



WINTER– 2016 Examinations

Subject Code: 17424

Model Answer

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Important suggestions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and communication skills)
- 4) While assessing figures, examiner may give credit for principle components indicated in a figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case some questions credit may be given by judgment on part of examiner of relevant answer based on candidate understands.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

SECTION — I

Q.1	Attempt any NINE of the following: 18 Marks
a)	State Ohm's law.
Ans	<p>D) Ohms Law:- (State-1 Mark & Equation-1 Mark)</p> <p style="text-align: center;">The current flowing through a solid conductor is directly proportional to the difference of potential across the conductor. & inversely proportional to its resistance provided the temperature remains constant.</p> <p>Equation:- i.e $I \propto V \quad \therefore \frac{V}{I} \text{ constant} \therefore I = \frac{V}{R}$</p> <p style="text-align: center;">$or \therefore V = I.R. \quad or \quad R = \frac{V}{I}$</p> <p style="text-align: center;">Where R is constant called as resistance, V=voltage and I = Current</p>
b)	The resistance of 4 Ohm and 2Ohm are connected in series 60V DC supply. Find current and power supplied to this circuit.
Ans	<p>Given Data: $R_1 = 4 \text{ ohm}$ $R_2 = 2 \text{ ohm}$ in series $V = 60V$</p> <p style="text-align: center;">$R_T = R_1 + R_2 = 4+2= 6 \text{ ohm}$</p> <p style="text-align: center;"><i>Current</i> $I = \frac{V}{R_T} = \frac{60}{6}$</p> <p style="text-align: center;"><i>Current</i> $I = 10.00 \text{ Amp}$</p> <p style="text-align: right;">----- (1 Mark)</p> <p style="text-align: center;"><i>Power Supplied</i> $P = V I = 60 \times 10$</p> <p style="text-align: center;"><i>Power Supplied</i> $P = 600 \text{ Watt} = 0.6 \text{ kW}$</p> <p style="text-align: right;">----- (1 Mark)</p>



c)	Different between core type and shell type transformer (any two points).		
Ans	(Any Two points expected each:1 Marks)		
	S.No	Core Type Transformer	Shell Type Transformer
	1.		
	2.	The Winding surround the core	The core surround the windings
	3.	Average length of the core is more	Average length of the core is less
	4.	Magnetic Flux has only one continuous path	Magnetic Flux is distributed into 2 paths
	5.	Suitable for high voltage & less output	Suitable for less voltage & high output
	6.	Easy for repairs	Difficult for repairs
	7.	Less in Weight	More in Weight
	8.	Leakage flux are more	Leakage flux are less
d)	State the necessity of Starter		
Ans	Necessity of the starter:----- (2 Mark)		
	<p>The current drawn by motor $I_a = \frac{V - E_b}{R_a}$, at start speed $N = 0$, $\therefore E_b = 0$ and</p> <p>$I_a = \frac{V}{R_a}$. As R_a is very small I_a will be dangerously high at the time of starting. This high starting current may damage the motor armature (& series field winding in the case of dc series motors). Hence to limit the starting current suitable resistance is inserted in series with armature which is called as starter. This starting resistance is cut-off insteps with increase in speed.</p>		
e)	State the type of transformer on the basis of voltage.		
Ans	The types of transformer on basis of voltage: (Any Two expected: 1 Mark each)		
	<ul style="list-style-type: none"> i) Step-up transformer ii) Step down transformer iii) 1-ph transformer iv) 3-ph transformer 		



f)	State the function of fuse. Name the material used for fuse wire.																					
Ans	<p style="text-align: right;">(Function of fuse-1 Mark & Name of material used-1 Mark)</p> <p>Function of Fuse:</p> <ul style="list-style-type: none">➤ Fuse is a wire of short length or thin strip of material having low melting point➤ It is protective device against over current, occurs due over load or short circuit.➤ When some faults, such as short circuit occurs or when loads more than circuit capacity is connected in it, the current exceeds the limiting value, the fuse wire gets heated, melts and breaks the circuit. <p>Name the material used for fuse wire:</p> <table border="1" data-bbox="475 869 1358 1178"><thead><tr><th>S.No</th><th>Material used for fuse wire</th><th>Melting point in °C</th></tr></thead><tbody><tr><td>1</td><td>Tin</td><td>230</td></tr><tr><td>2</td><td>Lead</td><td>328</td></tr><tr><td>3</td><td>Zinc</td><td>419</td></tr><tr><td>4</td><td>Silver</td><td>960</td></tr><tr><td>5</td><td>Copper</td><td>1090</td></tr><tr><td>6</td><td>Aluminum</td><td>-</td></tr></tbody></table>	S.No	Material used for fuse wire	Melting point in °C	1	Tin	230	2	Lead	328	3	Zinc	419	4	Silver	960	5	Copper	1090	6	Aluminum	-
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g)	Write two application of three phase Induction motor.																					
Ans:	<p>Applications of 3-Ph induction Motor: (Any Two Expected: 1 Mark each)</p> <table border="0" data-bbox="347 1290 1453 1451"><tr><td>i) Water Pumps</td><td>ii) Tube wells</td><td>iii) Lathes Machine</td></tr><tr><td>iv) Line shaft</td><td>v) Circular-saws</td><td>vi) Grinders</td></tr><tr><td>vii) Polishers</td><td>viii) Wood Planners</td><td>ix) Compressors</td></tr><tr><td>x) Laundry washing machines</td><td>xi) fans</td><td>xii) Blowers</td></tr></table>	i) Water Pumps	ii) Tube wells	iii) Lathes Machine	iv) Line shaft	v) Circular-saws	vi) Grinders	vii) Polishers	viii) Wood Planners	ix) Compressors	x) Laundry washing machines	xi) fans	xii) Blowers									
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h)	Write two safety precaution to be taken while handling an electrical equipment.																					
Ans:	<p style="text-align: right;">(Any Two Precautions expected -1 Mark each)</p> <p>The Following are the precautions should be taken while working electricity:- (Any Two point expected)</p> <ol style="list-style-type: none">1. Avoid working on live parts.2. Switch off the supply before starting the work.3. Never touch a wire till you are sure that no currents are flowing.4. Do not guess, whether electric current is flowing through a circuit by touching.5. Insulate yourself on the insulating material like wood, plastic etc. before starting the work on live main.6. Your hand & feet must be dry (not wet) while working on live main.7. Rubber mats must be placed in front of electrical switch board/ panel.8. Use hand gloves, Safety devices & proper insulated tools.																					



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	<ol style="list-style-type: none">9. Ground all machine tools, body, and structure of equipments.10. Earthing should be checked frequently.11. Do not use aluminum ladders but use wooden ladders.12. Do not operate the switches without knowledge.13. Use proper insulated tools & safety devices.14. When working on live equipment obey proper instruction.15. Do not work on defective equipment.16. Use safe clothing.17. Use shoes with rubber soles to avoid shock.18. Do not wear suspected Necklace, arm bands, finger ring, key chain, and watch with metal parts while working.19. Do not use defective material. Do not work if there is improper illumination such as in sufficient light or unsuitable location producing glare or shadows.20. Do not work if there is an unfavorable condition such as rain fall, fog or high wind.21. Do not sacrifice safety rules for speed.22. Do not allotted work to untrained person (worker) to handle electrical equipment.23. Make habit to look out for danger notice, caution board, flags, and tags.24. Warn others when they seen to be in danger near live conductors or apparatus.25. Inspect all electrical equipment & devices to ensure there is no damage or exposed wires that may causes a fire or shock.26. Avoid using electrical equipment near wet, damp areas.27. Use approved discharge earth rod for before working.28. Never speak to any person working upon live mains.29. Do not Do the work if you are not sure or knowledge of the condition of equipment/ machine.30. Safety book/ Training should be given to all persons working in plants.
i)	A 6 pole 3-phase Induction motor operates from a supply whose frequency is 50Hz. Calculate synchronous speed of the motor.
Ans:	Given Data: P=6, F=50Hz Find N_s $N_s = \frac{120 \times f}{P}$ ----- (1 Mark) $N_s = \frac{120 \times 50}{6}$ $N_s = 1000 \text{ rpm}$ ----- (1 Mark)



j)	List various parts of DC machine.
Ans:	Parts of DC Machine:----- (Any four parts expected: 1/2 Marks each) 1) Yoke: 2) Pole Cores & Pole shoe: 3) Armature core: 4) Armature winding: 5) Commutator: 6) Brush: 7) Cooling Fan: 8) End covers 9) Field winding
k)	"An induction motor cannot run at synchronous speed". Give reason.
Ans:	Justification.: (Marks -2) When the induction motor is supplied by 3-phase supply, the rotating magnetic field is developed. So there is a relative speed between field and rotor. It gives rise to change in flux and hence emf is induced in rotor. The small relative speed produces small induced emf. If an induction motor runs at synchronous speed, the relative speed is zero and no emf is induced. Therefore the motor will not run.
l)	State the necessity of earthing.
Ans:	Necessity Earthing: (2 Mark) ➤ Earthing provides protection to the electrical machinery due to leakage current. ➤ Earthing provides protection to Tall Building & structure against lightning stroke ➤ Earthing is protects human from shocks.
Q.2	Attempt any FOUR of the following: 16 Marks
a)	Write four point of comparison between single phase supply system and three phase supply system.
Ans:	Advantages of 3-phase system over 1-phase system: - (Any Four points expected: Each point 1 Mark) 1. More output: - for the same size output of poly-phase machines is always higher than single phase machines. 2. Smaller size: -for producing same output the size of three phase machines is always smaller than that of single phase machines. 3. More power is transmitted- it is possible to transmit more power using a three phase system than single system. 4. Smaller cross-sectional area of conductors- if the same amount of power is transmitted then the cross-sectional area of the conductors used for three phase

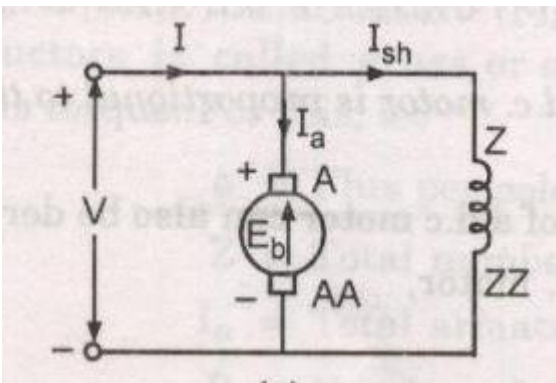
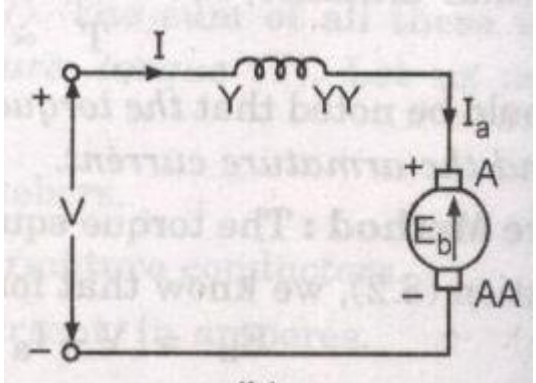


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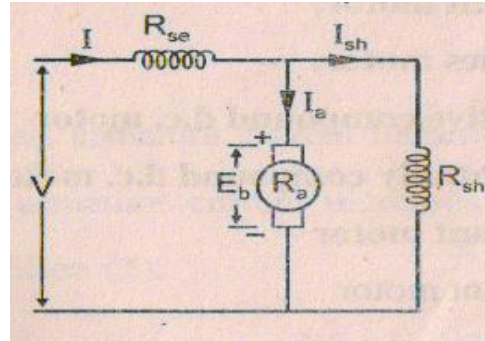
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	<p>system is small as compared to that of single phase system.</p> <p>5. Better power factor-power factor of three phase machines is better than that of single phase machines.</p> <p>6. Three phase motors are self starting-three phase ac supply is capable of producing a rotating magnetic field when applied to stationary windings, the three phase ac motors are self starting. While single phase induction motor needs to use additional starter windings</p> <p>7. Horse power rating of three phase motors is greater than that of single phase motor.</p> <p>8. Power delivered by a single phase system fluctuates whereas for three phase system power delivered to the load is the same at any instant.</p>
b)	<p>A single phase transformer of 50Hz has max. flux in the core as 0.021 Wb., the no. of turns in primary being 460 and that on secondary is 52. Calculate emf induced in primary and secondary winding of a transformer.</p>
Ans:	<p>Emf induced in primary winding of a transformer:</p> <p style="text-align: center;">$E_1 = 4.44 \phi_m f N_1$ ----- (1 Mark)</p> <p style="text-align: center;">$E_1 = 4.44 \times 0.021 \times 50 \times 460$</p> <p style="text-align: center;">$E_1 = 2144.52$ volts ----- (1 Mark)</p> <p>Emf induced in Secondary winding of a transformer:</p> <p style="text-align: center;">$E_2 = 4.44 \phi_m f N_2$ ----- (1 Mark)</p> <p style="text-align: center;">$E_1 = 4.44 \times 0.021 \times 50 \times 52$</p> <p style="text-align: center;">$E_1 = 242.424$ volts ----- (1 Mark)</p>
c)	<p>Draw different types of DC motors with circuit diagram and give an industrial application of the each type.</p>
Ans:	<p style="display: flex; justify-content: space-between;">i) D.C. Shunt Motor ii) D.C. Series Motor (Each Diagram: 1 Mark)</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div>



iii) D.C Compound Motor:



Industrial application Types of DC motor:

(1 Mark)

- a) DC Shunt Motor: - Pumps, Fans, Drill machine, grinding machine, wood cutting machine etc
- b) DC Series Motor: - Lift, hoist, Train, cranes
- c) DC Compound Motor: Paper Mill, Rolling Mill, Steel rolling mills, elevators, punchers.

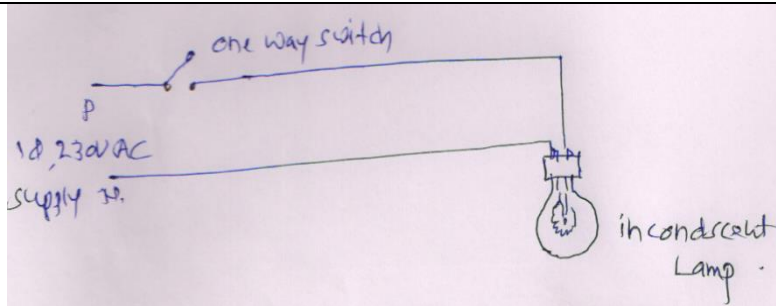
d) Differentiate between AC and DC supply (any four point)

Ans: **Differentiate AC supply with DC supply: (Any Four Point Expected : 1 each)**

S.No.	Points	AC Supply	DC Supply
1	Amount of energy that can be carried	Safe to transfer over longer city distances and can provide more power	Voltage of DC cannot travel very far until it begins to lose energy
2	Cause of the direction of flow of electrons	Rotating magnet along the wire	Steady magnetism along the wire
3	Frequency	The frequency of alternating current is 50Hz or 60Hz depending upon the country.	The frequency of direct current is zero.
4	Direction	It reverses its direction while flowing in a circuit.	It flows in one direction in the circuit.
5	Current	It is the current of magnitude varying with time	It is the current of constant magnitude.
6	Flow of Electrons	Electrons keep switching directions - forward and backward.	Electrons move steadily in one direction or 'forward'.
7	Obtained from	A.C Generator and mains.	Cell or Battery.
8	Passive Parameters	Impedance.	Resistance only



e)	Describe with the circuit diagram the operation of resistors split single phase induction motor.
Ans:	<p style="text-align: right; color: red;">(Diagram: 2 Mark & Operation: 2 Mark)</p> <p>Circuit diagram of resistors split single phase induction motor:</p> <div style="text-align: center;"> </div> <p style="text-align: right;">or equivalent figure</p> <p>Operation of resistors split single phase induction motor:</p> <ul style="list-style-type: none"> ➤ In resistors split phase I.M shown in above figure 'a', the main winding has low resistance but high reactance whereas the starting winding has a high resistance, but low reactance. ➤ The resistance of the starting winding may be increased either by connecting a high resistance 'R' in series with it or by choosing a high-resistance fine copper wire for winding purpose. ➤ A centrifugal switch S is connected in series with the starting winding and is located inside the motor. ➤ Its function is to automatically disconnect the starting winding from the supply when the motor has reached 70 to 80 per cent of its full load speed. ➤
f)	Describe the operation of Incandescent lamp with neat connection diagram.
Ans:	<p style="text-align: right; color: red;">(Neat diagram: 2 Mark & Operation: 2 Mark)</p> <p>Construction Figure of incandescent lamp</p> <div style="text-align: center;"> </div> <p style="text-align: right;">Or</p> <p style="text-align: center;">OR</p>



or equivalent figure

Operation of incandescent lamp

When the current is passed through the tungsten filament, it is heated to incandescence (while hot conditions) which then starts emitting energy in the form of light

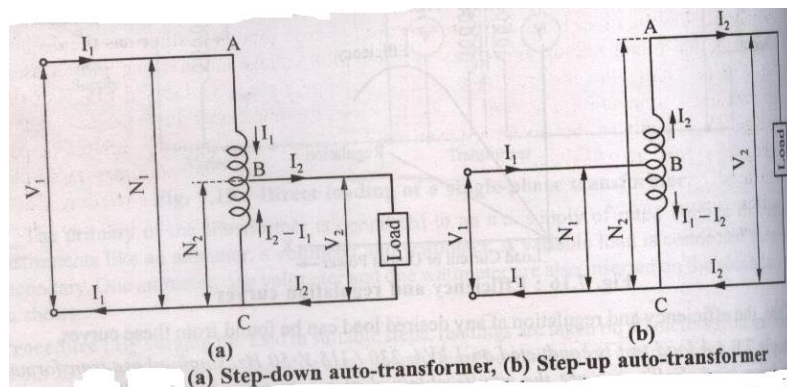
Q.3 Attempt any FOUR of the following: 16 Marks

a) Describe working principle of auto transformer.

