BE3252 - Electrical, Electronics & Instrumentation Engineering

2 Marks

① State ohm's Law.

When the temperature remains constant, current flowing through a conductor is directly proportional to the potential difference across the conductor.

$$V \propto I \qquad \boxed{V = IR}$$

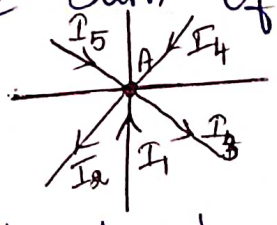
R - (Resistance) proportionality constant.

② Mention the limitations of ohm's Law.

* ohm's Law does not apply to all the non-metallic conductors.
* It is not applicable to non-linear devices such as zener diode, vaccum tubes etc.,
* ohm's law is true for metal conductors at constant temperature.

③ State kirchhoff's current law.

The sum of the currents flowing towards a junction is equal to the sum of the currents flowing away from it.



$$I_1 + I_5 + I_4 = I_2 + I_3.$$

(Incoming current) (Outgoing current)

According to kirchoff's Law, The current at node A is equal to zero.

④ State kirchhoff's voltage law.

In a closed circuit, the sum of the potential drops is equal to the sum of the potential rises.

5. Define RMS value (or) what is rms value of a periodic current?

* The effective or RMS value of an alternating current is given by that steady current (DC) which when flowing through a given circuit for a given time, produces the same amount of heat as produced by the alternating current which when flowing through the same circuit for the same time.

$$\text{RMS Value} = \sqrt{\frac{\text{Area of the Square curve for one cycle}}{\text{Total time period}}}$$

6 Define Power factor.

* The power factor is the cosine of the phase angle between voltage and current

$$\cos\phi = \frac{\text{Resistance}}{\text{Impedance}} \quad ; \quad \cos\phi = \frac{\text{Real power}}{\text{Apparent power}}.$$

7 Define Average Value.

$$\text{Average value} = \frac{\text{Area under the curve over one complete cycle}}{\text{Time period}}.$$

Unit-2 Magnetic Circuits & Electrical Installation

① Mention Some of the protective devices.
* Switch fuse unit (SFU)
* Miniature Circuit Breaker (MCB)
* Moulded case Circuit Breaker (MCCB)
* Earth leakage circuit Breaker (ELCB)

② Define fuse.
A fuse is a short piece of wire which melts when excessive current flows through sufficient time

③ Define flux (or) magnetic flux.
- Magnetic flux is the amount of magnetic field (or the number of lines of force) produced by a magnetic source.
The unit of magnetic flux is Weber (Wb).

④ What is meant by Magnetic flux density?
Magnetic flux density is the amount of flux passing through a defined area that is peripendicular to the direction of the flux.

$$\text{Magnetic flux density} = \frac{\text{Magnetic flux}}{\text{area}}$$

Symbol: B unit: tesla, T, $1T = 1\ Wb/m^2$.

$$\boxed{B = \Phi/A \text{ tesla}}$$

⑤ Define MMF.
- Magnetomotive force (mmf) is the cause of the existence of a magnetic flux in a magnetic circuit.

mmf, $\boxed{F_m = NI}$ amperes

$mmf = NI = Hl$ amperes, where $H = NI/l$ (magnetic field strength or magnetizing force)

⑥ write short note on Reluctance.
Reluctance (S or Rm) is the magnetic resistance of a magnetic circuit to the presence of magnetic circuit to the presence of magnetic flux

$$\text{Reluctance } S = \frac{F_m}{\Phi} = \frac{NI}{\Phi} = \frac{Hl}{BA} = \frac{l}{(B/H)A} = \frac{l}{\mu_0 \mu_r A}$$

List the features of JFET ? (unit - 4)

* Very high impedance
* less operational variation with respect to temperature
* Noise problem - minimized.

list the features of Synchronous motor ? (unit3)

* It operates at a current speed from no load to full load
* Power factor of the motor can be controlled easily.

what are the uses of sensors ? (unit - 5)

* They detect a mechanical condition (movement or position) chemical state, or temperature conditioning and change it into electrical signals that can be used by the microcomputer which makes decisions based on information it receives from sensors.

Name three output characteristics of transistor configuration.

