		UNIT-II			
10	a)	Analyse the Frequency Response characteristics of RC Coupled Amplifier.	L4	CO5	5 M
	b)	Analyze the characteristics of full wave bridge rectifier with and without using the capacitor filter.	L4	CO5	5 M
		OR			
11	a)	Describe the operation of Zener diode as a Voltage regulator.	L3	CO5	5 M
	b)	With neat block diagram, explain the working of a DC power supply. Also mention the principal components used in each block.	L3	CO4	5 M
		UNIT-III			
12	a)	Explain working of AND, NOR and EX-OR gates with truth tables.	L3	CO4	5 M
	b)	Convert the following numbers into decimal numbers. (i) $(110101)_2$ (ii) $(4576)_8$ (iii) $(268B)_{16}$	L3	CO4	5 M
		OR			
13	a)	Enumerate the master slave JK flip-flop with necessary diagrams and truth table.	L4	CO5	5 M
	b)	Design a full adder using two half adders and an OR gate.	L4	CO4	5 M

PVP 23

Code: 23ES1202

I B.Tech - II Semester – Regular Examinations - JULY 2024

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common for EEE, ECE, CSE)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts: Part-A and Part-B.
2. Each Part contains:
- 5 short answer questions. Each Question carries 1 Mark and
- 3 essay questions with an internal choice from each unit. Each question carries 10 marks.

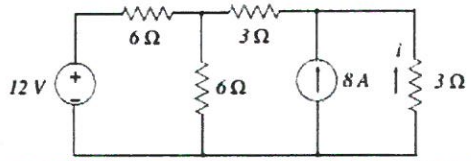
3. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Write the limitations of ohm's law.	L1	CO1
b)	What is a transformer?	L1	CO1
c)	State Faradays law of electromagnetic induction.	L1	CO2
d)	What is the voltage and current phasor relation for capacitor?	L1	CO2
e)	What is nuclear fusion?	L1	CO1

			BL	CO	Max. Marks
		UNIT-I			
2	a)	Discuss the network elements (R, L and C) in detail with example.	L2	CO1	5 M
	b)	Determine the Peak factor and form factor for sinusoidal waveform.	L3	CO2	5 M
		OR			

3	a)	Illustrate the behavior of series RL circuit excited by an Alternating voltage and draw its phasor diagram.	L3	CO3	5 M
	b)	Obtain the current 'i' using Superposition theorem for the following circuit. 	L3	CO3	5 M
		UNIT-II			
4	a)	Elaborate the construction of DC Machine with neat sketch.	L3	CO2	5 M
	b)	Illustrate the construction and working principle of Permanent Magnet Moving Coil.	L3	CO2	5 M
		OR			
5	a)	Explain the principle and operation of Three Phase Induction Motor.	L3	CO2	5 M
	b)	Explain the working principle and operation of an Alternator, Also write its applications.	L3	CO2	5 M
		UNIT-III			
6	a)	Enumerate the essential components of hydroelectric plant in detail with a layout.	L3	CO2	5 M
	b)	Differentiate among the Conventional and Non-Conventional energy resources.	L4	CO3	5 M
		OR			

7	a)	Explain in detail the Power Tariff used for domestic energy consumption.	L3	CO3	5 M
	b)	Illustrate the working principle and operation of Fuse, also write its merits and demerits.	L3	CO2	5 M

PART – B

		BL	CO
1. f)	What is diffusion current?	L1	CO4
g)	What is Zener breakdown?	L1	CO4
h)	Define ripple factor.	L1	CO4
i)	List out the characteristics of logic gate 'NOT'.	L1	CO4
j)	What is a sequential logic circuit?	L1	CO4

			BL	CO	Max. Marks
		UNIT-I			
8	a)	Illustrate about the switching characteristics of PN junction diode with suitable diagrams.	L3	CO4	5 M
	b)	Explain the construction and the principle of operation of Bipolar Junction Transistor (BJT).	L3	CO4	5 M
		OR			
9	a)	Develop the input and output characteristics of a transistor in CE configuration.	L3	CO4	5 M
	b)	Illustrate the evolution of electronics from vacuum tubes to nano electronics.	L3	CO4	5 M

Code: 23ES1202 **PVP 23**

I B.Tech-II Semester-Rcgular Examinations-JULY 2024

BASIC ELECTRICAL & ELECTRONICS ENGINEERING
(Common forEEE,ECE,CSE)
SCHEME OF EVALUATION

Duration:3hours Max.Marks:70

PART-A

1. a) **Write the limitations of ohm's law.**
   Any one limitation **1 M**
   b) What is a transformer?
   Definition or application **1 M**
   c) State Faradays law of electromagnetic induction
   Any one law **1 M**
   d)What is the voltage and current phasor relation for capacitor ?
   voltage and current phasor relation **1 M**
   e) What is nuclear fusion?
   Nuclear fusion **1 M**

UNIT-I

2. **a)Discuss the network elements (R,L and C) in detail with example**
   R, L, C representations **2 M**
   R, L, C definitions **2 M**
   Example **1M**
   b) Determine the Peak factor and form factor for sinusoidal waveform
   Peak Factor derivation **2.5M**
   Form Factor derivation **2.5M**
3. a) Series RL circuit representation **2M**
   Deriving various parameters **1M**
   Phasor diagram **2M**
   b) Procedure for calculation of current **4 M**
   Result **1M**

UNIT-II

4. a) DC Machine construction figure **2M**
   List of various parts **1M**
   Explanation about any 4 parts of DC Machine **2M**
   b) PMMC construction figure **2M**
   Principle of operation **3M**
5. a) Principle of Three phase Induction Motor **1M**

Representation of working **2M**
Operation explanation **2M**
b) Principle of Alternator **1M**
Representation of working and operation **3M**
Applications 1M

UNIT-III

6. a) Hydroelectric plant Layout **3M**
   Explanation about the components **2M**
   b) Any 5 differences between the Conventional and Non-Conventional energy resources. **5M**
7. a)Tariff definition **1M**
   Two part tariff importance **2M**
   Representation of tariff **2M**
   b) Representation of FUSE. **2M**
   Working principle **1M**
   Merits **1M**
   Demerits **1M**

PART-B

1. f) Diffusion current **1M**
   g) Zener breakdown **1M**
   h) Ripple factor definition **1M**
   i) Any two characteristics of logic gate NOT **1M**
   j)Representation of sequential logic circuit **or** description **1M**

UNIT-I

8. a)PN Junction Diode representation **1M**
   Forward bias, Reverse Bias **2M**
   Explanation **1M**
   Switching characteristics **1M**
   b) PNP or NPN representation **1M**
   Construction details **2M**
   Principle of operation **2M**
9. a) CE configuration of transistor **1M**
   Input characteristics with explanation **2M**
   Output characteristics with explanation **2M**
   b) Any 4 devices explanation **5 M**

UNIT-II

10. a)Representation of RC coupled Amplifier **1M**
    Frequency response representation **2M**
    Explanation about frequency response **2M**
    b) Representation of Full wave bridge rectifier **2M**
    Explanation with & without filter **1M**
    Waveforms for Full wave bridge rectifier with & without filter **2M**
11. a) Zener diode as voltage regulator representation **3M**
    Explanation about voltage regulation **2M**
    b) Block diagram of DC power supply **3M**
    Principal components with explanation **2M**

UNIT-III

12. a)AND,NOR,EX-OR logic diagram **2M**
    AND, NOR, EX-OR Truth table **2M**
    Explanation 1M
    b) Binary to decimal conversion **1M**
    Octal to decimal conversion **2M**
    Hexadecimal to decimal conversion **2M**
13. a)Master slave JK Flip flop representation **2M**
    Truth Table **2M**
    Explanation **1M**
    b) Full Adder representation **2M**
    Truth table **2M**
    Full adder using 2 half adders representation **1M**

Code: 23ES1202 **PVP 23**

I B.Tech-II Semester-Regular Examinations-JULY 2024

BASIC ELECTRICAL & ELECTRONICS ENGINEERING
(Common forEEE,ECE,CSE)
SCHEME OF EVALUATION

Duration:3hours Max.Marks:70

PART-A

1. a) **Write the limitations of ohm's law.**
Limitations of Ohm's law:
   - Ohm's law is applicable when the temperature of the conductor is constant. Resistivity changes with temperature.
   - The relation between voltage and current depends on the sign of voltage.
   - It does not apply to semiconductors, which do not have a direct current-voltage relationship.

b) What is a transformer?
A transformer is a static piece of equipment used either for raising or lowering the voltage of an AC supply with a corresponding decrease or increase in current.

c) State Faradays law of electromagnetic induction
1. Whenever a conductor is placed in a varying magnetic field, an electromotive force is induced.
2. The induced emf in a coil is equal to the rate of change of flux linkage

d)What is the voltage and current phasor relation forcapacitor ?
Voltage lags behind the current by 90 degrees in a capacitor

e) What is nuclear fusion ?
Nuclear fusion is the process by which two light atomic nuclei combine to form a single heavier one.

UNIT-I

2. **a)Discuss the network elements R,L and C)in detail with example**

Resistance:

The opposition offered by a substance to the flow of current is called resistance.

Symbol

Unit is Ohms. $R = \rho l/a$
In a resistor at a constant temperature, the electrical current flowing through a conductor is directly proportional to the voltage applied across it.
$I \propto V$ i.e. $V = IR$
Eg: If R=10Ω, I=10A, then V=100V

Inductance:

Inductance is the tendency of an electrical conductor to oppose a change in the electric current flowing through it. L is used to represent the inductance.

The unit of inductance is henry (H).

$v = L\, di/dt$

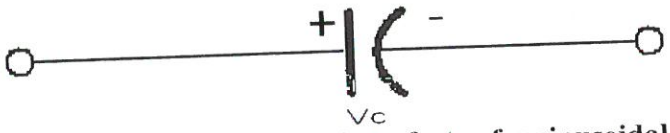
Eg: If L=2H, I=5 sin60wt A, then V=600cos60wt

Capacitance:

Capacitance is the ability of a component or circuit to collect and store energy in the form of an electrical charge.

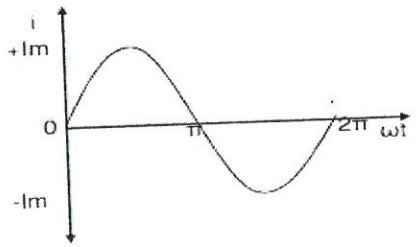
Capacitance is denoted by *"C"*, The unit of capacitance is units Farad denoted by *"F"* Capacitance $C = Q/Vc$

Eg: If Q=20C, Vc=2V , then C=10F



b) Determine the Peak factor and form factor for sinusoidal waveform

RMS value of a sinusoidal current



$i = I_m \sin$

$$I_{rms} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi} i^2 d(\omega t)}$$

$$I_{rms} = \sqrt{\frac{1}{\pi}\int_0^{\pi} I_m^2 \sin^2 \omega t\, d(\omega t)}$$

$$I_{rms} = \frac{I_m}{\sqrt{2}} = 0.707 I_m$$

Form Factor

The ratio of RMS value to the average value of an alternating quantity is known as Form Factor

$$FF = \frac{RMS Value}{Average Value}$$

Peak Factor or Crest Factor

The ratio of maximum value to the RMS value of an alternating quantity is known as the peak factor

$$PF = \frac{Maximum Value}{RMS\ Value}$$

For a sinusoidal waveform

$$I_{av} = \frac{2I_m}{\pi} = 0.637I_m$$

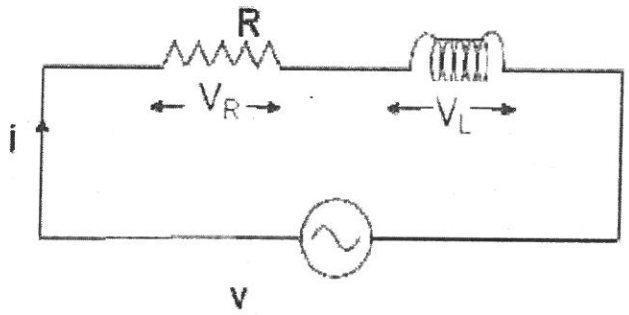
$$I_{rms} = \frac{I_m}{\sqrt{2}} = 0.707I_m$$

$$FF = \frac{I_{rms}}{I_{av}} = \frac{0.707I_m}{0.637I_m} = 1.11$$

$$PF = \frac{I_m}{I_{rms}} = \frac{I_m}{0.707I_m} = 1.414$$

3. a) Illustrate the behaviour of serics RL circuit excited by an Alternating voltage and draw its phasor diagram.

Series R-L Circuit



Consider an AC circuit with a resistance R and an inductance L connected in series as shown in the figure. The alternating voltage v is given by

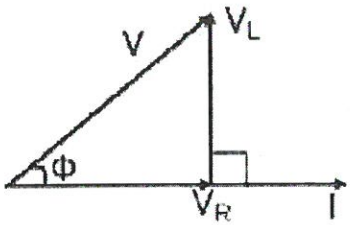
$$v = V_m \sin \omega t$$

The current flowing in the circuit is i. The voltage across the resistor is V_R and that across the inductor is V_L.

V_R=IR is in phase with I

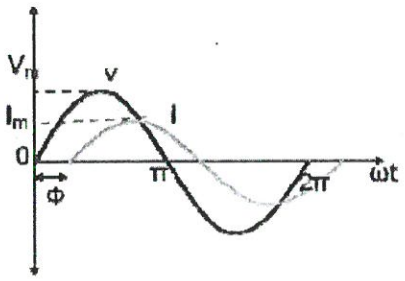
V_L=IX_L leads current by 90 degrees

With the above information, the phasor diagram can be drawn as shown.



The current I is taken as the reference phasor. The voltage V_R is in phase with I and the voltage V_L leads the current by 90°. The resultant voltage V can be drawn as shown in the figure. From the phasor diagram we observe that the voltage leads the current by an angle Φ or in other words the current lags behind the voltage by an angle Φ.

The waveform and equations for an RL series circuit can be drawn as below.



$$V = V_m \sin \omega t$$
$$I = I_m \sin(\omega t - \Phi)$$

From the phasor diagram, the expressions for the resultant voltage V and the angle Φ can be derived as follows.

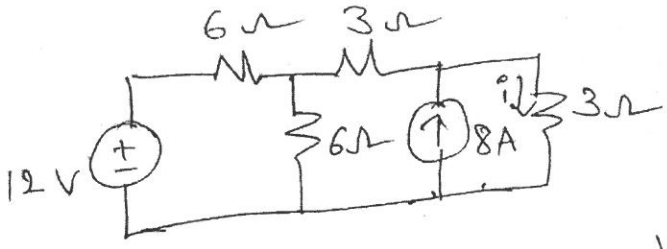
$$V = \sqrt{V_R^2 + V_L^2}$$
$$V_R = IR$$
$$V_L = IX_L$$
$$V = \sqrt{(IR)^2 + (IX_L)^2}$$
$$V = I\sqrt{R^2 + X_L^2}$$
$$V = IZ$$
$$\text{where} \quad Z = \sqrt{R^2 + X_L^2}$$

Phase angle

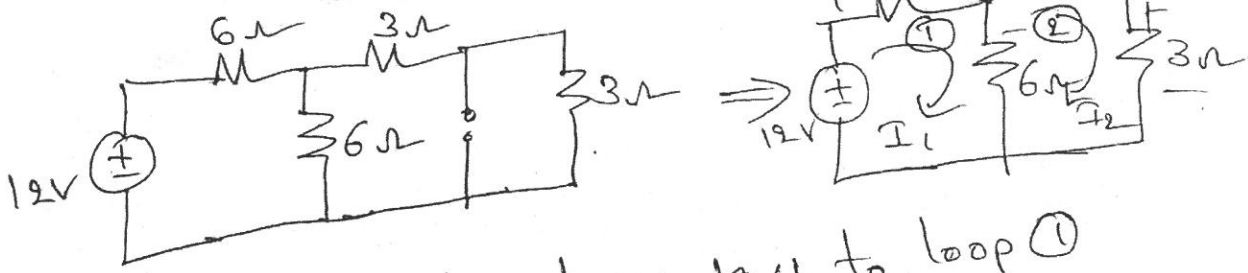
$$\Phi = \tan^{-1}\left(\frac{V_L}{V_R}\right)$$
$$\Phi = \tan^{-1}\left(\frac{IX_L}{IR}\right)$$
$$\Phi = \tan^{-1}\left(\frac{X_L}{R}\right)$$
$$\Phi = \tan^{-1}\left(\frac{\omega L}{R}\right)$$

b) Obtain the current i using Superposition theorem for the following circuit

3. b) obtain the current i using Superposition theorem for the following circuit.



Only 12V Source is Considered, 8A is open circuited.



By Mesh analysis: KVL to loop ①

$$-12 + 6I_1 + 6(I_1 - I_2) = 0$$

$$12I_1 - 6I_2 = 12$$

$$2I_1 - I_2 = 2 \quad \text{— ①}$$

KVL to loop ②

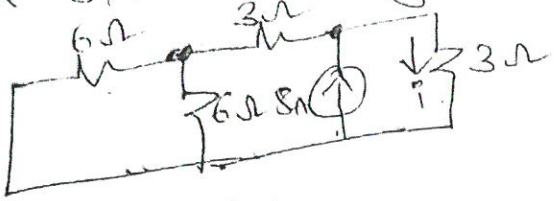
$$3I_2 + 3I_2 + 6(I_2 - I_1) = 0$$

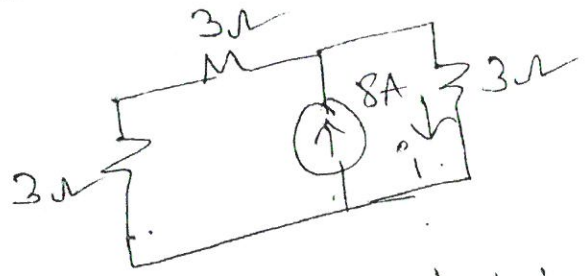
$$-6I_1 + 12I_2 = 0 \quad \text{— ②}$$

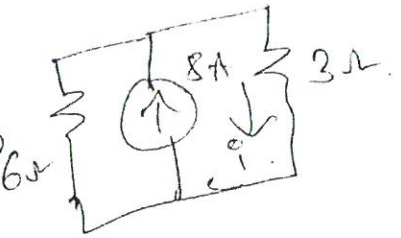
Solving ① & ②, $I_1 = 1.33A$, $I_2 = 0.66A$

∴ Current through 3Ω when 12V is acting alone $i' = 0.66A$.

When 8A is acting & 12V is shorted,







By current division rule,

$$i_{3\Omega} = \frac{8 \times 6}{6+3} = \frac{8 \times 6}{9} = \frac{16}{3} = 5.33A$$

$\therefore i'' = 5.33A$.

$\therefore$ current through 3Ω when 8A source is acting alone is 5.33A.

$\therefore$ By superposition theorem, i is calculated as:

$$i = i' + i''$$

$$\therefore i = 0.66 + 5.33 = 5.99A$$

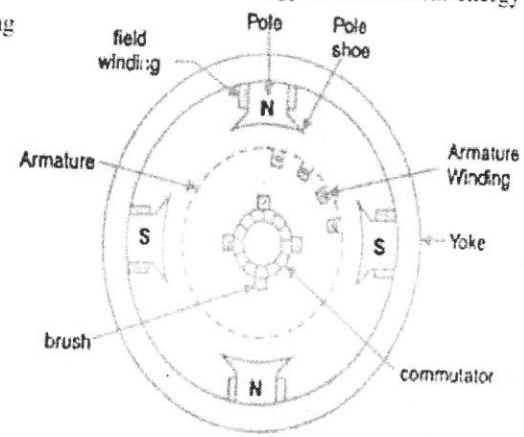
UNIT-II

4. a) Elaborate the construction of DC Machine with neat sketch

Constructional details of the DC Machine:

A DC machine is a device that deals with the conversion of electrical energy to mechanical energy and vice versa and which consist of following essential parts.

1) Magnetic frame or YOKE
2) Pole cores and pole shoes
3) Field coils or pole coils or field winding
4) Armature core
5) Armature winding
6) Commutator
7) Brushes and bearings



Yoke:

1. The magnetic frame or the yoke of DC machine made up of cast iron or cast steel.
2. Its main function is to form a protective covering over the inner sophisticated parts of the motor and provide support to the poles.

Pole cores and pole shoes:

1. The construction of magnetic poles basically comprises of two parts namely, the pole core and the pole shoe stacked together under hydraulic pressure and then attached to the yoke.
2. Field winding is placed on the pole core. The pole core function is to just hold the pole shoe over the yoke.
3. Whereas the pole shoe spreads the flux produced over the air gap between the stator and rotor. Pole shoes made with either cast-iron or cast-steel.

Field Winding:

1. The field winding of DC machine is made up of copper wire.
2. When the field current flows through these coils, they electro magnetize the poles which produce the necessary flux.

Armature core:

1. It houses the armature conductors or coils and causes them to rotate and hence cut the magnetic flux of the field magnets.
2. It consists of slotted soft-iron laminations that are stacked to form a cylindrical core.
3. The purpose of laminating the core is to reduce the eddy-current losses.

Armature Winding:

1. The winding in which the EMF is induced is known as armature winding.
2. The slots of the armature core hold insulated conductors that are connected in a suitable manner. This is known as "Armature winding".
3. The construction of armature winding of DC machine can be of two types:-

   a. Lap winding b. Wave winding.

Commutator:

1. The Commutator of DC machine is a cylindrical structure made up of copper segments stacked together, but insulated from each other by mica.
2. Commutator reverses the current direction between the rotor and the external circuit.
3. Its main function as far as the DC motor is concerned it produces unidirectional torque.
4. In DC Generators commutator is a mechanical rectifier. This converts the alternating voltage generated in the armature winding into direct voltage across the brushes.

Brushes of DC Machine:

1. The brushes of DC machine are made with carbon or graphite structures, making sliding contact over the rotating commutator.
2. The brushes are used to transfer the current from external circuit to the rotating commutator from where it flows into the armature winding.

b) Illustrate the construction and working principle of Permanent Magnet Moving Coil

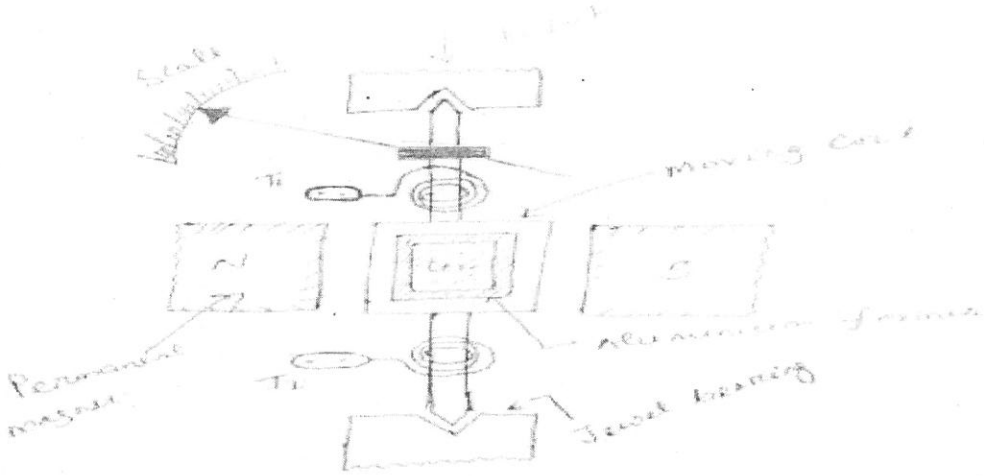
Permanent Magnet Moving Coil (PMMC) instrument

One of the most accurate type of instrument used for D.C. measurements is PMMC instrument.

Construction: A permanent magnet is used in this type instrument. uminum former is provided in the cylindrical in between two poles of the permanent gnet . Coils are wound on the aluminum former which is connected with the spindle. This idle is supported with jeweled bearing. Two springs are attached on either end of the spind The terminals of the moving coils are connected to the spring. Therefore the current flow rough spring 1, moving coil and spring 2.

Damping: Eddy current damping is used. This is produced by aluminum for

Control: Spring control is used.



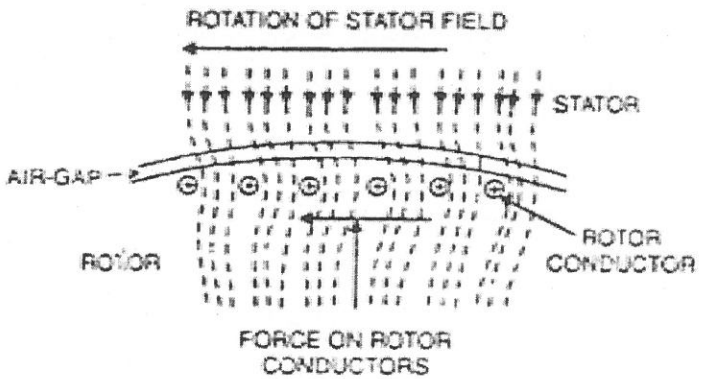
Principle of operation

When D.C. supply is given to the moving coil, D.C. current flows through it. When the current carrying coil is kept in the magnetic field, it experiences a force. This force produces a torque and the former rotates. The pointer is attached with the spindle. When the former rotates, the pointer moves over the calibrated scale. When the polarity is reversed a torque is produced in the opposite direction. The mechanical stopper does not allow the deflection in the opposite direction. Therefore the polarity should be maintained with PMMC instrument.

If A.C. is supplied, a reversing torque is produced. This cannot produce a continuous deflection. Therefore this instrument cannot be used in A.C.

5 a) Explain the principle and operation of Three Phase Induction Motor

Working of Three Phase Induction Motor



Consider a portion of 3-phase induction motor as shown in Figure. The operation of the motor can be explained as under:

(i) When 3-phase stator winding is energized from a 3-phase supply, a rotating magnetic field is set up which rotates round the stator at synchronous speed N_S (= 120 f/P).

(ii) The rotating field passes through the air gap and cuts the rotor conductors, which as yet, are stationary. Due to the relative speed between the rotating flux and the stationary rotor, e.m.f.s is induced in the rotor conductors. Since the rotor circuit is short-circuited, currents start

(iii) The current-carrying rotor conductors are placed in the magnetic field produced by the stator. Consequently, mechanical force acts on the rotor conductors. The sum of the mechanical forces on all the rotor conductors produces a torque which tends to move the rotor in the same direction as the rotating field.

(iv) The fact that rotor is urged to follow the stator field (i.e., rotor moves in the direction of stator field) can be explained by Lenz's law. According to this law, the direction of rotor currents will be such that they tend to oppose the cause producing them. Now, the cause producing the rotor currents is the relative speed between the rotating field and the stationary rotor conductors. Hence to reduce this relative speed, the rotor starts running in the same direction as that of stator field and tries to catch it.

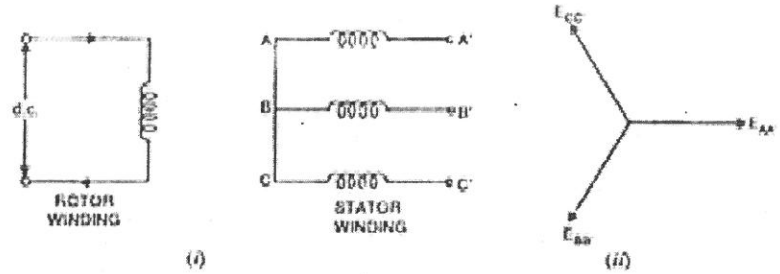
b) Explain the working principle and operation of an Alternator, Also write its applications.

Principle of operation of Alternator:

The rotor winding is energized from the d.c. exciter and alternate N and S poles are developed on the rotor. When the rotor is rotated in anti-clockwise direction by a prime mover, the stator or armature conductors are cut by the magnetic flux of rotor poles. Consequently, e.m.f. is induced in the armature conductors due to electromagnetic induction. The induced e.m.f. is alternating since N and S poles of rotor alternately pass the armature conductors. The direction of induced e.m.f. can be found by Fleming's right hand rule and frequency is given by. $f = \frac{NP}{120}$

where N = speed of rotor in r.p.m
P = number of rotor poles

The magnitude of the voltage induced in each phase depends upon the rotor flux, the number and position of the conductors in the phase and the speed of the rotor.



The above figure shows star-connected armature winding and d.c. field winding. When the rotor is rotated, a 3-phase voltage is induced in the armature winding. The magnitude of induced e.m.f. depends upon the speed of rotation and the d.c. exciting current. The magnitude of e.m.f. in each phase of the armature winding is the same. However, they differ in phase by 120° electrical as shown in the phasor diagram.

Alternators Applications:

Automobiles, Electrical power generator plants, Marine applications, Diesel electrical multiple units,Radiofrequency transmission, Emergency communication and lightning, Backup power supply.

UNIT III

6 a) Enumerate the essential components of hydroelectric plant in detail with a layout.

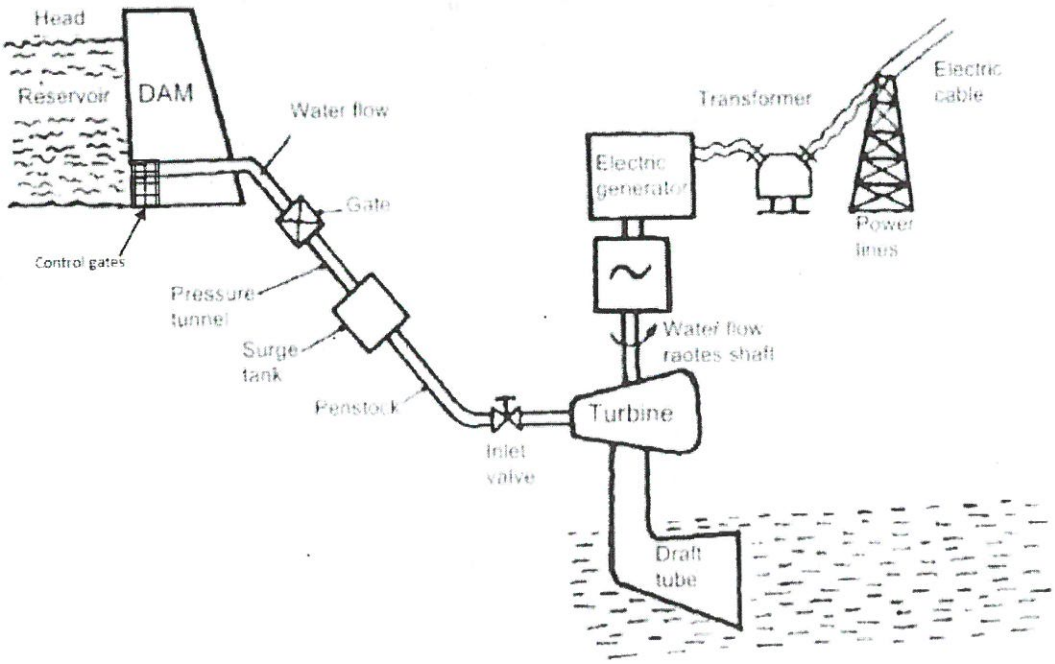
Components: Storage Reservoir, Dam, Forebay, Spillway, Intake, Surge Tank, Penstock, Trash Racks, Tail Race, Draft Tube, Water Turbine, Valves and Gates

Storage Reservoir: Its purpose is to store water during excess periods (i.e., rainy season) and supply the same during lean flow periods (i.e., dry season).It helps in supplying water to turbines according to the load on the power plant. A reservoir can be either natural or artificial.

Dam: The function of dam is to raise the water surface of the stream to create an artificial head and to provide the pondage, storage or the facility of diversion into conduits. Dams are built of concrete or stone masonry, earth or rock fill.

Forebay: A forebay may be considered as an enlarged body of water to store water temporarily to meet the hourly load fluctuations. Forebay serves as a regulating reservoir storing water temporarily during light load period and providing the same for initial increase on account of increasing load during which water in the canal is being accelerated.

Layout and operation of Hydel power Generation:



Spillway: This is constructed to act as a safety valve. It discharges the overflow water to the downstream side when the reservoir is full, a condition mainly arising during flood period.

Intake: The intake includes the head-works which are the structures at the intake of conduits, tunnels. These structures include booms, screens or trash racks, sluices. Booms prevent the unwanted solid materials (icebergs, wood logs) flowing into into the turbine. Trash racks are fitted directly to prevent entry of debris into the turbines.

Surge tank: Surge tank is a water storage reservoir or tank (open at the top) for receiving the rejected flow and thus relieving the conduit pipe (Penstock) of excessive water hammer pressure .Increase in load conditions additional water is required, which is supplied from the surge tank. Ideal location of sure tank is as close to the power station as possible.

Penstock: Penstocks are pipes or long channels that carry water down from the hydroelectric reservoir (or forebay or surge tank) to the turbines inside the actual power station. The water in the penstock possesses kinetic energy due to its motion and potential energy due to its height. Penstocks are built of steel or reinforced concrete.

Valves and Gates: In low head plants gates at the entrance to the turbine casing are usually all that is needed to shut off the flow and provide for unwatering the turbine for inspection and repairs.

Trash Racks: Trash-racks are installed in the intake system of hydroelectric power plants to prevent entrance of debris which can damage turbine parts and cause serious problems in power plant operation.

Draft Tubes: An airtight pipe of suitable diameter attached to the runner outlet and conducting water down from the wheel and discharging it under the surface of the water in the tailrace is known as draft tube.

Tail race: The water after having done its useful work in the turbine is discharged to the tailrace which may lead it to the same stream or to another one.

Prime Movers or Water Turbines: In hydroelectric power plants, water turbines are used as prime movers and their function is to convert the kinetic energy of water into mechanical energy which is further utilized to drive the alternators to generate electrical energy.

Alternators: Alternators convert mechanical energy into electrical energy

b) Differentiate among the Conventional and Non-Conventional energy resources.

S.NO	Conventional Energy Sources	Non-Conventional Energy Sources
1	These sources of energy availability are limited in nature.	These sources of energy are abundantly available in nature.
2	They have been in use for a long time.	They are yet in development stage over the past few years.
3	They are not replenished continuously. They are formed over a million years.	They are replenished continuously by natural process.
4	They are called non-renewable sources of energy.	They are called renewable sources of energy.
5	They can be exhausted completely due to over consumption except hydel power.	They cannot be exhausted completely.
6	They pollute environment by emitting harmful gases and also contribute to global warming	They do-not pollute the environment
7	They are used in large scale compared to non- conventional sources	They are used in small scale compared to non- conventional sources
8	Operating cost is high compared to non-conventional energy sources (except hydel power)	Operating cost is less
9	Power supply is reliable	Power supply is unreliable
10	Ex:-Coal, Diesel, Natural Gas, Petrol etc.	Ex- Solar, Wind, Tidal, Geo-thermal etc.

(14)

7 a) Explain in detail the Power tariff used for domestic energy consumption

Tariff:

The rate at which electrical energy is supplied to a consumer is known as tariff.

Two-part tariff: When the rate of electrical energy is charged on the basis of maximum demand of the consumer and the units consumed, it is called a two-part tariff.

In two-part tariff, the total charge to be made from the consumer is split into two components viz., fixed charges and running charges. The fixed charges depend upon the maximum demand of the consumer while the running charges depend upon the number of units consumed by the consumer.

$$\textit{Total charges} = Rs\ (b \cdot kW + c \cdot kWh)$$

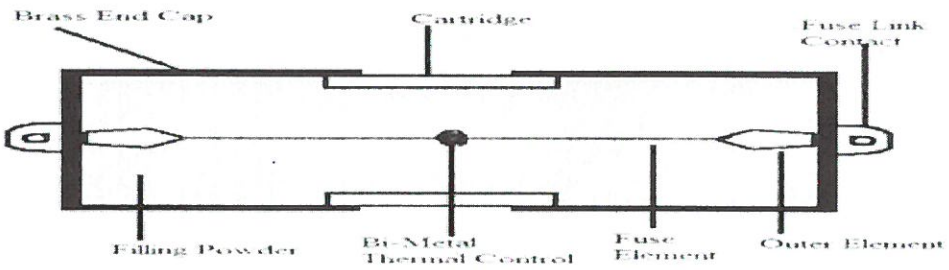
where, b = charge per kW of maximum demand

c = charge per kWh of energy consumed

This type of tariff is mostly applicable to industrial consumers who have appreciable maximum demand.

b) Ilustrate the working principle operation of Fuse.alsowriteits merits and demerits

Fuse:



An Electric Fuse is a protective device which interrupts the flow of excessive current in an Electric circuit. This works on the principle of heating effect of the Electric Current .

A Fuse consists of conducting wire, which has high resistivity and low melting point. The thickness of the Fuse wire is determined based on the amount of current flow in the circuit. If a fault causes a flow of excess Current then a Conductor break the Circuit by melting or separating it, the thin Conductor used is known as an Electric Fuse. The wire inside the Fuse melts if there is an occurrence of high Current due to a short Circuit or an overloaded Circuit. As a result of which the Current stops flowing since the wire has broken. In order to stop the flow of Electricity. Once a Fuse melts, it can be changed or replaced with a new Fuse. A Fuse is normally made up of elements like zinc, copper, aluminum and silver.

Merits :

1. Provides protection against power overloads

2. Automatic operation
3. Low Cost

Demerits:

1. It doesn't give any indication of overloads
2. Low breaking capacity compared to the circuit breaker

PART-B

1. f) **What is diffusion current?**

Diffusion current is a current in a semiconductor caused by the diffusion of charge carriers (electrons and/or electron holes).

g) **What is Zener breakdown?**

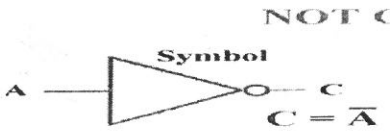
Occurs in a heavily doped p-n junction and when high reverse voltage is applied to zener diode, zener breakdown occurs.

h) **Define ripple factor**

RF is defined as the ratio of effective value of the alternating components of the rectified voltage (Vac) or current to the average value (Vdc)

i) **List out the characteristics of logic gate NOT**

a) A NOT gate is a single input and output digital device or logic gate.
b) It is known as an inverter since it gives an inversion of the applied input.
c) The symbol Of NOT gate is a triangle which has a bubble over it.
d) The bubble in the NOT gate is known as an inversion bubble.



Truth Table

INPUT	OUTPUT
A	NOT A
0	1
1	0

NOTE: Consider any 2 characteristics

j) **What is a sequential logic circuit?**

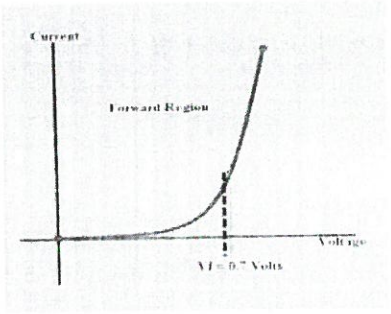
Sequential circuit is a combinational logic circuit that consists of inputs variable (X), logic gates (Computational circuit), and output variable (Z).

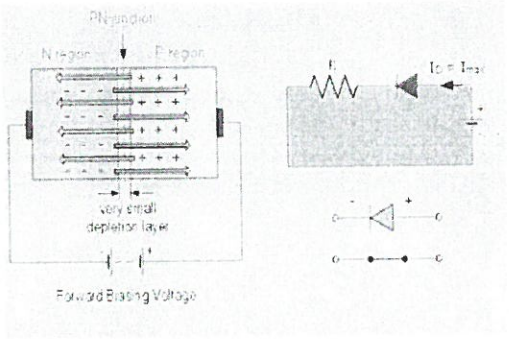
UNIT I

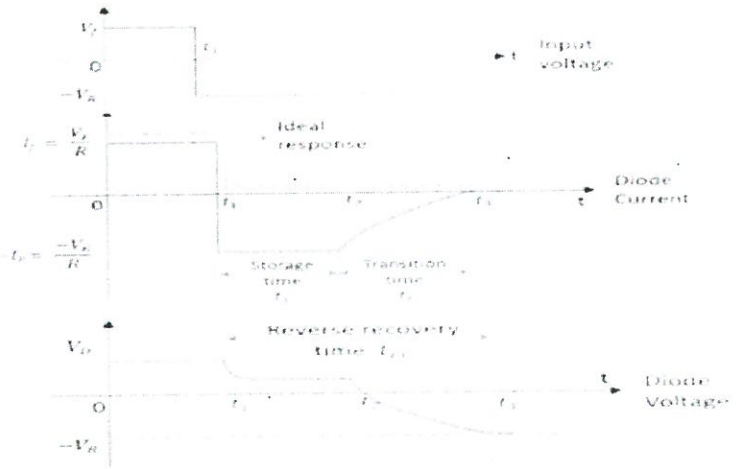
8a) Illustrate about the switching characteristics of PN junction diode with suitable diagrams

When a diode is connected in a Forward Bias condition, a negative voltage is applied to the N-type material and a positive voltage is applied to the P-type material. If this external voltage becomes greater than the value of the potential barrier, approx. 0.7 volts for silicon and 0.3 volts for germanium, the potential barriers opposition will be overcome and current will start to flow.

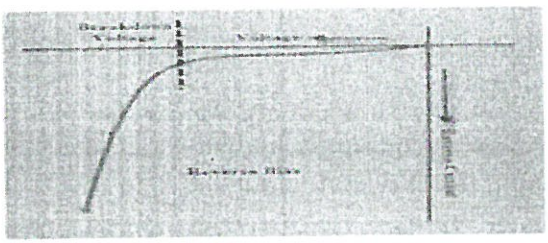
Forward Bias

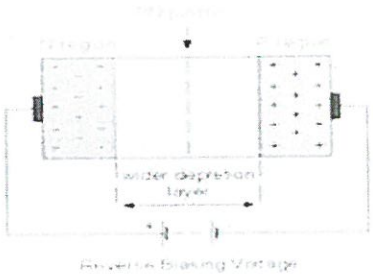






Reverse Bias: When a diode is connected in a Reverse Bias condition, a positive voltage is applied to the N-type material and a negative voltage is applied to the P-type material. The positive voltage applied to the N-type material attracts electrons towards the positive electrode and away from the junction, while the holes in the P-type end are also attracted away from the junction towards the negative electrode.

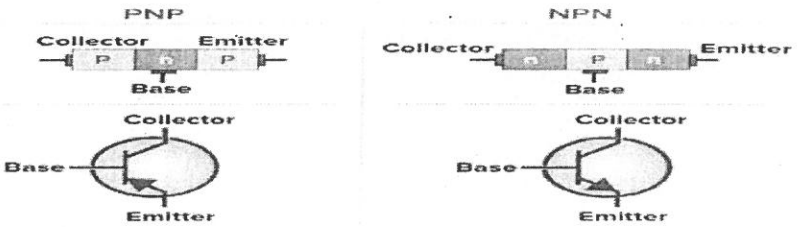




The switching characteristics are important particularly at high-frequency, to define the device velocity in changing from conduction state to blocking state and vice versa.

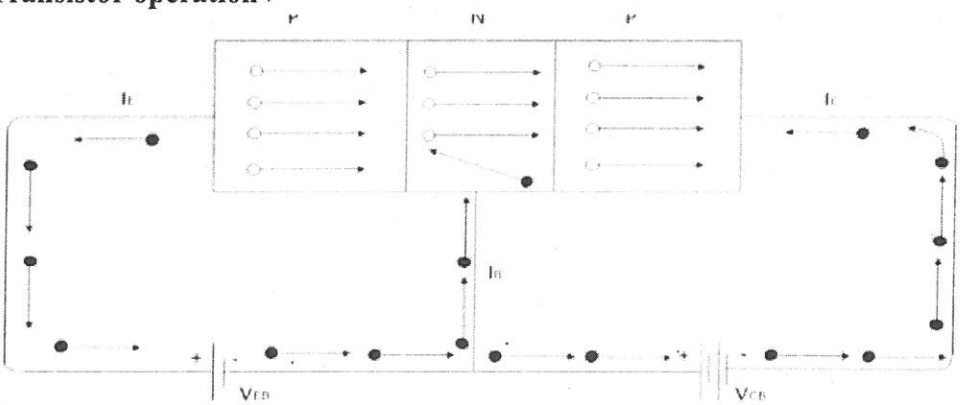
b) **Explain the construction and the principle of Bipolar Junction Transistor(BJT)**

Transistor Construction: Transistor consists of two pn junctions formed by sandwiching either p-type or n-type semiconductor between a pair of opposite types. Accordingly; there are two types of transistors, namely;
(i) n-p-n transistor (ii) p-n-p transistor



The center layer is called the base, one of the outer layers is termed the emitter, and the other outer layer is referred to as the collector. The emitter, base and collector are provided with terminals, which are appropriately labeled E, B, and C. Two PN junctions exist within each transistor: the collector-base junction and the emitter-base junction. The arrowhead on each symbol always identifies the emitter terminal of the transistor. Also, in each case its direction indicates the conventional direction of current flow. For the NPN transistor, the arrowhead points from the p-type base to the n-type emitter. For the PNP transistor, it points from the ptype base. Thus, the arrowhead is always from p to n. The center layer of the transistor is made very much narrower than the two outer layers. Also the outer layers are much more heavily doped than the center layer. This causes the depletions regions to penetrate deeply into the base, and thus the distance between the emitter-base (EB) and collector-base (CB) depletion regions is minimized.

Transistor operation .

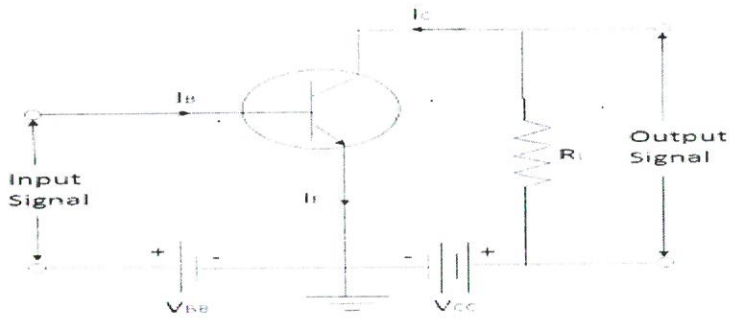


A small value battery VEB forward biases the emitter-base junction of a PNP and the collector-base junction is reverse biased by a high value battery

VCB.The positive terminal of the battery VEB repels the holes in the P-region on the left. These holes in the P- Type emitter to flow towards the base. This constitutes the emitter current IE. As these holes cross into the N-Type base, they tend to combine with the electrons. As the base is lightly doped and very thin, therefore only a few holes (less than 5%) combine with the electrons. The remainders (more than 95%) cross into the collector region. The negative terminal of the battery VCB attracts these holes. This constitutes the collector current Ic

9 a) Develop the input and output characteristics of a transistor in CE configuration

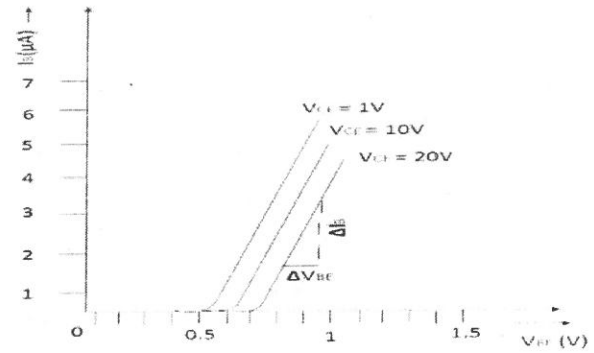
CE Characteristics



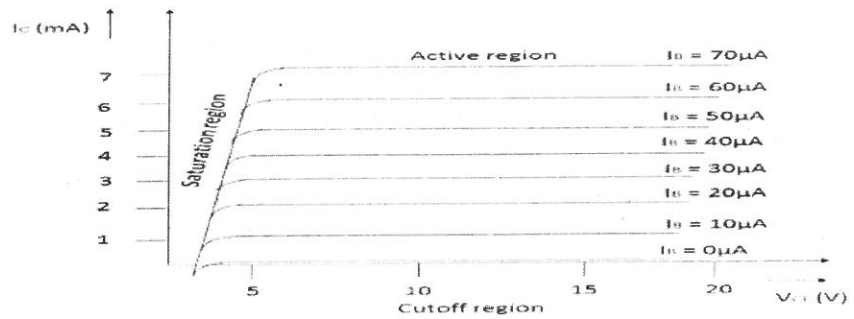
NPN transistor

In this configuration, the input is applied between the base and the emitter and the output is taken from the collector and the emitter. In this connection, the common emitter is common to both the input and the output circuits as shown in fig. In the common emitter configuration, the input current is the base current IB and the output current is the collector current IC. The ratio of change in collector current to the change in base current at constant collector-emitter voltage is called current amplification factor (β).

Input Characteristics: It is a curve, which shows the relationship between the base current IB and the emitter-base voltage, VBE at constant VCE. The method of determining the characteristic is as follows.



Output Characteristics: It is a curve that shows the relationship between the collector IC and the collector-emitter voltage VCE. A suitable base current IB is maintained. VCE is increased in a number of steps from zero and the corresponding values of IC are noted. It is repeated for different values of IB then they are plotted as shownin the fig



b) **Illustrate the evolution of electronics from vacuum tubes to nano electronics**

Evolution of Electronics from Vacuum Tubes – Nano Electronics

Vacuum Tubes (1900s– 1950s): Vacuum Tubes, also known as electron tubes or thermionic valves, were the first practical electronic components. Vacuum Tubes were used for signal amplification and switching in early radios, televisions, and computing devices. Vacuum tubes were relatively large, consumed a lot of power and prone to failures. Transistors (1947): The invention of the transistor at Bell Labs in 1947 by John Barden, Walter Brattain, and William Shockley revolutionized electronics.

Transistors were much smaller and more reliable than vacuum tubes. Transistors played a crucial role in the digital revolution, enabling smaller and more efficient electronic devices. Integrated Circuits (ICs) (1950s-1960s): Jack Kilby and Robert Noyce independently developed the integrated circuit (IC) in the late 1950s and early 1960s. ICS allowed the integration of multiple transistors and other electronic components onto a single silicon chip. ICs paved the way for the development of powerful computers and a wide range of electronic devices.

Microelectronics (1970s-1980s): The 1970s and 1980s saw advancements in semiconductor manufacturing processes, enabling smaller and more densely packed transistors on IC's. Microelectronics played a significant role in the rise of personal computers.

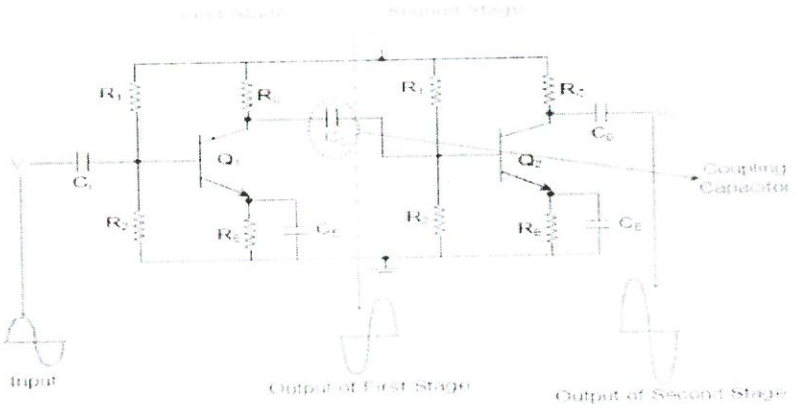
Nano-electronics (Late 20th Century – Present):

Nano – electronics focuses on electronic components at the Nano scale, typically involving structures with dimensions less than 100 Nano-meters. Moore's Law continued to drive the miniaturization of transistors and IC's predicting the doubling of transistor density roughly every 18-24 months. New materials and fabrication techniques, such as strained silicon and high – k dielectrics, have been explored to continue shrinking transistors. P-N Junction Diode

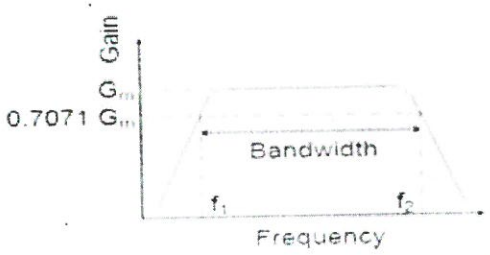
UNIT II

10 a) Analyse the Frequency response characteristics of RC Coupled Amplifier.

RC Coupled Amplifier: A Resistance Capacitance (RC) Coupled Amplifier is basically a multi-stage amplifier circuit extensively used in electronic circuits. Here the individual stages of the amplifier are connected together using a resistor–capacitor combination due to which it bears its name as RC Coupled.



Frequency Response:



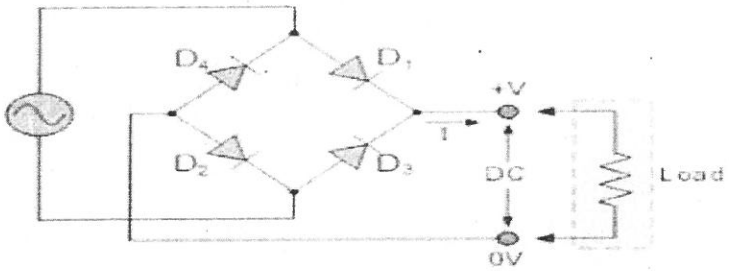
Frequency Response Curve of a RC Coupled Amplifier

The frequency response of a RC coupled amplifier (a curve of amplifier's gain v/s frequency), shown by Figure, indicates that the gain of the amplifier is constant over a wide range of mid-frequencies while it decreases considerably both at low and high frequencies. This is because, at low frequencies, the reactance of coupling capacitor CC is high which causes a small part of the signal to couple from one stage to the other. Moreover for the same case, even the reactance of the emitter capacitor CE will be high due to which it fails to shunt the emitter resistor RE effectively which in turn reduces the voltage gain.

On the other hand, at high frequencies, the reactance of CC will be low which causes it to behave like a short circuit. This results in an increase in the loading effect of the next stage and thus reduces the voltage gain. In addition to this, for this case, the capacitive reactance of the base-emitter junction will be low. This results in a reduced voltage gain as it causes the base current to increase which inturn decreases the current amplification factor β. However, in mid-frequency range, as the frequency increases, the reactance of CC goes on decreasing which would lead to the increase in gain if not compensated by the fact that the reduction in reactance leads to an increase in the loading effect. Due to this reason, the gain of the amplifier remains uniform/constant throughout the mid-frequency band.

b) Analyze the characteristics of full wave bridge rectifier with and without using the capacitor filter.

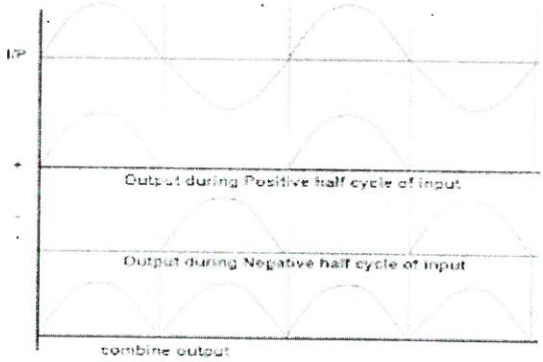
Full Wave bridge rectifier



Without filter:

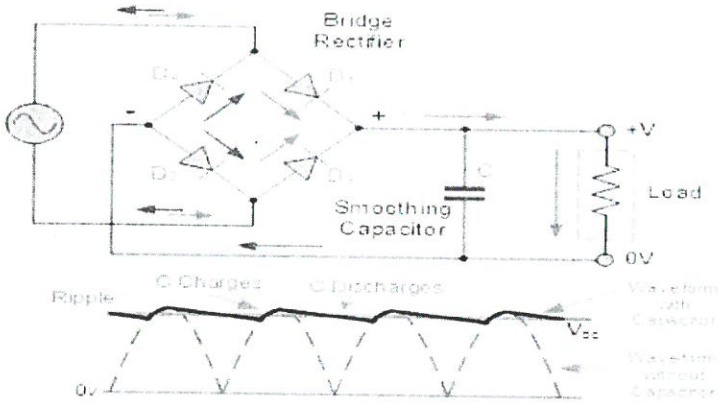
During the positive half cycle of the supply, diodes D1 and D2 conduct in series while diodes D3 and D4 are reverse biased and the current flows through the load.

Waveforms:



During the negative half cycle of the input ac voltage diodes D3 and D4 conduct, whereas diodes D1 and D2 do not conduct. The conducting diodes D3 and D4 will be in series through the load resistance RL and the current flows through the RL, in the same direction as in the previous half cycle. Thus a bidirectional wave is converted into a unidirectional wave.

With filter:

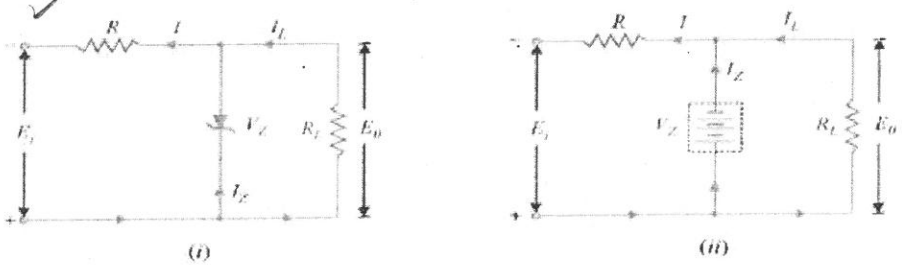


Resultant Output Waveform

During the positive quarter cycle of the ac input signal, the diodes D1 ,D2 are forward biased, the capacitor C gets charges through forward bias diodes D1 ,D2 to the peak value of input voltage Vm. In the next quarter cycle from $\pi/2$ to π the capacitor starts discharging through load resistance RL , because once capacitor gets maximum value diodes D1 ,D2 will be reverse biased and stops conducting, so during this period from $\pi/2$ to π capacitor C supplies load current. In the next quarter cycle from π to $3\pi/2$ of the rectified output voltage, if the input voltage exceeds the capacitor voltage, making diodes D3, D4 forward biased, this charges the capacitor back to Vm. In In the next quarter cycle that is from $3\pi/2$ to 2, the diodes D3, D4 gets reverse biased and the capacitor supplies load current.

11 a) **Describe the operation of Zener diode as aVoltage regulator**

Working of Zener diode as a voltage regulator



(i) (ii)

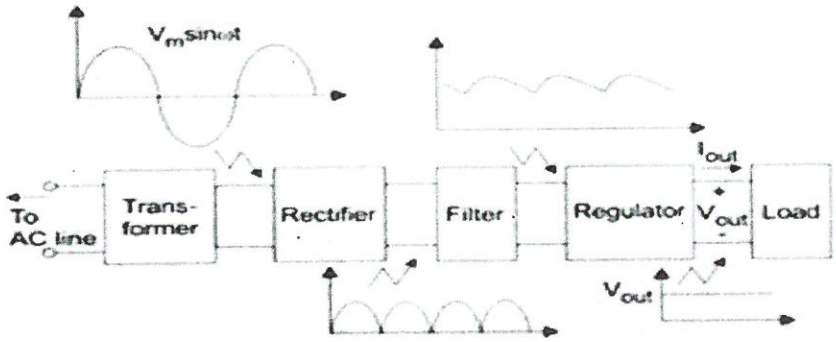
A Zener diode can be used as a voltage regulator to provide a constant voltage from a source whose voltage may vary over sufficient range. The circuit arrangement is as shown in figure (i). The Zener diode of Zener voltage Vz is reverse connected across the load RL across which constant output is desired. The series resistance R absorbs the output voltage fluctuations so as to maintain constant voltage across the load. It may be noted that the Zener will maintain a constant voltage Vz (=EO) across the load so long as the input voltage does not fall below Vz.

When the circuit is properly designed, the load voltage EO remains essentially constant even though the input voltage Ei and load resistance RL may vary over a wide range. (i) Suppose the input voltage increases. It is clear that output voltage remains constant at VZ. The excess voltage is dropped across the series resistance R. This will cause increase in the value of total current I. The Zener will conduct the increase of current in I while the load current remains constant. Hence, output voltage EO remains constant irrespective of the changes in the input voltage Ei .

(ii) Now suppose that input voltage is constant (supply current I is constant) but the load resistance RL decreases. This will cause an increase in load current. The additional current will come from a decrease in Zener current IZ by maintain supply current I constant. Similarly if load RL increases then load current IL will be decreases, absorbed by the Zener diode by increasing its Zener current IZ by maintain supply current I constant. Consequently, the output voltage stays at constant value if load resistance.

b) **With neat block diagram explain the working of a DC power supply. Also mention the principal components used in each block**

Block diagram of a DC power supply



Working:

A regulated power supply can convert unregulated an AC (alternating current or voltage) to a constant DC (direct current or voltage). A regulated power supply is used to ensure that the output remains constant even if the input changes. A regulated DC power supply is also called as a linear power supply, it is an embedded circuit and consists of various blocks. The regulated power supply will accept an AC input and give a constant DC output. Figure below shows the block diagram of a typical regulated DC power supply.

Principal components: . 1. A step down transformer 2. A rectifier 3. A DC filter 4. A regulator

Step Down Transformer: A step down transformer will step down the voltage from the ac mains to the required voltage level. The turn's ratio of the transformer is so adjusted such as to obtain the required voltage value. The output of the transformer is given as an input to the rectifier circuit.

Rectification: Rectifier is an electronic circuit consisting of diodes which carries out the rectification process. Rectification is the process of converting an alternating voltage or current into corresponding direct (DC) quantity. The input to a rectifier is ac whereas its output is unidirectional pulsating DC. Usually a full wave rectifier or a bridge rectifier is used to rectify both the half cycles of the ac supply (full wave rectification).

DC Filtration The rectified voltage from the rectifier is a pulsating DC voltage having very high ripple content. But this is not we want, we want a pure ripple free DC waveform Hence a filter is used. Different types of filters are used such as capacitor filter, LC filter, Choke input filter, π type filter.

Regulation This is the last block in a regulated DC power supply. The output voltage or current will change or fluctuate when there is change in the input from ac mains or due to change in load current at the output of the regulated power supply. This problem can be eliminated by using a regulator. A regulator will maintain the output constant even when changes at the input or any other changes occur.

12 a) **Explain working of AND, NOR and EX-OR gates with truth tables**

AND gate

Logical symbol

Inputs		Output
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Truth table

In the given truth table When both inputs A and B are 0, the output is 0.If either input A or B is 0 while the other is 1,the output is 0.Only when both inputs A and B are 1,the output is 1.This behavior reflects the AND gate's logical operation, where the output is true (1) only when all inputs are true (1).

NOR gate

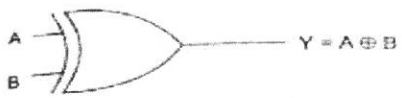
Logical symbol

Inputs		Output
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Truth table

NOR Gate takes Boolean values as input and returns '1', if f all the inputs are 0 and returns 0, if any of the input is 1, or all of the inputs are 1.

EX-OR gate



Logical symbol

Inputs		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Truth table

XOR Gate takes Boolean values as input and returns '1', if the number of logical high input is odd and returns 0, if number of logical high input is even.

b) Convert the following numbers into decimal numbers,

(i) $(110101)_2$ (ii) $(4576)_8$ (iii) $(268B)_{16}$

(i) $(110101)_2$

$1\times2^5+1\times2^4+0\times2^3+1\times2^2+0\times2^1+1\times2^0$

$1\times32+1\times16+0\times8+1\times4+0\times2+1\times1.$

$=32+16+0+4+0+1$

$=(53)_{10}$

(ii) $(4576)_8$

$4\times8^3+5\times8^2+7\times8^1+6\times8^0$

$=2048+320+56+6$

$=(2430)_{10}.$

(iii) $(268B)_{16}$ $(B=11)$

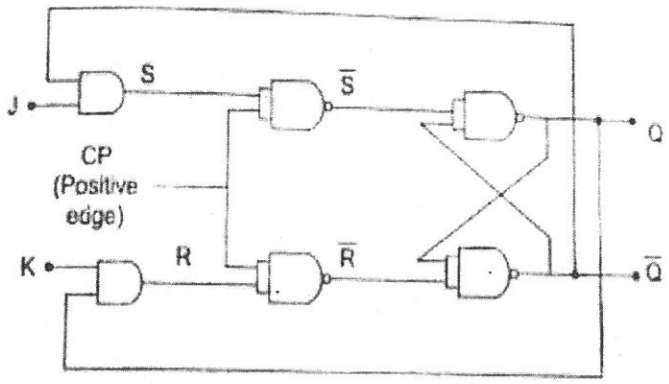
$2\times16^3+6\times16^2+8\times16^1+11\times16^0$

$8192+1536+128+11$

$=(9867)_{10}.$

13a) **Enumerate the master slave JK flip-flop with necessary diagrams and truth table**

Master Slave JK Flipflop



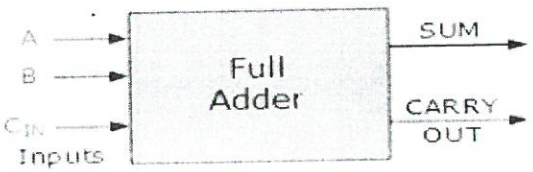
Logic diagram of JK flip-flop

CP	J	K	Qn	Qn+1	State
↑	0	0	0	0	No Change
↑	0	0	1	1	(NC)
↑	0	1	0	0	Reset
↑	0	1	1	0	
↑	1	0	0	1	Set
↑	1	0	1	1	
↑	1	1	0	1	Toggle
↑	1	1	1	0	
0	×	×	0	0	No Change
0	×	×	1	1	(NC)

Truth table of JK flip-flop

1. When the clock pulse goes to 1, the slave is isolated; J and K inputs may affect the state of the system. The slave flip-flop is isolated until the CP goes to 0. When the CP goes back to 0, information is passed from the master flip-flop to the slave and output is obtained.
2. Firstly the master flip flop is positive level triggered and the slave flip flop is negative level triggered, so the master responds before the slave.
3. If J=0 and K=1, the high Q' output of the master goes to the K input of the slave and the clock forces the slave to reset, thus the slave copies the master.
4. If J=1 and K=0, the high Q output of the master goes to the J input of the slave and the Negative transition of the clock sets the slave, copying the master.
5. If J=1 and K=1, it toggles on the positive transition of the clock and thus the slave toggles on the negative transition of the clock.
6. If J=0 and K=0, the flip flop is disabled and Q remains unchanged.

b) **Design a full adder using two half adders and an OR gate.**



Inputs			Outputs	
A	B	C_{in}	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Truth Table

A combinational logic circuit that can add two binary digits (bits) and a carry bit, and produce a sum bit and a carry bit as output is known as a full-adder. In other words, a combinational circuit which is designed to add three binary digits and produces two outputs (sum and carry) is known as a full adder. Thus, a full adder circuit adds three binary digits, where two are the inputs and one is the carry forwarded from the previous addition.