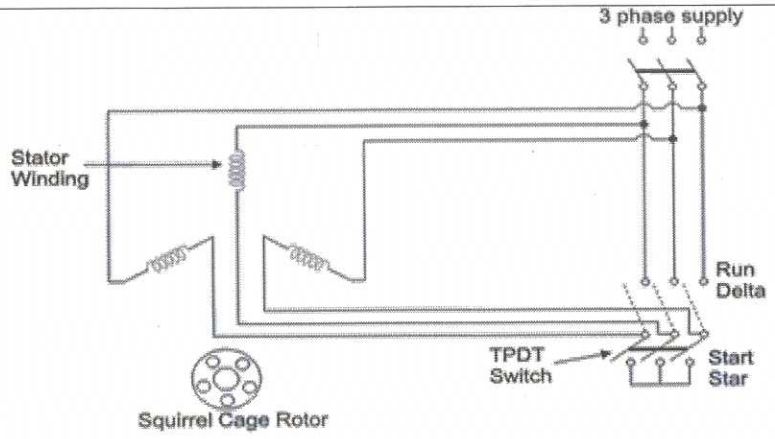
|---|---|---|---|---|
| IV(b) | ***Maintenance of lead acid cell***<br>• Check the batteries on a regular basis to be sure they are getting charged.<br>• Use a hydrometer to check the specific gravity of lead acid batteries.<br>• Check the electrolyte level in batteries at least four times a year and top up each cell with distilled water.<br>• Do not add water to discharged batteries.<br>• Keep the tops of the batteries clean and check that cables are tight.<br>• Do not tighten or remove cables while charging or discharging.<br>• Any spark around batteries can cause a hydrogen explosion inside. | 7<br>(Any 5 numbers) | 7 | 7 |
| V(a) | **Application of DC motor**<br>1. **DC shunt motor**: Used in Lathes, centrifugal pump, reciprocating pump, blowers<br>2. **DC series motor**: Used for traction purpose, used in cranes, rapid transit system, conveyors<br>3. **DC compound motor**: Used in elevators, conveyors, rolling mills, punches | 8<br>(Any 8 application) | 8 | 8 |
| V(b) |  | 7<br>Figure-4 marks+ Explanation-3 marks) | 7 | 7 |

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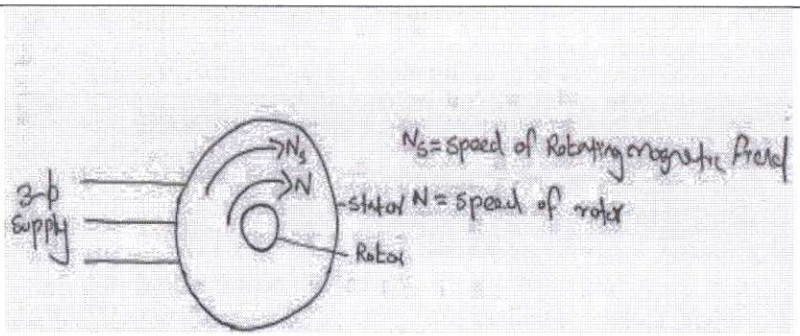
|---|---|---|---|---|
| | • It is the one of the most common starter to reduce the starting current in three phase induction motors.For starting, star delta starter TPDT switch is placed in the star side. Now the windings will become in star connected. When motor is started starting current will reduced to 1/3 times. After motor attaines sufficient speed, the TPDT switch will be changed to delta side. Now the winding become delta connected.<br>• That is n 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.<br>• Total starting current is reduced to 1/3 times | | | |
| VI(a) |  | **Figure-3 marks+ Explanation-5 marks)** | **8** | **8** |

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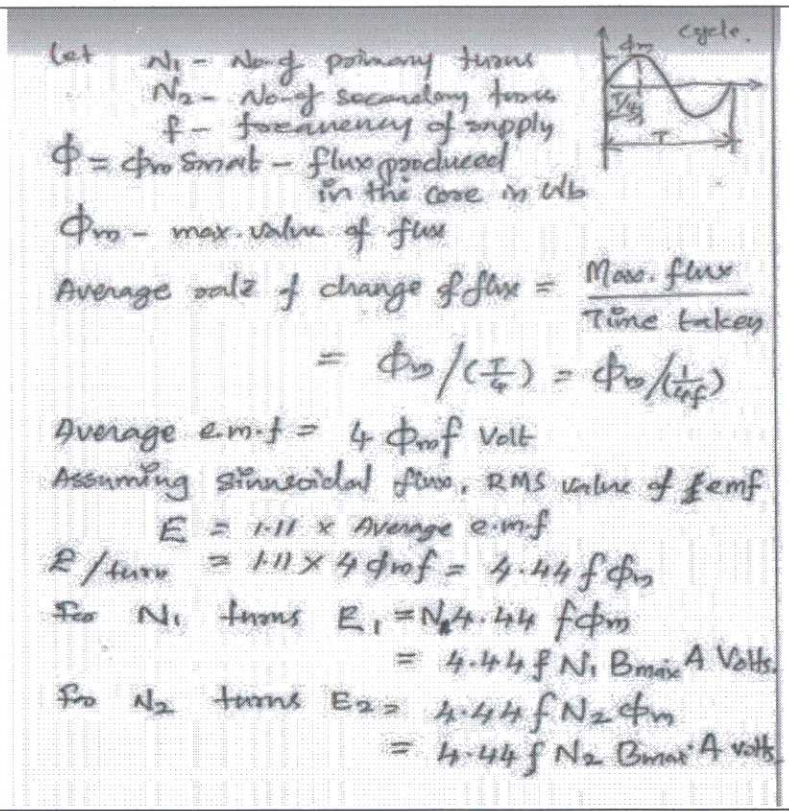
|---|---|---|---|---|
| | 1. When a three-phase supply is given to three phase winding on the stator, a rotating magnetic field having constant magnitude and speed equal to synchronous speed is developed<br><br>2. This rotating magnetic field cuts the stationery rotor conductors. So an emf is induced in the rotor conductors according to faradays law of electromagnetic induction.<br><br>3. Since rotor circuit is closed, a rotor current will flow through rotor conductors due to the induced emf<br><br>**4.** Here the cause for producing rotor current was relative speed between rotating magnetic field and rotor. So according to Lenz's law to oppose the cause of production of rotor current, the rotor starts to rotate in the same direction of rotating magnetic field | | | |
| VI(b) |  | 3+4 | 7 | 7 |