Ans:

Diagram:

(Figure: 2 Mark & Working: 2 Mark)



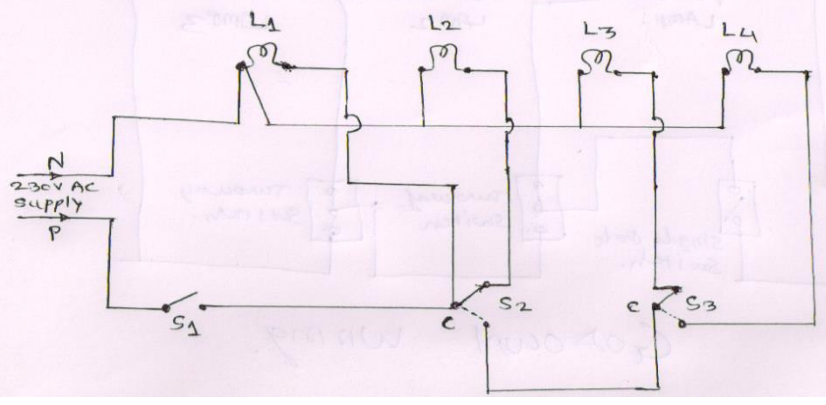
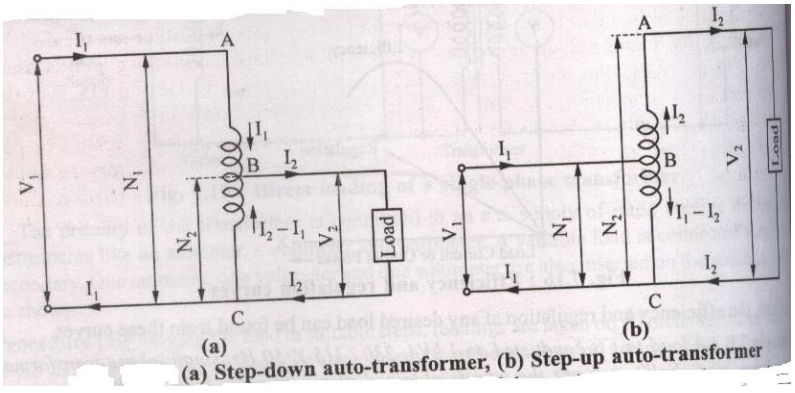
Auto Transformer:-

An Auto Transformer is a transformer having only one winding wound on a laminated magnetic core, the part of this winding being common to both the primary & secondary circuits auto transformer is also called as dimmerstat **OR**

Autotransformer explanation:-

- It is a transformer with one winding only.
- Autotransformer is a special transformer in which a part of winding is common for the primary and secondary windings.
- It consists of only one winding wound on a laminated magnetic core, with a rotary movable contact.
- Autotransformer can operate as a step down or a step up transformer.



<p>b) Draw wiring diagram of godown wiring and describe the working.</p> <p>Ans:</p>	<p style="text-align: right;">(Figure: 2 Mark & Working: 2 Mark)</p>  <p style="text-align: right;">or equivalent figure</p> <p>Working of godown Wiring:</p> <ul style="list-style-type: none">➤ S1: is ON – L1 & L2 : ON➤ S2 : is ON – L1& L3 : ON➤ S3: is ON– L1 & L4 : ON and Remains lamps is OFF
<p>c) Draw neat construction sketch of auto transformer and state its two merits.</p> <p>Ans:</p>	<p>Sketch of auto transformer: (Figure: 2 Mark & Merits: 2 Mark)</p>  <p>Auto Transformer:-</p> <p>An Auto Transformer is a transformer having only one winding wound on a laminated magnetic core, the part of this winding being common to both the primary & secondary circuits auto transformer is also called as dimmerstat OR</p> <p>Merits of Autotransformer explanation:- (Any Two points expected)</p> <ol style="list-style-type: none">1. Copper required is very less.2. High efficient than two winding transformer.3. Small size and low cost.

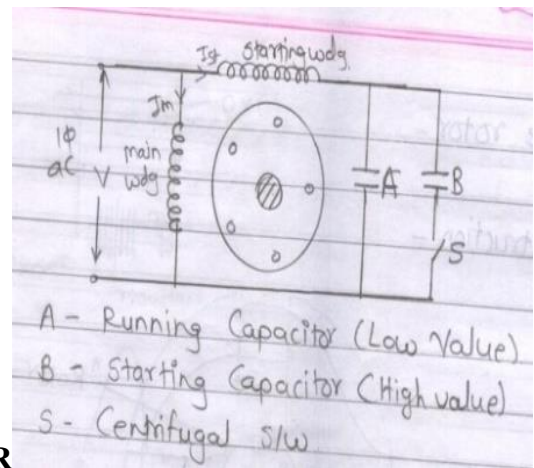
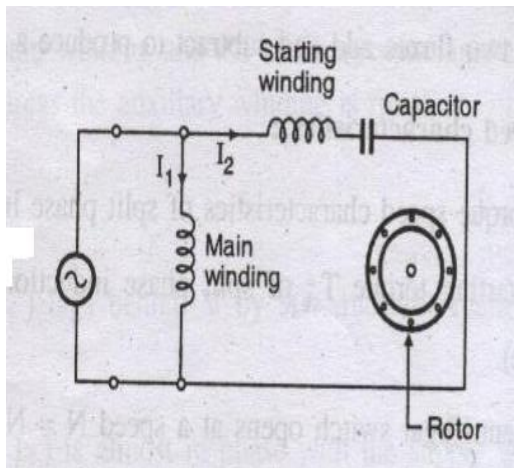


4. Resistance and leakage reactance is less compared to two winding transformer.
5. Copper losses are less.
6. superior voltages regulation than two winding transformer.

d) Describe with a circuit diagram operation of C-split single phase induction motor.

Ans: Capacitor Split Induction Motor:-

(Figure: 2 Mark & Working:2 Mark)



OR

or Equivalent fig

Working Principle:

In these motors one capacitor is connected in series with the auxiliary winding. There is no centrifugal switch. Thus this winding along with the capacitor remains energized for both starting and running conditions. Capacitor used serves the purpose of obtaining necessary phase displacement at the time of starting and also improves the power factor of the motor.

e) Draw and explain different type of wire. (any two)

Ans: Following types of wires:

(Any Four Expected: 1 Mark each)

- i) **VIR: Vulcanized Indian Rubber:** Conductor used for wire is flexible and insulation is used Vulcanized Indian Rubber, Conductor may be copper or aluminum
- ii) **PVC: Polyvinyl Chloride wires:** Conductor used for wire is flexible and insulation is used Polyvinyl Chloride wires, Conductor may be copper or aluminum
- iii) **T.R.S. Wire:** Conductor used for wire is flexible and insulation is used T.R.S. Wire, Conductor may be copper or aluminum



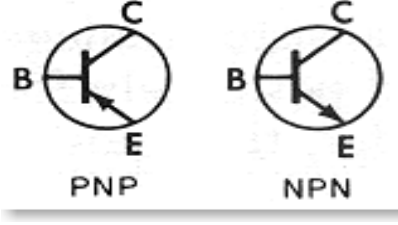
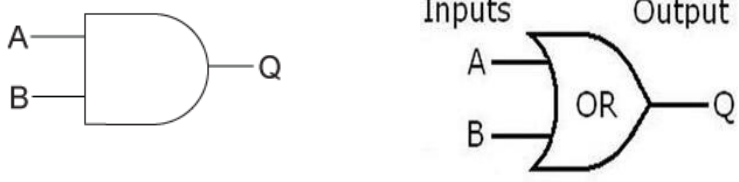
	<p>iv) Flexible wire: Conductor used for wire is stranded and insulation is used P.V.C Wire, Conductor may be copper or aluminum</p> <p>v) Lead sheathed wires: Conductor used for wire is stranded and insulation is used P.V.C Wire, Conductor may be copper or aluminum</p> <p>vi) CTS: Cab Tyre sheathed wires: Conductor used for wire is stranded and insulation is used Cab Tyre sheathed wires, Conductor may be copper or aluminum</p>
f)	State the necessity, of starter for dc motor. Also two application of DC series motor and DC shunt motor.
Ans:	<p>Necessity of the starter: (2 Mark)</p> <p>The current drawn by motor $I_a = \frac{V - E_b}{R_a}$, at start speed $N = 0$, $\therefore E_b = 0$ and $I_a = \frac{V}{R_a}$. As R_a is very small I_a will be dangerously high at the time of starting. This high starting current may damage the motor armature (& series field winding in the case of dc series motors). Hence to limit the starting current suitable resistance is inserted in series with armature which is called as starter. This starting resistance is cut-off in steps with increase in speed.</p> <p>Applications of DC series motor: (Any Two applications expected: 1/2 each)</p> <ol style="list-style-type: none">1. Electrical Railways2. Rolling mills3. Metal-lurgical works4. Mine hoists5. Continuous conveyors6. Cranes and valve operation etc <p>Applications of DC shunt motor: (Any Two applications expected: 1/2 each)</p> <ol style="list-style-type: none">1. Line shafts2. Lathes3. Vacuum cleaners4. Pressure blowers5. Reciprocating pumps6. Wood working machines



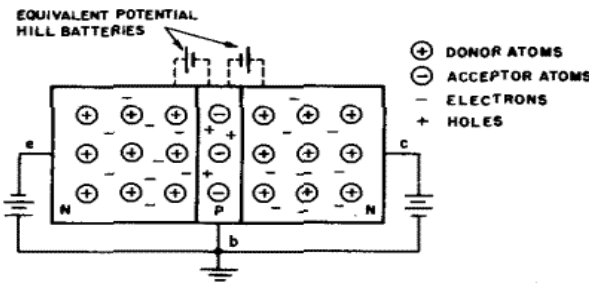
SECTION — II

Q.4	Attempt any NINE of the following:	18 Marks
a)	Define semiconductor. Draw the energy band diagram of it.	
Ans:	Semiconductor :- In Semiconductors the gap between Valence band and Conduction band is very small ie. 1 eV. So the conductivity is between conductors and insulator.	(1 Mark)
	<p>The diagram shows a vertical axis labeled 'Band Energy' with a '0' at the top. Two horizontal bands are shown: a lower 'Valence Band' (yellow) and an upper 'Conduction Band' (hatched). A double-headed arrow between them is labeled 'Small Energy Gap' with E_G next to it.</p>	(1 Mark)
	or equivalent figure	
b)	Define intrinsic semiconductor. List any two doping materials to form N-type semiconductor material.	
Ans:	Intrinsic Semiconductor : Semiconductor in its pure form is called intrinsic semiconductor .	(1 Mark)
	Materials to form N-type semiconductor material:	(1 Mark)
	1. Doping in N type Semiconductor: Phosphorus (P), Arsenic (As), Antimony(Sb). 2. Doping in P type Semiconductor: boron (B), aluminium(Al), gallium(Ga) .	
c)	Draw the symbol of SCR. List any two application of SCR.	
Ans:	Symbol of SCR :	(1 Mark for Symbol & 1 Mark for any 2 applications)
	<p>The symbol shows a triangle pointing right towards a vertical line (Cathode). A horizontal line (Anode) enters from the left. A diagonal line (Gate) enters from the bottom.</p>	
	SCR SYMBOL	
	Applications of SCR :- (Any Two expected) 1.Chopper & Inverters 2. Industrial Drives control, 3. Phase controlled Rectifiers. 4. Timer, lamp dimmer, temperature controller etc.	



d)	Draw the symbol of NPN and PNP transistor.
Ans:	Symbol of NPN and PNP transistor: (1 Mark for each symbol)  <p style="text-align: center;">PNP NPN</p>
e)	Why NAND and NOR gate are called universal gates?
Ans:	Reason for NAND and NOR gate are called universal gates : (Definition : 2 Marks) <p>A universal logic gate is a logic gate that can be used to construct all other logic gates such as AND gate, OR gate, NOT gate etc.</p> <p style="text-align: center;">OR</p> <p>A universal gate is a gate which can implement any Boolean function without need to use any other gate type</p>
f)	Draw the symbol of AND gate and OR gate
Ans:	1. Symbol of AND gate : Symbol of OR gate: (1 Mark for each symbol) 
g)	List any two application of TRIAC.
Ans:	Two applications of TRIAC: (2 Marks for any 2 applications) <ol style="list-style-type: none">1. <u>light dimmers</u>2. speed controls for <u>electric fans</u>3. <u>electric motors</u>4. AC power control.
h)	What is an amplifier? State the types of power amplifiers.
Ans:	(1 Mark for definition and 1 Mark for any 2 types) Amplifier : An amplifier is an electronic device that increases the voltage, current, or power of a signal. Types : 1) Class A amplifier 2) Class B amplifier 3) Class AB amplifier 4) Push pull power amplifier

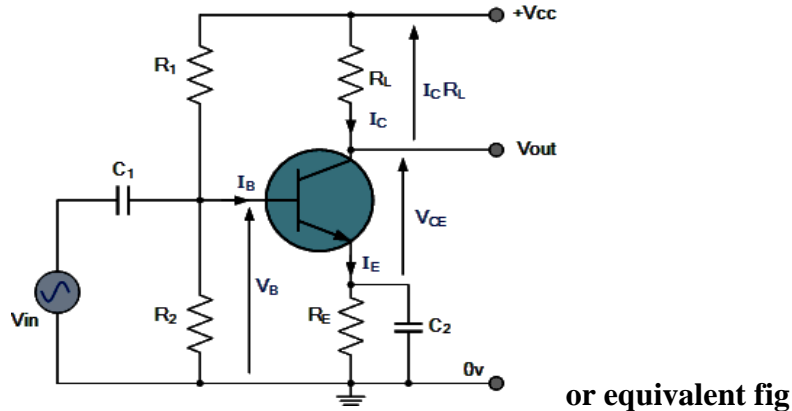


Q.5	Attempt any Four of the following:	16 Marks
a)	Define with example: (i) conductor (ii) semiconductor (iii) Insulator	
Ans:	<p style="text-align: center;">(3 Marks for definition and 1 Mark for Examples)</p> <p>(i) Conductor: In conductors Valence band and Conduction band overlap with each other. So they are good conductor of electricity. Examples : All metals like Iron, Copper, Aluminum etc</p> <p>(ii) Semiconductor : In Semiconductors the gap between Valence band and Conduction band is very small ie. 1 eV. So the conductivity is between conductors and insulator. Examples : Silicon & Germanium</p> <p>(iii) Insulator : In Insulators the gap between Valence band and Conduction band is high. So they are bad conductor of electricity. Examples : Paper, rubber, wood etc.</p>	
b)	Draw and explain working of NPN transistor.	
Ans:	<p>Operation of NPN transistor- (2 Marks for diagram and 2 Marks for Working)</p> <div style="text-align: center;"><p>The diagram shows an NPN transistor with three regions: N (Emitter), P (Base), and N (Collector). Donor atoms (circles with '+') are present in the N regions, and acceptor atoms (circles with '-') are present in the P region. Electrons (circles with '-') are shown moving from the emitter towards the collector, while holes (circles with '+') are shown moving from the collector towards the emitter. The base is connected to ground (terminal 'b'). The emitter is connected to a positive terminal 'e', and the collector is connected to a positive terminal 'c'. Above the transistor, 'EQUIVALENT POTENTIAL HILL BATTERIES' are indicated with arrows pointing to the potential barriers at the emitter-base and base-collector junctions.</p></div> <p style="text-align: right;">or equivalent figure</p> <p>Working:-</p> <p>N-p-n transistor is made by sandwiching thin layer of p-type semiconductor between two layers of n-type semiconductor. It has three terminals - Emitter, Base and collector. The npn transistor has two supplies, one is connected through the emitter base and one through the collector base. The supply is connected such that emitter-base are forward biased and collector base are reverse biased. It means, Base has to be more positive than the emitter and in turn, the collector must be more positive than the base. The current flow in this type of transistor is carried through movement of electrons. Emitter emits electrons which are pulled by the base as it is more positive. This end up in the collector as it is more positive. In this way, current flows in the transistor.</p> <p style="text-align: center;">Transistor can be used as an amplifier, a switch etc.</p>	



c) Draw circuit diagram of single stage CE amplifier and state function of each component.

Ans: **Diagram :** (2 Marks for diagram and 2 Marks for explanation)

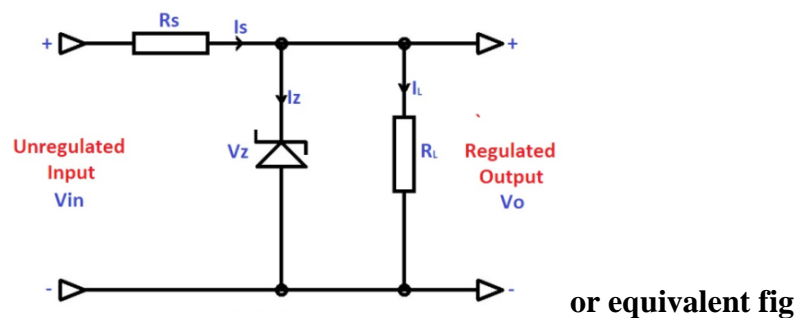


Transistor Q is configured in common emitter mode to design a voltage Amplifier. Small ac input V_{in} which is to be amplified is applied at the base of Q. Emitter is common(ground) and output is obtained at the collector of Q. As the transistor is NPN, $+V_{cc}$ supply is applied as the biasing voltage.

- Resistors R_1 & R_2 form voltage divider biasing .
- R_1 , R_2 & R_E (emitter resistor) are used to bias the transistor in the active region, because for operating the transistor as an amplifier it is necessary to bias it in the active region.
- R_c – collector resistor is used to control the collector current.
- C_1 = Input coupling capacitor
- C_2 =Output coupling capacitor
- CE = Emitter bypass capacitor.

d) Explain with diagram principle of zener shunt regulator.

Ans: **Diagram of zener diode as voltage regulator:** (2 Mark)





Working:

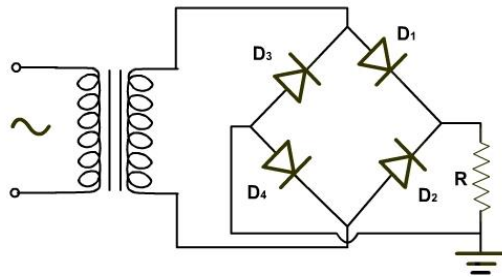
(2 Mark)

Zener Diodes are widely used as Shunt Voltage Regulators to regulate voltage across small loads. Zener Diodes have a sharp reverse breakdown voltage and breakdown voltage will be constant for a wide range of currents. Thus we will connect the zener diode parallel to the load such that the applied voltage will reverse bias it. Thus if the reverse bias voltage across the zener diode exceeds the knee voltage, the voltage across the load will be constant.

e) **Draw the circuit of bridge rectifier with i/p and o/p wave form. Describe its working.**

Ans: **circuit of bridge rectifier:**

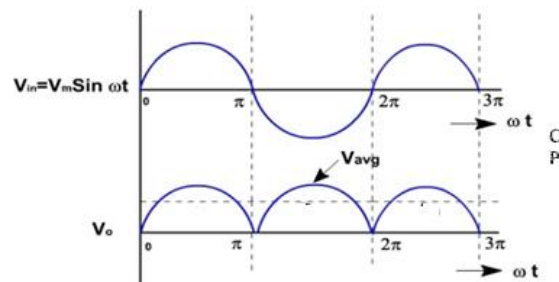
(1 Marks)



or equivalent fig

Bridge rectifier with i/p and o/p wave form:

(1 Marks)



or equivalent fig

Operation of bridge rectifier :

Working:-

During positive half cycle of an AC supply, D1 & D4 will forward biased and current starts flowing through load. The output voltage is equal to +Vs.

During negative half cycle of an AC supply, D2 & D3 will forward biased and current starts flowing through load. The output voltage is equal to +Vs.

In this pulsating DC waveform will be obtained at the load.

(2 Marks)



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f) Write the De Morgan's theorem, prove any one theorem.

Ans: De Morgan's theorem (2 Marks for theorem & 2 Marks for any 1 proof)

DeMorgan's Theorem is a simplification technique that can be used to simplify Boolean expressions.

$$\overline{A + B} = \bar{A} \cdot \bar{B}$$

$$\overline{A \cdot B} = \bar{A} + \bar{B}$$

This can be proved by using truth tables as follows: (Any one expected) (2 Mark)

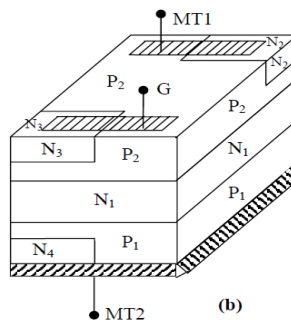
A	B	$\overline{A + B}$	$\bar{A} \cdot \bar{B}$
0	0	1	1
0	1	0	0
1	0	0	0
	1	0	0

A	B	$\overline{A \cdot B}$	$\bar{A} + \bar{B}$
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	0

Q.6 Attempt any Four of the following: 16 Marks

a) Describe the working of TRIAC along with its construction.

Ans: Diagram of TRIAC : (2 Marks for diagram & 2 Marks for working)



or equivalent figure

Working of TRIAC along with its construction

Since a Triac is a bidirectional device and can have its terminals at various combinations of positive and negative voltages, there are four possible electrode potential combinations as given below

1. MT_2 positive with respect to MT_1 , G positive with respect to MT_1
2. MT_2 positive with respect to MT_1 , G negative with respect to MT_1



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- 3. MT_2 negative with respect to MT_1 , G negative with respect to MT_1
- 4. MT_2 negative with respect to MT_1 , G positive with respect to MT_1

The triggering sensitivity is highest with the combinations 1 and 3 and are generally used. However, for bidirectional control and uniform gate trigger mode sometimes trigger modes 2 and 3 are used. Trigger mode 4 is usually avoided.

In trigger mode-1 the gate current flows mainly through the $P_2 N_2$ junction like an ordinary thyristor. When the gate current has injected sufficient charge into P_2 layer the triac starts conducting through the $P_1 N_1 P_2 N_2$ layers like an ordinary thyristor.

In the trigger mode-3 the gate current I_g forward biases the $P_2 P_3$ junction and a large number of electrons are introduced in the P_2 region by N_3 . Finally the structure $P_2 N_1 P_1 N_4$ turns on completely.

b) Describe the working principle of LED along with its construction. List any two application of its.

Ans: Working of LED :-

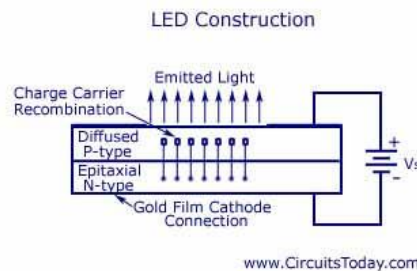
(2 Marks)

LED- Light Emitting Diode

- When it is forward bias, it emits visible light . The electrons are in the higher conduction band on the N-side , where are holes are in the lower valence band on p-side.
- When forward biased electrons recombine with the holes. During recombination energy is emitted in form of light.
- GaAs , GaP, GaAsP are used to get visible light.
- Colors of the emitted light depends on the type of material used
GaAs- Infrared radiation, GaP- Red or green
GaAsP- Red or yellow

Diagram of LED :-

(1 Mark)



Applications of LED :

(Any two applications 1 Mark)

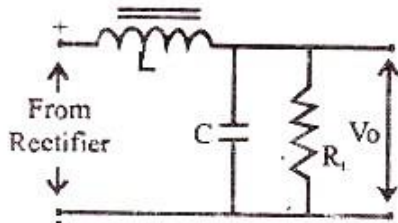
7 segment display, bar graph display, as a indicators, monitoring & control display, 14 segment display.



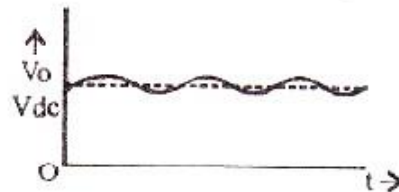
c) Draw and explain the diagram of LC filter with their o/p waveform.

Ans: Diagram of LC filter with their o/p waveform

(1 Mark for diagram, 1 Mark for waveform & 2 Marks for working)



a)



b) Waveform

Explanation :

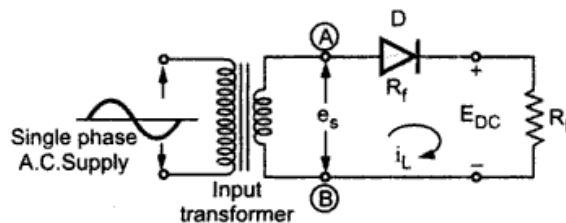
In this type inductor L is in series and capacitor C is in shunt with load. The choke (L) allows the dc component to pass through easily because its dc resistance R is very small. The capacitive reactance X_c is very high for dc and it acts as open circuit. All dc current passes through across which dc output voltage is obtained.

The inductive reactance $X_L = 2\pi fL$ is high for ac components. Therefore the ripples are reduced. Even if any ac current passes through L, it flows through the capacitor because of its low capacitive reactance.

d) Draw circuit diagram of half wave rectifier explain working with their input and output waveform.

Ans: Half wave Rectifier (Circuit) :-

(Circuit - 1 Mark)



The rectifier circuit consists of resistive load, rectifying element and the source of a.c. voltage, all connected in series. To obtain the desired d.c. voltage across the load, the a.c. voltage is applied to rectifier circuit using suitable step-up or step-down transformer.



Operation-

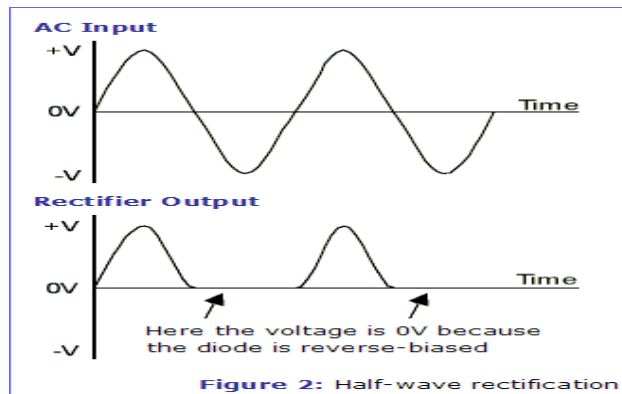
(2 Marks)

During the positive half cycle, terminal (A) becomes positive with respect to terminal (B). The diode is forward biased and the current flows in the circuit. The current will flow in almost full positive half cycle.

During the negative half cycle, terminal (A) becomes negative with respect to terminal(B). The diode is reverse biased and the no current flows in the circuit.

Waveform:

(Waveform - 1 Mark)



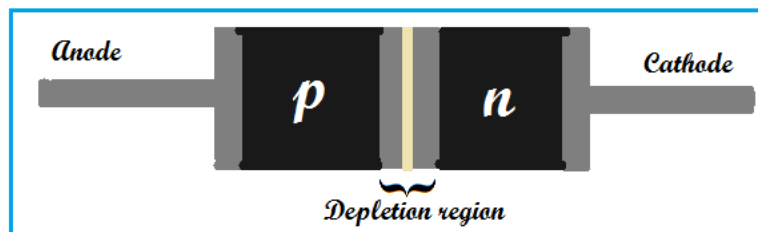
or equivalent figure

e) **Explain with diagram construction and symbol of zener diode.**

Ans:

(1 Marks for Construction, 1 Mark for symbol & 2 Marks for working)

Constructional Diagram of zener diode :



The construction of Zener diode is similar to conventional PN junction diode, however the doping concentration is high in zener diode.

Symbol of zener diode :

Zener diode:





Explanation :

A **Zener diode** is a diode which allows current to flow in the forward direction in the same manner as an ideal diode, but also permits it to flow in the reverse direction when the voltage is above a certain value known as the breakdown voltage, or zener voltage.

When the reverse voltage to zener diode is increased to a large extent & when the applied voltage is sufficient to establish an electric field that can break covalent bonds and new electron hole pair gets generated. In this process no collision of electrons. And breakdown of reverse biased junction occurs.

f) Differentiate between Intrinsic and Extrinsic Semiconductor.

Ans: **Difference between Intrinsic and Extrinsic Semiconductor: (Each point : 1 Mark)**

S.No.	Intrinsic Semiconductor	Extrinsic Semiconductor
1	It is in pure form	It is formed by adding trivalent and pentavalent impurities
2	Holes and electrons are equal	Number of holes are more in p type and Number of electrons are more in n type
3	Fermi level lies in between valence band & conduction band.	Fermi level lies near valence band in p type & near conduction band in n type
4	Conductivity is very low	Conductivity increases by adding trivalent and pentavalent impurities

-----**END**-----