* Saturation region (unit 4)
* Active region
* Cut off region.

(7) Define leakage flux.

The flux setup in the air paths around the magnetic material is known as leakage flux

(8) what is fringing ?

In the air gap, the magnetic flux fringes out into neighboring air paths due to the reluctance of air gap which causes a non-uniform flux density in the airgap of a machine. This is called fringing effect.

(9) Define Inductance

The Inductance of a conductor is defined as the ratio of the linking magnetic flux to the current producing the flux $L = \frac{N\Phi}{I}$

(10) Define Mutual Inductance and self Inductance.

Mutual Inductance: is defined as the ratio of induced magnetic flux linkage in one coil to the current through the other coil $M = \frac{N_1 \Phi_{21}}{I_2}$; $M = \frac{N_2 \Phi_{12}}{I_1}$

Self Inductance: It is the property of a circuit by which change in current induces emf in the circuit to oppose the change in current

$L = N\Phi / I$ H

Unit 3 (MECH) ; Unit - 4 (civil)

1. What is doping?

The process of adding impurity into a pure form of semiconductor is called doping.

2. What is breakdown Voltage?

It is the reverse voltage at which the PN junction breaksdown with suddenrise in reverse current.

3. What is cut-in Voltage?

The forward voltage at which the current through the junction starts increasing rapidly is called as knee voltage or cut in voltage.

4. what is a rectifier?

A rectifier is an electrical device that converts alternating currents to direct current, a process known as rectification.

A circuit which performs the opposite function (converting DC to Ac) is known as an inverter.

5. What is meant by ripple factor?

The ripple factor is defined as the ratio of the rms value of ac component to the average value of dc component.

Ripple Factor (γ) = $\frac{\text{RMS Value of AC component}}{\text{Average Value of DC component}}$

6. What is biasing?

To use the transistor in any application it is necessary to provide sufficient voltage and current to operate the Transistor. This is called biasing.

7. What is meant by biasing a PN Junction?

Connecting a PN junction to an external voltage source is biasing a PN Junction.

8. Why is the transistor called a current Controlled device?

The output characteristics of the transistor depend on the input current. so the transistor is called a current controlled device.

9. What are the Types of rectifiers?

1. Half wave rectifier
2. Full wave rectifier.
3. Bridge wave rectifier.

10. What is forward biasing?

If the positive terminal of the voltage is connected to the P side and negative terminal is connected to the N side of the diode is said to be forward biased.

11. What is reverse biasing?

If the positive terminal of the voltage is connected to the N side and negative terminal is connected to the P side of the diode is said to be reverse biased.

12. What is zener diode?

A zener diode is a type of diode that permits current to flow in the forward direction like a normal diode, but also in the reverse direction if the voltage is larger than the breakdown voltage known as "zener knee voltage" or "zener voltage"

13. What is a conductor?

Conductor is a material that easily conduct the current.

14. What is an insulator?

Insulators are those material in which has no free charge carrier available with them under normal condition.

15. What are the applications of PN diode?

As rectifier, Power supplies & switches.

16) Define TUF. [Transformer utilisation factor]

* It is defined as the ratio of dc power delivered to the load to the ac rating of transformer secondary

$$TUF = \frac{\text{DC power delivered to the load}}{\text{AC rating of transformer secondary}}$$

17) What is meant by avalanche breakdown?

This usually occurs in lightly doped diodes where the depletion layer is very wide and electric field is very low. when reverse voltage is applied that leads minority carriers to disrupt covalent bonds. The newly released valance electrons gain energy to disrupt other covalent bonds. This is a uncontrolled chain reaction is a cummulative process and it is known as avalanche multiplication. It leads to avalanche or flood of charge carriers thus increasing the reverse current dramatically.

18) How the transistor is used as a switch?

* In Saturation region: transistor carry heavy current, hence considered as ON state
* In cut-off region: it carry no current and it is considered as OFF state.

19) Comparison between FET and BJT

FET	BJT
* Unipolar device	* Bipolar device
* voltage controlled device	* current controlled device
* Input resistance is high	* Input resistance is low
* Has negative temperature co-efficient	* has positive temperature co-eff
* cost is high	* Low cost

Unit-5

(1) What is transducer?

A transducer is defined as a device that receives energy from one system and transmits it to another in different form

(or)

It may be defined as a device which converts one form energy into another.

(2) Write short note on LVDT?

- Linear variable Differential Transformer converts the mechanical energy into differential energy. It has single Primary winding and two secondary winding wound on a hollow cylindrical former. A movable soft iron slides within the hollow former and therefore affects the magnetic coupling between the primary and the two secondary's.

(3) Define Hall Effect.

Hall Effect is "the production of a potential difference across an electrical conductor, when a magnetic field is applied in a direction perpendicular to that of the flow of current.

(4) What is meant by Strain Gauge?

A strain gauge is a device used to measure strain on an object if ΔL is the change in length of the (wire) object by the application of force or stress, then strain (ε) is given by.

$$\text{Strain } (\varepsilon) = \frac{\Delta L}{L}$$

(5) Define Gauge factor?

Gauge factor is defined as the ratio of fractional change in electrical resistance to the fractional change in length (strain) $G_f = \frac{\Delta R/R}{\Delta L/L} = \frac{\Delta R/R}{\varepsilon}$

R - Original resistance L - Origenal Length.
ΔR - change in resistance ΔL - Change in Length.

$$\varepsilon = \Delta L / L$$

(6) what is piezoelectric transducer?
It is a device which can convert mechanical energy like force or pressure into an electrical energy. It is an active transducer. It uses piezoelectric effect for the generation of electric charge.

(7) Mention the uses of LVDT.
- It is used for measuring the displacement. It directly converts the displacement into an electrical signal.
- It is used for measuring the force, weight and pressure

(8) Define Mechatronics?
Mechatronics brings together the areas of technology involving sensors and measurement system, drive and actuation system, analysis of behaviour of the system control system and microprocessor system.
Applications: washing machines, cameras, ovens, dish washers etc.

(9) what are the elements of mechatronics?
Actuators, sensors, signal conditioning units, Digital control devices, Graphical displays.

(10) what is a proximity sensor?
They are a form of position sensor used to determine the distance of a object without any physical contact with them.

(11) what are the uses of photo sensor (or) photosensitive devices?
- used to detect the presence of a opaque object by detecting the light reflected back by the object or breaking a beam of light or infrared radiation.

UNIT-I

1. Define ohm's Law

At constant Temperature, the current flowing through the circuit is directly proportional to its applied voltage & inversely proportional to its resistance

$$V \propto IR$$

$$I = \frac{V}{R}$$

where

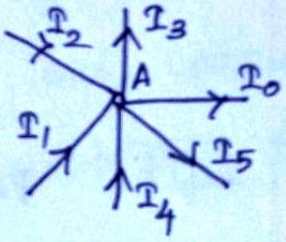
$I \rightarrow$ current in ampere

$V \rightarrow$ Voltage in volts

$R \rightarrow$ Resistance in ohms.

2. Define Kirchoff's current Law.

The sum of the current entering the node is equal to the sum of the current Leaving the node.



$$I_1 + I_2 + I_4 = I_3 + I_5 + I_6$$

$$I_1 + I_2 - I_4 - I_3 - I_5 - I_6 = 0.$$

ΣI at Junction Point $= 0$

3. Define kirchoff's Voltage Law.

kirchoff's voltage Law (KVL) states that the algebraic sum of the voltages around any closed Path is zero.

Around a closed path $\Sigma V = 0$

4. Define R.M.S Value.

The r.m.s value may be determined by taking the mean of the squares of the instantaneous value of current over one complete cycle.

$$RMS = \sqrt{\frac{(\text{Area under hatched line})^2}{\text{Period.}}}$$

5. What is average value?

* It is defined as area under one complete cycle to period.

* The average value of the sinewave is the total area under the half-cycle curve divided by the distance of the curve.

$$\text{Average value} = \frac{\text{Area under one complete cycle}}{\text{Period.}}$$

6. Define Peak factor

Peak factor is defined as the ratio of the maximum value to the rms value.

$$\text{Peak Factor } (K_p) = \frac{\text{Maximum Value}}{\text{RMS Value.}}$$

7. Define form factor

The ratio of RMS value to the average value is called the form factor.

$$\text{Form factor } (K_f) = \frac{\text{RMS value}}{\text{Average value}}.$$

8. What is instantaneous value?

The value of an alternating current, at any particular moment is called its instantaneous value.

9. Define effective value or RMS value of a sinusoidal voltage.

The RMS value may be determined by taking the mean of the squares of the instantaneous value of current over one complete cycle. This is often known as the effective value.

$$V_{rms} = \sqrt{\frac{1}{T}\int_0^T [v(t)]^2 dt}.$$

10. What are independent sources?

Independent sources are those in which, voltage and current are independent and are not affected by other part of the circuit.

11. What are dependent sources?

Dependent sources are those in which source voltage or current is not fixed, but is dependent on the voltage or current existing at some other location in the circuit.

12. What are the different types of dependent or controlled sources?

1. Voltage controlled voltage sources (VCVS)
2. Current controlled voltage sources (CCVS)
3. Voltage controlled current sources (VCCS)
4. Current controlled current sources (CCCS)

13. What is apparent power?

The product of V_{rms} and I_{rms} is known as the apparent power (S). Apparent power (S) = $V_{eff} I_{eff}$ VA

14. Define power factor?

The ratio of the average power to the apparent power is called the power factor.

$$\text{Power Factor} = \frac{\text{Average power}}{\text{Apparent power}}$$

15. Write the expression for finding reactive power

Reactive power is given by

$$Q = V_{eff} I_{eff} \sin\theta \text{ VAR}$$

UNIT-II

1. What is the basic principle of dc generator.

* Basic principle of dc generator is Faraday's Law of electromagnetic induction.

* whenever a conductor is moved in a magnetic field, dynamically induced emf is produced in that conductor.

2. What are the basic parts of a dc generator.

1. Magnetic Frame or yoke.
2. Poles
3. Armature
4. Commutator, Pole shoes, Armature windings, Interpoles
5. Brushes, bearings & shaft.

3. Write down the emf equation of a d.c generator.

$$E_g = \frac{P\phi ZN}{60A} \text{ volts}$$

$E_g \rightarrow$ Induced emf in generator

$P \rightarrow$ Number of poles

$Z \rightarrow$ Total number of conductors in armature.

$N \rightarrow$ Speed in rpm

$A \rightarrow$ Number of parallel path

$\phi \rightarrow$ flux per pole in Wb.

4. What are the different types of d.c generators?

1. Separately excited d.c generator
2. Self excited d.c generator
   a) Series generator
   b) Shunt generator
   c) compound generator — Long shunt compound
                          — short shunt compound.

5. What is the basic principle of operation of a d.c motor.

* A current carrying conductor placed in a magnetic field experiences a force tending to move it. * the direction of force is given by Fleming's Left hand rule.

6. Define back emf or counter emf.

* If the armature of a D.C motor rotates under the influence of the driving torque, the armature conductor moves through the magnetic field and hence emf is induced in the generator.

* the induced emf acts in opposite direction to the applied voltage V and is known as back emf (or) counter emf.

$$E_b = \frac{P\phi NZ}{60A} \text{ volts.}$$

7. What are the major Characteristics of D.C Motor.

1. Torque Vs Armature current
2. speed Vs Armature current
3. speed Vs Torque Characteristics.

8. Define shaft Torque.

The Torque which is available at the motor shaft for doing useful work is known as shaft Torque.

$$T_{sh} = 9.55 \times \frac{\text{output}}{\text{speed of the motor}} \text{ Nm.}$$

9. Mention few speed control of D.C shunt Motor?

1. Armature control Method.
2. Field control Method.
3. Voltage control Method.

10. Mention few speed control Methods of DC series Motor?

1. Flux control Method.
2. Variable resistance in series with Motor.

1. Write down the voltage equation of a d.c Motor.

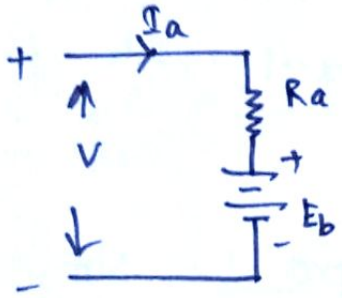
$$V = E_b + I_a R_a.$$

V → applied voltage.
E_b → back emf
I_a → armature current
R_a → armature Resistance.

12. What are the purpose of using brushes in D.C generator ?

1. To collect current from commutator to external Load circuit
2. To provide Lubrication.

13. Draw the circuit Model of DC Motor.



V → supply voltage.
Ia → armature current
Ra → armature resistance
Eb → back emf.

14. What is a dc shunt Motor?

* In a dc shunt Motor, the field winding is connected across the armature.
* the shunt field winding has more number of Turns and less cross sectional area.

15. What is a separately excited d.c Motor?

* In this motor, field winding and armature windings are seperated.
* the field winding is excited by a separate D.C source.
* That is why It is called Separately excited D.C Motor.

UNIT - III

1. Define forbidden energy gap.

Gap between the upper most band "conduction band" and the lower one "valance band", is known as forbidden energy gap.

2. Distinguish between intrinsic semiconductor and extrinsic semiconductor.

Intrinsic semiconductor	Extrinsic semiconductor
1. It is pure form of semiconductor.	1. An impurity or doping agent added to the pure semiconductor.
2. Number of electrons and holes are equal	2. number of electrons and holes are not equal
3. conductivity is poor	3. conductivity is improved.

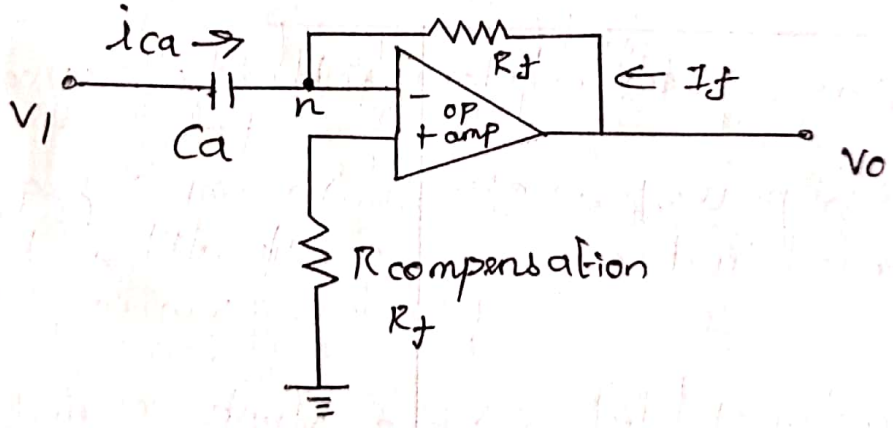
3. What is fermi level?

At room temperature the maximum energy level occupied by an electron is at the middle of the forbidden energy gap, it is known as fermi level.

4. What you mean by depletion layer in PN junction diode? (April/May-2018)

The immobile positive ions deposited across the P region into N region, similarly, the immobile negative ions deposited across the N region into P region is restricted. These immobile ions forms a depletion region.

5. Draw the circuit arrangement of op-amp based differentiator. (April-May-2018)



6. What are the applications of 555 timer IC?

1. Oscillator
2. Traffic light control
3. Ramp and square wave generator
4. Frequency divider
5. Burglar alarm
6. Pulse generator
7. Voltage monitor.

7. What is an operational amplifier ?

operational amplifier is a basic analog device used for constructing merely mathematical circuit. The mathematical operations are addition, differentiation, integration etc.

8. Define transistor biasing ?

The proper flow of zero signal DC collector current and the maintenance of proper collector emitter voltage during the passage of signal is known as transistor biasing.

9. Why transistor is called current controlled device ?

Transistor is also called current controlled device, because, the collector current can be controlled by base current.

10. What is meant by zener effect ?

In a general purpose PN diode, the doping is light. As a result of this, the breakdown voltage is high. This effect is known as zener effect.

11. What is an extrinsic semiconductor?

Impure form of semiconductor is called as Extrinsic semiconductor.

Example : N and P type semiconductor.

12. What do you mean by ripple factor?

The ripple factor is defined as the ratio of the effective value or rms value of the ac component of voltage or current to the average value of voltage or current.

13. Enlist the limitations of bipolar junction transistor.

1. It has low input impedance because of forward biased emitter junction.
2. There is considerable noise is present in the transistor.