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<td>VII(a)</td>
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<tr><th>Basis of comparison</th><th>Moving Iron Instrument</th><th>Moving Coil Instrument</th></tr>
<tr><td>Moving part</td><td>In moving iron instrument the soft iron is used for moving mechanism.</td><td>In moving coil instrument the moving coil is used for moving mechanism.</td></tr>
<tr><td>Uses</td><td>Both for AC and DC measurement</td><td>DC Measurement</td></tr>
<tr><td>Accuracy</td><td>Less</td><td>More</td></tr>
<tr><td>Scale</td><td>Non-uniform</td><td>Uniform</td></tr>
<tr><td>Damping</td><td>Air Friction Damping</td><td>Eddy Current Damping</td></tr>
<tr><td>Power Consumption</td><td>High</td><td>Low</td></tr>
<tr><td>Controlling Torque</td><td>Gravity or spring</td><td>Spring</td></tr>
<tr><td>Deflection</td><td>Proportional to Current</td><td>Square of current</td></tr>
<tr><td>Hysteresis Loss</td><td>Not occurs</td><td>Occurs</td></tr>
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<td>8<br>(Any four points)</td>
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<td>VII(b)</td>
<td>1. Melting applications of metals and alloys<br>2. Soldering applications<br>3. Welding of metals<br>4. Brazing of metals<br>5. Sterilisation of surgical instruments<br>6. Annealing of brass and bronze<br>7. Surface hardening of metals<br>8. Drying points of metal<br>9. Bonding clutch facing</td>
<td>7<br>(Any seven)</td>
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<tr>
<td>VIII(a)</td>
<td>Working principle</td>
<td>8</td>
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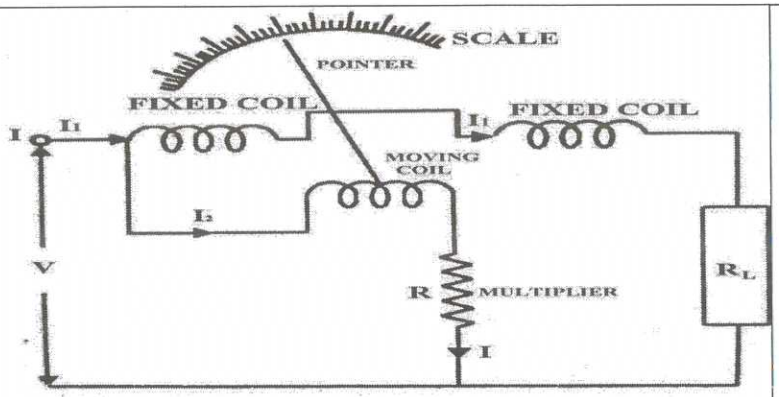
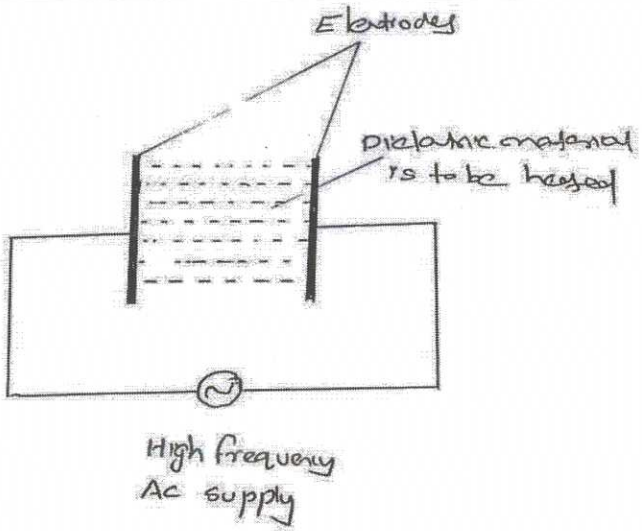
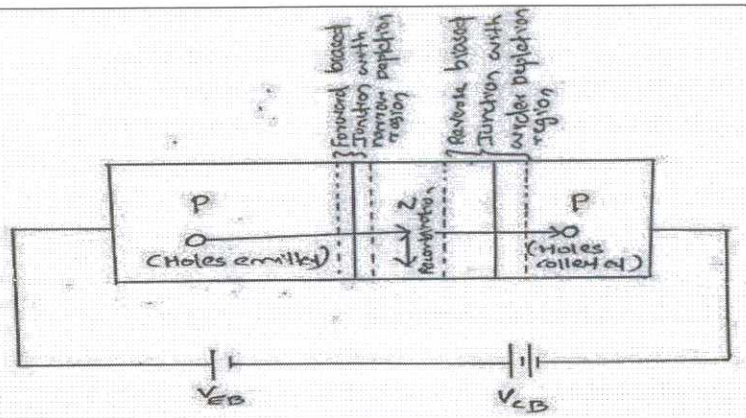
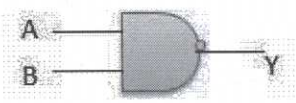
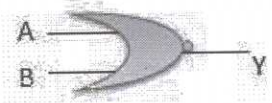
|---|---|---|---|---|
| |  <br>Dynamometer type wattmeter consists of fixed coil (also called current coil) and moving coil (also called pressure coil). The current coil is connected in series with load whose power is to be measured and pressure coil is connected across input suppl<br>• When this wattmeter is connected to measure the power, there will be 2 currents in the wattmeter. One will be through current coil which is connected in series with load and other through pressure coil. These two currents produce a magnetic field and they will interact with each other. It produces a torque in the pressure coil (i.e., moving coil).<br>• Here the torque produced in this wattmeter is directly proportional to power consumed by the load. Hence the reading shown by the pointer of the wattmeter shows the power consumed by the load. | | | |
| VIII(b) |  <br>• This heating is used for heating of insulating materials only | 7<br>**(Figure - 4 marks + Explanation-4 marks)** | 7 | 7 |

| | | | | |
|---|---|---|---|---|
| | • In this method of heating, material to be heated (it must be insulating material) is placed in between two metal electrodes as shown in the figure above. Then a high voltage, high frequency input supply is applied across the metal electrodes. Due to the high frequency high voltage input supply, a dielectric loss will be present in the heating material. This dielectric loss appears as heat. Thus, electrical energy is converted to heat energy.<br>• Dielectric heating, heating effect can be varied by varying supply frequency and supply voltage. | | | |
| IX(a) | 1. For controlled AC to DC conversion<br>2. In HVDC system<br>3. In DC circuit breaker<br>4. In battery charging circuit<br>5. In automobiles<br>6. in overvoltage protection circuits<br>7. power flow control<br>8. zero voltage switching<br>9. In FACT devices | **7 (Any Seven)** | 7 | 7 |
| IX(b) | Automation is a technology by which a work or a process is completed with minimal human assistance<br>**<u>Need for automation</u>**<br>1. To reduces the number of labors needed for a work<br>2. To increases the speed of a process<br>3. To increase the efficiency of a work<br>4. To reduce overall running cost for a process<br>5. To replace humans from work done from dangerous environment such as fire chance area, electric shock area etc.<br>6. To perform a task which are beyond the human capability in term of weight, speed etc<br>7. To enhance the technological development in associated with automation<br>8. To reduce the overall time needed to complete a work<br>9. To increase the accuracy, precision and quality of a work | **2+6**<br>**Definitio n-2 marks**<br>**Need of automati on- 6 marks( Any 6 points)** | 8 | 8 |

| | | | | |
|---|---|---|---|---|
| X(a) |  <br>• Figure shows the PNP transistor connection diagram. Here emitter base junction is forward biased and collector base junction is reverse biased. So, width of depletion region in emitter base region will be small and collector base region will be large.<br>• Since emitter base junction is forward biased, holes in P type emitter region (majority charge carrier) flows towards N type base region through emitter base junction. So, emitter current is produced<br>• A small number of this holes reached at base region combine with free electrons in lightly doped N-type base region. So base current is produced.<br>• Remaining holes came from emitter to base region reaches collector through collector base junction. So, collector current is produced.<br><br>In a PNP transistor we can say that, emitter current= base current + collector current | 4+4 | 8 | 8 |
| X(b) | NAND GATE<br>  <br>$Y = \overline{A.B}$<br>TRUTH TABLE | **Simbol-3 marks + Truth table-4 marks** | 7 | 7 |

| Inputs | | Output |
|---|---|---|
| A | B | $\overline{AB}$ |
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

NOR GATE

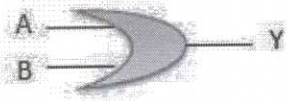



Y= $\overline{A+B}$

TRUTH TABLE

| Inputs | | Output |
|---|---|---|
| A | B | $\overline{A+B}$ |
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

OR GATE




Y=A+B

TRUTH TABLE

| Inputs | | Output |
|---|---|---|
| A | B | A + B |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |