PANIMALAR INSTITUTE OF TECHNOLOGY

Jaisakthi Educational Trust, Chennai – 600 123

Department of Electrical and Electronics Engineering

QUESTION BANK-FINAL YEAR

INSTITUTE:

Vision

An Institution of Excellence by imparting quality education and serve as a perennial source of technical manpower with dynamic professionalism and entrepreneurship having social responsibility for the progress of the society and nation

Mission

Panimalar Institute of Technology will strive to emerge as an Institute of Excellence in the country by

- Providing State-of-the-art infrastructure facilities for designing and developing solutions to the Engineering problems.
- Imparting Quality education and training through qualified, experienced and committed members of the faculty**.**
- ·Inculcating high moral values in the minds of the Students and transforming the students into well rounded personality**.**
- Establishing Industry Institute interaction to make students ready for the industrial environment.
- Promoting research based projects/activities in the emerging areas of Engineering &Technology.

DEPARTMENT:

VISION

To impart innovative technical education with global standards ,inculcate high pattern of discipline, thereby nurturing our Electrical and Electronics Engineering students technologically prominent and ethically strong to meet the challenges of serving the society.

MISSION

- To provide state-of-the art infrastructure to impart quality education in Electrical and Electronics Engineering.
- To shape the young minds of the students with the fundamental knowledge, inter-disciplinary problem solving skills, analytical skills and confidence required to excel in their profession.
- To conduct training programs that bridge the gap between the academic and industry to produce competitive electrical engineering professionals.
- To inculcate a professional attitude, effective communication skills, ethical & moral values in the students, which make themto compete in global scenario.
- To nurture Research and Development activities leading to the novel technologies and innovations for the betterment of the nation.

Program Educational Objective

PEO-I: To **a**pply the technical knowledge in the field of Electrical and Electronics Engineering to pursue higher studies or in their professional career.

PEO-II:.T**o** demonstrate technical knowledge to analyze, design, develop, optimize, and implement complex electrical systems.

PEO-III: To gain multidisciplinary knowledge through projects and industrial training, providing a sustainable competitive edge in R&D and meeting industrial needs in the field of Electrical and Electronics Engineering.

PEO-IV: To possess professional and ethical attitudes with effective communication skills, entrepreneurial thinking and an ability to relate engineering issues to the broader social context.

PEO-V: To develop requisite skills to excel in their chosen profession with an awareness of contemporary issues and the need for life -long learning.

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QUESTION BANK-FINAL YEAR

CONTENTS

EE8701 – HIGH VOLTAGE ENGINEERING

CO.1	Ability to understand the causes of over voltages and its effects on power system and also the various protections against these over voltages
CO.2	Able to understand the Electrical breakdown in gases, pure and commercial liquids and also
CO.3	Ability to understand the generation of high voltages and high currents in the laboratories
CO.4	Able to understand the measurement of high voltages and high currents in the laboratories
CO.5	Ability to understand the testing of power apparatus and insulation coordination

UNIT-I

OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS

PART – A

1. What are the causes of over voltages in power system? (CO1, U) (Nov/Dec 2011) (May 2005)

- Lightning
- Switching surges

2. What is counter poise wire? Give its use. (CO1, U) (Nov/Dec 2011)

Counter poise wires are buried in the ground at a depth of 0.5 to 1m, running parallel to the transmission line conductors and connected to the lower legs. Wire length may be 50 to 100m long.

Use: when the lightning stroke, incident on the tower, discharges first through the tower to the ground and discharges through the counter poise.

3. A transmission line of surge impedance 250 ohm is connected to a cable of surge impedance 50 ohm at the other end, if a surge of 400 kV travels along the line to the junction point, find the voltage build at the junction. (CO1, AN) (April/May 2011)

Solution

Z1=250Ω ; Z2=50Ω ; V=400kV

V1=[(Z2-Z1)/(Z1+Z2)]*V

V1=[(250-50)/(50+250)]*400

V1=266.67 kV

Voltage build at the junction = V+V1

= 400+266.67=666.67kV

4. What are different types of faults that may occur on power lines? (CO1, U) (May 2005)

Symmetrical faults - 3Φ fault (LLLG)

Unsymmetrical faults – (i) L-G fault

(ii) L-L fault

(iii) L-L-G fault

5. Why protection of transmission line important? (CO1, AN)

It is essential for electrical power engineers to reduce the number of outages and preserve the continuity of service and electric supply.

6. What are the causes of over voltages in electric system? (CO1, U) (May/June 2008)

(i) Lightning over voltages

(ii) Switching over voltages

7. How does switching over voltage originate? (CO1, AN)

Switching over voltages originate in the system itself by connection and disconnection of circuit breaker contact or due to initiation or interruption of faults.

8. What are the factors that influence the lightning induced voltage on transmission lines? (CO1, U)

(i) The ground conductivity

(ii) The leader stroke current

(iii) Corona

9. How is transmission lines classified? (CO1, AN)

(i) Lines with no loss or ideal lines

(ii) Line without distortion or distortion less lines

(iii) Line with small losses

(iv) Lines with infinite and finite length defined by all the four parameters

10. Define attenuation and distortion. (CO1, U)

The decrease in the magnitude of the wave as it propagates along the line is called attenuation. The elongation or change of wave shape that occurs is called distortion.

11. How is attenuation and distortion caused? (CO1, AN)

Attenuation is caused due to the energy loss in the line an distortion is caused due to the inductance and capacitance of the line.

12. What are the causes for the change of inductance on transmission line? (CO1, U)

The changes in the inductance are due to the skin effect, the proximity effect and non-uniform distribution effect of the currents and the nearness to steel structures.

13. What are the causes for the change of capacitance on transmission line? (CO1, U)

The variation in capacitance is due to capacitance change in the insulation nearest to the ground structures, etc.

14. What is the effect of corona on transmission lines? (CO1, U) (Nov/Dec 2007)

The effect of corona is to reduce the crest of the voltage wave under propagation, limiting the peak value to the critical corona voltage. Hence, the excess voltage above the critical voltage will cause power loss by ionizing the surrounding air.

15. What are the principles observed in the lattice diagram? (CO1, U)

- All waves travel down hill, i.e, into the positive time.
- The position of the wave at any instant is given by means of the time scale at the left of the lattice diagram.
- The total potential at any instant of time is the super position of all the waves which arrive at that point until that instant of time, displaced in position from each other by time intervals equal to the time difference of their arrival.
- Attenuation is included so that the amount by which a wave is reduced is taken care.
- The previous history of the wave, if desired can be easily traced. If the computation is to be carried out at a point where the operations cannot be directly placed on the lattice diagram, the arms can be numbered and the quantity can be tabulated and computed.

16. Define corona. (CO1, U)

The traveling wave is divided into a number of sections corresponding to different voltage levels, each voltage level corresponding to a different velocity of propagation since each lamination ionizes a different capacitance. Hence, a distortion is caused in the wave shape.

17. What are the components of switching surges? (CO1, U) (May/June 2005)

Switching surges may include high natural frequencies of the system, damped normal frequency voltage component or the restriking and recovery voltage of the system with successive reflected waves from terminations.

18. How does switching surges cause damage to circuit breaker? (CO1, AN)

In circuit breaking operation, switching surges with a high rate of rise of voltage may cause repeated restriking of the arc between the contacts of a circuit breaker, thereby causing destruction of the circuit breaker contacts.

19. What are the factors of origin of switching surges? (CO1, U) (Nov/Dec 2006)

(i) De-energizing of transmission lines, cables, shunt capacitor banks

(ii) Disconnection of unloaded transformer, reactors

(iii) Energization or reclosing of lines and reactive load

(iv) Sudden switching off of loads

(v)Short circuit and fault clearance

(vi) Resonance phenomenon

20. Give the factor for over voltages generation in EHV system. (CO1, U)

Over voltages are generated in EHV system when there is sudden release of internal energy stored either in the electrostatic form in the electromagnetic form.

21. Give the situation that give rise to switching over voltages of short duration and lower magnitude. (CO1, U)

(i) Single pole closing of circuit breaker

(ii) Interruption of fault current when the L-G or L-L fault is cleared

(iii) Resistance switching used in circuit breakers

(iv) Switching lines terminated by transformer

(v) Series capacitor compensated lines

(vi) Sparking of the surge diverter located at the receiving end of the line to limit the lightning over voltages.

22. What are the different method by which switching over voltages of short duration and long magnitude be calculated? (CO1, U)

- Mathematical modeling of a system using digital computer
- Scale modeling using transient network analyzers
- By conducting field tests to determine the expected maximum amplitude of the over voltages and their duration at different points on the line.

23. What are the different measures to control or reduce over voltages? (CO1, U)

(Nov/Dec 2006)

- One step or multi step energisation of lines by pre insertion or resistors
- Phase controlled closing or circuit breakers with proper sensors
- Drainage or trapped charges on long lines before the reclosing of the lines
- Limiting the over voltages by using surge diverter.

24. What are the causes for power frequency and its harmonic over voltages? (CO1, U) (Nov/Dec 2004)(Nov/Dec2017)

- Sudden load rejection (loss of loads)
- Disconnection of inductive loads or connection of capacitive loads
- Ferranti effect, unsymmetrical faults
- Saturation in transformers, etc.
- Tap changing operations.

25. How are the over voltage of power frequency harmonics and voltage with frequency measure the operating frequency caused? (CO1, AN)

These are caused during tap changing operations, by magnetic or Ferro resonance phenomena in large power transformers and by resonating over voltages due to series capacitors with shunt reactors or transformers.

26. What are the methods to control over voltages due to switching? (CO1, U)

(i) Energization of transmission lines in one or more steps by inserting resistance and withdrawing then afterwards

(ii) Phase controlled closing of circuit breakers

(iii) Drainage of trapped charges before reclosing

(iv) Use of shunt reactors

(v) Limiting switching surges by suitable surge diverters.

27. Give the factor by which over voltages due to lightning strokes can be minimized or avoided in practice. (CO1, U)

(i) Shielding the over head lines by using ground wires above the phase wires

(ii) Using the ground rods and counter poise wires

(iii) Including protective devices like expulsion gaps, protector tubes on the lines and surge diverters at the line terminations and substations.

28. Where is surge arrester placed in sub station? (CO1, AN) (May/June 2005)

Surge arresters are devices used at substations and at line terminations to discharge the lightning over voltages and short duration switching surges. These are usually mounted at the line end at the nearest point to the substation. They have a flash over voltage lower than that of any other insulation or apparatus at the substation.

29. What is back flashover? (CO1, U) (Nov/Dec 2016)

When a direct lightning stroke occurs on a tower, the tower has to carry huge impulse currents. If the tower footing resistance is considerable, the potential of the tower rises to a large value, steeply with respect to the line and consequently a flashover may take place along the insulator strings. This is known as back flashover.

30. Define Isokeraunic level or thunderstorm days. (CO1, U) (Nov/Dec 2016) (Nov/Dec 2017)

Isokeraunic level is defined as the number of days in a year when thunder is heard or recorded in particular location.

Number of ground flashovers, Ng = (0.1 to 0.2) TD/strokes/km^2-year.

Ng can be obtained from TD. TD value in india is 30 to 50.

31. What are the causes for switching surges? (CO1, U) (May/June 2016)

- Opening and closing of switchgears.
- In circuit breaker operation, switching surges with a high rate of rise of voltage may cause repeated restriking of the arc between the contacts of the circuit breaker.
- High natural frequencies of the system.
- Damped normal frequency voltage components.

- Restriking and recovery voltage with successive reflected waves from terminations.

32. What are the protective devices used to protect power system equipments against lightning? (CO1, U) (May/June 2016)

Protection of equipments in the power system from over voltages due to lightning can be done by:

- Using ground wires above the phase wires.
- Using ground rods.
- Using counter-poise wires.
- Using protective devices like rod gap, expulsion type and valve type surge arrester, etc.

33. What are the characteristics of a lightning voltage? (CO1, U) (April/May 2015)

Amplitude of the current, the rate of rise, the probability distribution of them and the wave shapes of the lightning voltages and currents.

34. What are the various abnormalities in a high voltage system? (CO1, U) (April/May 2015)

35. What is Bewley Lattice Diagram? (CO1, U) (Nov/Dec 2014)

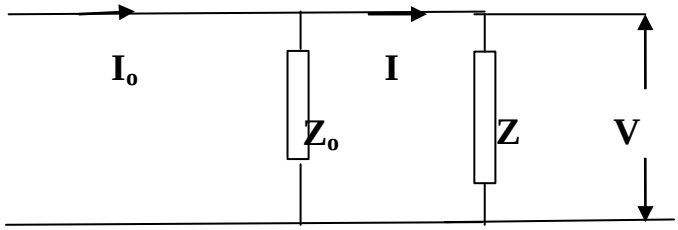
It is the diagram from which the motion of reflected and transmitted waves and their positions at every instant can be obtained.

36. State the causes of over voltage in power system. (CO1, R) (Nov/Dec 2014)

(i) Lightning

(ii) Switching surges.

37. Draw the mathematical model for lightning discharges. (CO1, R) (May/June 2014)



38. State the sources which determine the wave shape of switching surges. (CO1, R) (Nov/Dec 2013)

- Opening and closing of switchgears.
- In circuit breaker operation, switching surges with a high rate of rise of voltage may cause repeated restriking of the arc between the contacts of the circuit breaker.
- High natural frequencies of the system.
- Damped normal frequency voltage components.
- Restriking and recovery voltage with successive reflected waves from terminations.

39. Write down the causes of power frequency and its harmonic over voltages. (CO1, U) (Nov/Dec 2013)

- Sudden load rejection (loss of loads)
- Disconnection of inductive loads or connection of capacitive loads

- Ferranti effect, unsymmetrical faults
- Saturation in transformers, etc.
- Tap changing operations.

40. Mention the different kinds of over voltages. (CO1, U) (May/June 2013)

(i) Lightning over voltages

(ii) Switching over voltages

41. What is stepped leader stroke? (CO1, U) (May/June 2013)

When the electric field intensity at some point in the charge concentrated cloud exceeds the breakdown value of the moist ionized air (= 10 kV/cm), an electric streamer with plasma start towards the ground with a velocity of about 1/10 times that of the light ($3 \text{ X } 10^8$ m/s) but may progress only about 50 m or so before it comes to a halt emitting a bright flash of light. The halt may be due to insufficient build-up of electric charge at its head and not sufficient to maintain the necessary field gradient for further progress of the streamer. But after a short interval of about 100 μs, the streamer again starts out repeating its performance. This discharge is known as stepped leader stroke.

42. Define Lightning phenomenon. (CO1, U) (Nov/Dec 2012)

Lightning phenomenon is a peak discharge in which charge accumulated in the clouds discharge into a neighbouring cloud or to the ground.

43. List some sources causing switching surges. (CO1, U) (Nov/Dec 2012)

(i) Opening and closing of switchgears

(ii) In circuit breaker operation, switching surges with high rate of rise of voltage may cause repeated restriking of the arc between the contacts of the Circuit breaker.

(iii) High natural frequencies of the system

(iv) Damped normal frequency voltage components

(v)Restriking and recovery voltage with successive reflected waves from terminations.

44. List the sources of switching over voltage in power system. (CO1, U) (May/June 2012)

(i) Opening and closing of switchgears

(ii) In circuit breaker operation, switching surges with high rate of rise of voltage may cause repeated restriking of the arc between the contacts of the Circuit breaker.

(iii) High natural frequencies of the system

(iv) Damped normal frequency voltage components

(v)Restriking and recovery voltage with successive reflected waves from terminations.

45. Define isokeraunic level. (CO1, U) (May/June 2012)

Isokeraunic level is defined as the number of days in a year when thunder is heard or recorded in particular location.

number of ground flashovers, Ng=(0.1 to 0.2) TD/strokes/km^2-year

Ng can be obtained from TD. TD value in India is 30 to 50.

46. What is known as Isokeraunic level? (CO1, U) (April/May 2011)

Isokeraunic level is defined as the number of days in a year when thunder is heard or recorded in particular location.

number of ground flashovers, Ng=(0.1 to 0.2) TD/strokes/km^2-year

Ng can be obtained from TD. TD value in India is 30 to 50.

47. Define surge impedance of transmission line. (CO1, U) (April/May 2010)

Surge impedance = $Z_c = \sqrt{L/C}$.

48. Mention the causes for internal over voltages and give their approximate magnitude and frequency. (CO1, U) (May/June 2009)

(i) Power frequency oscillations (or) harmonics

(ii) Switching over voltages.

49. What are the techniques to be adopted for controlling the switching over voltages? (CO1, U) (Nov/Dec 2008)

In EHV or UHV lines, we should control the switching voltages less than 2.5 p.u. The following measures are taken to reduce over voltages:

- One or Multi-step energization of lines by inserting resistors.
- Phase controlled closing of circuit breaker with proper sensors.
- Drain the trapped charges before reclosing of the lines.
- Using shunt reactors.
- By using lightning arresters or surge diverters.

50. What is a surge arrester? (CO1, U) (Nov/Dec 2008)

A surge arrester or lightning arrester is a device used to protect the power system against transient voltages due to lightning and switching surges.

51. What are meant by switching surges? Mention the approximate magnitude of switching surges and their frequency. (CO1, U) (April/May 2008)

A switching surge is a short duration transient voltage produced in the system due to a sudden opening or closing of a switch or circuit breaker or due to an arcing at a fault in the system.

Switching surges contain larger energy than the lightning impulse voltages because:

(i) The transient voltage may be an oscillatory or damped oscillatory wave of frequency ranging from few hundred Hertz to few thousand hertz.

(ii) The transient voltage may be considered as a slow rising impulse having a wave front time of 0.1 to 10 msec.

52. Mention the different kinds of over voltages. (CO1, U) (Nov/Dec 2007)

(i) Lightning over voltages (ii) Switching over voltages.

53. **Write the mathematical model for lightning**. ***(Ap/May 2018)***

Voltage across the object $V=I_0Z$

I_0=lightning stroke current Z=surge impedance

54. **What is the use of protective devices?** ***(Ap/May 2018)***

Protective devices are used to protect the power system components against the travelling waves caused by lightning.

55. What are the causes for power frequency over voltage in power system?(Nov/Dec 2017)

The causes for power frequency and harmonic over voltages in EHV and UHV systems are:

a. Sudden load reflection (loss of loads)
b. Disconnection of inductive loads or connection of capacitive loads.
c. Ferranti effect.
d. Unsymmetrical faults.
e. Saturation in transformers, etc,
f. Tap charging operations.

56. **Define corona critical disruptive voltage.** ***(Ap/May 2017)***

The potential difference between conductors, at which the electric field intensity at the surface of the conductor exceeds the critical value(30kV/cm)and occurs corona is known as corona critical disruptive voltage.

57. **What are the different methods employed for protection of overhead lines against lightning?** (***Ap/May 2017)***

a. Using ground wires above phase wires
b. Using ground rods
c. Using counter-poise wires
d. Using protective devices like rod gap, expulsion gap and valve type arrester etc..

58. **State the sources which determine the wave shape of switching surges.** ***(Ap/May 2018)***

a. Opening and closing of switchgears.
b. In circuit breaker operation, switching surges with a high rate of rise voltage may cause repeated restriking of the arc between the contacts of the CB.
c. High natural frequencies of the system.
d. Damped normal frequency voltage components.
e. Restriking and recovery voltage with successive reflected waves from terminations.

PART – B

1. Explain the technique of modeling the lightning. (CO1,U) (8) (May/June 2012) (Reg. 2008)

2. What are causes of power frequency over voltages in power system? Explain them in detail. (CO1,U) (8)(May/June 2012) (Reg. 2008)
3. Explain the operation of expulsion gap lightning arrester along with advantages and disadvantages. (CO1,U) (8) (May/June 2012) (Reg. 2008)
4. Explain the sources and characteristics of switching surges. (CO1,U) (8) (May/June 2012) (Reg. 2008)
5. Give the origin and characteristics of switching surges and explain the causes of over voltage due to switching surges in EHV and UHV system. (CO1,U) (10) (Nov/Dec 2011) (Reg. 2008)
6. Explain the control measures for over voltage due to switching surge. (CO1,U) (6) (Nov/Dec 2011) (Reg. 2008)
7. Elaborate the discussion on protection of power system equipments using protective devices. (CO1,R) (16) (Nov/Dec 2011) (Reg. 2008)
8. What are the different methods employed for lightning protection of overhead lines? (CO1,U) (16) (Nov/Dec 2004)
9. Explain the characteristics of switching surges with typical wave shapes clearly. (CO1,U) (16) (Nov/Dec 2004)
10. What are the methods used to control of over voltages due to switching? Explain briefly. (CO1,U) (16) (April/May 2005)
11. Explain the selection of surge arresters for E.H.V. system. Explain the V-I characteristics of typical surge arresters. (CO1,U) (16) (April/May 2005)
12. What are the causes for switching and power frequency over voltage? How are they controlled in power systems? (CO1,U) (12) (Nov/Dec 2005)
13. Explain lightning phenomena. (CO1,U) (4) (Nov/Dec 2005)
14. Give the mathematical model of lightning discharges and explain them. (CO1,U) (12) (May/June 2006)
15. Discuss overvoltage due to surges. (CO1,U) (4) (May/June 2006)
16. What are the causes for power frequency over voltages in EHV systems? (CO1,U) (6) (Nov/Dec 2006)
17. A 3 phase single circuit transmission line is 400 km long. If the line is rated for 220 kV and having R = 0.1Ω/km, L = 1.26mH/km and C = 0.009μF/km. Find (1) the surge impedance (2) the velocity of propagation neglecting resistance of the line. If a surge of 150 kV (infinitely long tail) strikes at one end of the line, what is the time taken for the surge to the other end of line? (CO1,U) (10) (Nov/Dec 2006)
18. State the principles that are followed in the insulation design of EHV and UHV substations. (CO1,R) (6) (Nov/Dec 2006)
19. Name the various controlling methods of over voltages due to switching and power frequency and discuss briefly. (CO1,R) (10) (Nov/Dec 2006)
20. With Neat sketches, describe the two types of lightning strokes. (CO1,U) (16) (May/June 2007)

21. What is meant by Insulation coordination? How are the protective devices chosen for optimal insulation level in a power system? (CO1,AN) (16) (May/June 2007)
22. What is meant by ‗Co-efficient of Earthing' of a power system? Explain its implication on the design of insulation of system and connected equipment. (CO1,U) (16) (Nov/Dec 2007)
23. (i) State the different methods of protection against over voltages. (CO1,R) (4)
    (ii) Draw the cross-sectional view of a non-linear resistor lightning arrestor and explain its operation in detail including its V-I characteristics. (CO1,U) (12) (Nov/Dec 2007)
24. Discuss the mechanism of lightning strokes and over voltages on transmission lines. (CO1,U) (8) (April/May 2008)
25. Cloud discharges 15 coulombs within 1.5 milliseconds on to a transmission line during lightning. Estimate the voltage produced at the point of the stroke on the transmission line (Assume the surge impedance of the line as 350 ohms). (CO1,AN) (8) (April/May 2008)
26. Mention the drawbacks of expulsion type lightning arresters. (CO1,U) (4) (April/May 2008)
27. Draw a cross sectional view of a non-linear resistor lightning arrester and explain its operation. (CO1,U) (12) (April/May 2008)
28. Explain the mechanism of lightning stroke. (CO1,U) (10) (Nov/Dec 2016) (Reg. 2013)
29. Give the mathematical models for lightning discharges and explain them. (CO1,AN) (6) (Nov/Dec 2016) (Reg. 2013), (8) (May/June 2016) (Reg. 2008), (6) (May/June 2013) (Reg. 2008) (Nov/Dec 2017)
30. Explain the different methods employed for lightning protection of overhead lines. (CO1,U) (16) (Nov/Dec 2016) (Reg. 2013)
31. What are the causes for power frequency over voltages? How are they controlled in power systems? (CO1,AN) (8) (May/June 2016) (Reg. 2008)
32. A long transmission line is energized by a unit step voltage 1 V at the sending end and is open circuited at the receiving end. Construct the Bewley's lattice diagram and obtain the value of the voltage at the receiving end after a long time. Take the attenuation factor $\alpha = 0.8$. (CO1,AN) (16) (May/June 2016) (Reg. 2008), (16) (Nov/Dec 2014) (Reg. 2008)
33. Briefly describe a method of recording the occurrence of lightning in an over head transmission line. (CO1,U) (8) (April/May 2015) (Reg. 2008)
34. Explain why a steep fronted surge waveform are more vulnerable to insulation. (CO1,U) (8) (April/May 2015) (Reg. 2008)
35. Define surge impedance of a line. Obtain the expression of reflection and transmission waves at transition points. (CO1,U) (16) (Nov/Dec 2014) (Reg. 2008)
36. Discuss the step by step procedure for constructing Bewley's Lattice Diagram with an example. (CO1,U) (8) (May/June 2014) (Reg. 2008)

37. Explain how are switching and power frequency over voltages controlled in power system. (CO1,U) (8) (May/June 2014) (Reg. 2008)
38. Draw the cross-sectional view of a valve type lightning arrester and explain its operation with V-I characteristics. (CO1,U) (8) (May/June 2014) (Reg. 2008)
39. What are the requirements of a ground wire for protecting power conductors against direct lightning stroke? Explain how they are achieved in practice. (CO1,U) (8) (May/June 2014) (Reg. 2008)
40. What are the mechanisms by which lightning strokes develop and induce over voltages on over head power lines? (CO1,U) (8) (Nov/Dec 2013) (Reg. 2008)
41. Write short notes on ground rods as protective devices. (CO1,U) (8) (Nov/Dec 2013) (Reg. 2008)
42. What are the causes for switching and power frequency over voltages? How are they controlled in power systems? (CO1,U) (16) (Nov/Dec 2013) (Reg. 2008)
43. Explain the mechanism of lightning strokes. (CO1,U) (10) (May/June 2013) (Reg. 2008)
44. Explain causes of power frequency over voltages in power system. (CO1,U) (8) (May/June 2013) (Reg. 2008) (April /May 2017)
45. Give a brief note on protection of transmission lines using protection devices. (CO1,U) (8) (May/June 2013) (Reg. 2008)
46. Explain briefly about power frequency over voltages in power systems. (CO1,U) (16) (Nov/Dec 2012) (Reg. 2008)
47. Show the charge distribution patterns in the cloud following Wilson‘s and Simpson‘s theories. (CO1,AN) (16) (Nov/Dec 2012) (Reg. 2008)
48. Describe about various types of shunt protected devices used for overhead lines against lightning stroke. (CO1,U) (8) (April/May 2011) (Reg. 2008)
49. Discuss about the various control techniques for switching and power frequency over voltages. (CO1,U) (8) (April/May 2011) (Reg. 2008)
50. Explain the different theories of charge formation in clouds. (CO1,U) (8) (April/May 2011) (Reg. 2008) (Nov/Dec 2017)
51. An underground cable of inductance 0.150 mH/km and of capacitance 0.2 μF/km is connected to an overhead line having an inductance of 1.2 mH/km and capacitance of 0.006 μF/km. Calculate the transmitted and reflected voltage and current waves at the junction, if a surge of 200 kV travels to the junction, (1) along the cable and (2) along the overhead line. (CO1,AN) (8) (April/May 2011) (Reg. 2008)
52. Explain in detail about the protection of transmission line against the overvoltage. (CO1,R) (16) (Nov/Dec 2017) (Nov/Dec 2018)

UNIT – II

DIELECTRIC BREAKDOWN

1. **Write the criterion for breakdown in non uniform fields. (CO2,U) (May/June 2012)**

   Ý(exp(αd)-1)=1

2. **What is Paschen's Law? (CO2,U) (Nov/Dec 2011) (May/June 2011) (May/June 20018)**

   V=f (pd)

$$f_2\left(\frac{V}{pd}\right)\left[\exp\left\{pdf_1\left(\frac{V}{pd}\right)\right\} - 1\right] = 1$$

   The breakdown voltage of a uniform field gap is a unique function of the product of gas pressure p and gap length d for a particular gas and electrode material. This relation is known as paschen's law.

3. **Define uniform and non-uniform fields. (Ap/May 2018)**

   In uniform field the applied field remains constant across the gap. Example: The field between the two plane electrodes.

   In non uniform field the applied field varies across the gap. The examples are coaxial cylinders, point-plane and the sphere plane gaps.

4. **What are the two main reasons for long term breakdown in composite dielectrics? (CO2,U) (Nov/Dec 2011)**

   (i) Aging and breakdown due to partial discharges

   (ii) Aging and breakdown due to accumulation of charges on insulator surfaces

5. **What do you mean by intrinsic strength of solid dielectrics? (CO2,U) (May/June 2011)**

   When voltages are applied for very short time of the order of 10^{-8} sec, the electric strength of a solid material increases rapidly to an upper limit. This is called as intrinsic electric strength.

6. **What are the different gases that are used as insulating medium? (CO2,U)**

   Air, Nitrogen, carbon dioxide, Freon and sulphur hexa fluoride.

7. **What are the various phenomena that occur in gaseous dielectric? (CO2,U) (May/June 2004)**

When the applied voltage is low, small currents flow between the electrodes and the insulation retains its electrical properties. On the other hand, if the applied voltages are large, the current flowing through the insulation increases very sharply and an electrical breakdown occur.

8. **What is break down voltage? (CO2,U) (Nov/Dec 2008)**

The maximum voltage applied to the insulation at the moment of breakdown is called the breakdown voltage.

9. **Give the types of electrical discharge in gases**. **(CO2,U)**

   (i) Non sustaining discharges (ii) Self sustaining discharges

10. **Define spark breakdown and ionization. (CO2,U) (May/June 2006)**

The break down in a gas, called spark breakdown is the transition of a non-sustaining discharge into self-sustaining discharge. The build-up of high currents in a breakdown is due to the process known as ionization in which electrons and ions are created from neutral atoms or molecules and their migration to the anode and cathode respectively leads to high currents.

11. Give the theories that explain the mechanism for breakdown. (CO2,U) (Nov/Dec 2007)

(i) Townsend theory (ii) Streamer theory

12. Define the elastic collision & inelastic collision. (CO2,U)

Elastic collision are collisions which when occur, no change takes place in the internal energy of the particles but only their kinetic energy gets redistributed. Inelastic collision is those in which internal changes in energy take place within an atom or a molecule at the expense of the kinetic energy of the colliding particles.

13. Define electron drift velocity. (CO2,U)

The electrons drift velocity which has been defined as the average velocity, with which the centre of mass of the electron swarm moves in the direction of the field.

14. What is Maxwellian distribution? (CO2,U) (Nov/Dec 2005)

The Maxwellian distribution has been found to apply where there is thermal equilibrium between the electrons and molecules.

$F(\varepsilon) = C1\ \varepsilon 0.5 \exp(1.5\ \varepsilon/\ \varepsilon)$

15. What is Druyesteynian distribution? (CO2,U)

Druyesteynian distribution applies when the electron or ion energy is much greater than the thermal energy and is therefore expected to be more of application in transcends discharges.

$F(\varepsilon) = C2\ \varepsilon 0.5 \exp(-0.55\ \varepsilon 2/\ \varepsilon\text{-}2)$

15. Define collision cross section. (CO2,U)

Collision cross section is defined as the area of contact between two particles during collision. The total area of impact.

16. What is mean free path? (CO2,U)

The mean free path is defined as the average distance between collisions. When the discharge occurs large number of collisions occurs between the electrons and the gas molecules.

17. What are the different processes by which radiation can be absorbed by atom? (CO2,U)

(i) Excitation of the atom to a higher energy state

(ii) Continuous absorption by direct excitation of the atom or dissociation of diatomic molecule or direct ionization

18. Define the secondary ionization process. (CO2,U) (Nov 2008)

The secondary ionization processes by which secondary electrons are produced are the one which sustain discharge after it is established due to ionization by collision and photo ionization.

19. What is an electron attachment collision? (CO2,U)

The types of collisions in which electrons may become attached to atoms or molecules to form negative ions are called attachment collisions. Electron attachment process depends on the energy of the electron and the nature of the gas.

20. Define time lag. (CO2, U)

The time difference between the application of a voltage sufficient to cause breakdown and the occurrence of breakdown itself is called the time lag.

21. On what factors does time lag depend? (CO2,U)

(i) Statistical time lag- Pre ionization, size of the gap and quantity of radiation

(ii) Formative time lag – Mechanism of the avalanche growth in the gap, transit time.

22. What are the effects of corona? (CO2, U) (Nov/Dec 2006)

(i) Loss of power

(ii) Deterioration of insulation

(iii) Rise to radio interference.

23. Define corona. (CO2, U) (May/Dec 2008)

If the field is non-uniform an increase in voltage will first cause a discharge in the gas to appear at points with highest electric filed intensity namely at sharp points or where the electrodes are curved or on transmission lines. This form of discharge is called a corona discharge.

24. What are the properties of good gaseous dielectric for the HV application? (CO2, U) (Nov/Dec 2006)

(i) High dielectric strength

(ii) Thermal stability and chemical inactivity towards materials of construction.

(iii) Non-flammability and physiological inertness and environmentally non- hazardous.

(iv) Low temperature of condensation

(v) Good heat transfer

(vi) Ready availability at moderate cost.

25. What is vacuum? (CO2, U)

A vacuum system which is used to create vacuum is a system in which the pressure is maintained at a value much below the atmospheric pressure.

26. Define vacuum discharge. (CO2, U)

Electrons get multiplied due to the various ionization processes and an electron avalanche is formed. In high vacuum, even if the electrodes are separated by a few centimeters, an electron crosses the gap without encountering any collisions.

27. What are the different mechanisms of breakdown in vacuum? (CO2, U) (May 2007)

(i) Particle exchange mechanism

(ii) Field emission mechanism

(iii) Clump theory

28. On what factors does liquid dielectric is selected? (CO2, U) (Nov/Dec 2008)

(i) Chemical stability

(ii) Space

(iii) Cost

(iv) Previous usage

(v) Susceptibility to the environmental influences.

29. Give different properties of liquid electric. (CO2, U) (May 2008)(Nov/Dec2017)

(a) Electrical properties

(i) Its capacitance per unit volume or its relative permittivity

(ii) Its resistivity

(iii) Its loss tangent or its power factor

(iv) Its ability to with stand high electric stresses.

(b)Heat transfer characteristics

(c) Chemical stability.

30. What are the factors that influence conduction in pure liquid dielectric and in commercial liquid dielectric? (CO2, U)

(i) The nature and condition of the electrodes

(ii) The physical properties of the liquid

(iii) The impurities and gases present in the liquid

31. What are the various theories that explain breakdown in commercial liquid dielectric? (CO2, U) (Nov 2009)

(i) Suspended particle mechanism

(ii) Cavitation and bubble mechanism

(iii) Stressed oil volume mechanism

32. What are the properties of good solid dielectric? (CO2, U)

(i) Low dielectric loss

(ii) High mechanical strength

(iii) Should be free from gaseous inclusions and moisture

(iv) Resistant to thermal and chemical deterioration

33. Give different solid dielectric material. (CO2, U)

(i) Organic material

(a) Paper

(b) Wood

(c) Rubber

(ii) In organic material

(a) Perspex

(b) PVC

(c) Epoxy resins

(d) Mica

(e) Glass

(f) Porcelain

34. Give different breakdown mechanism in solid dielectrics. (CO2, U) (May/June 2005)

(i) Intrinsic or ionic breakdown

(ii) Electromechanical breakdown

(iii) Failure due to treeing and tracking

(iv) Thermal breakdown

(v) Electrochemical breakdown

(vi) Breakdown due to internal charges.

35. What are the different breakdown mechanisms in composite dielectric? (CO2, U) (May/June 2007)

(i) Short term breakdown ii) Long term breakdown

36. What is an electronegative gas? (CO2, U) (May/June 2012) (Nov/Dec2017)

An electronegative gas is one in which the electrons get attached to form negative ion.

37. What is ionization by collision? (CO2, U) (Nov/Dec 2016)

When an electric field is applied between anode and cathode,any electron from cathode with a neutral molecule and produces a positive ion and a new electron. This additional electrons again collide with a neutral molecule and this process repeats an ionzing collision takes place.

38. Define Gas law. (CO2, U) (Nov/Dec 2016)

It consists of many laws. The following laws are very important. I) Charle‘s law P α T Volume is constant 2) Boyle‘s law P α 1/V T is constant

General equation: PV = nRT Where P-pressure ; V-Volume; n-number of moles ; R-molar gas constant; T-temperature.

39. State Townsend‘s breakdown criterion. (CO2, U) (May/June 2016) (May/June 2018)

$$1-\Upsilon(e^{\alpha ds}-1)=0$$

40. Give the electrical properties that are essential in determining the dielectric performance of a liquid dielectric. (CO2, U) (May/June 2016)

- Permittivity
- Resistivity
- Power factor
- Dielectric strength

PART – B

1. Explain clearly breakdown in non-uniform fields and corona discharges. (CO2,U) (16) (Nov/Dec 2004) (Reg. 2001)
2. Classify the various breakdown mechanisms occurring on solid dielectrics and explain them briefly. (CO2,U) (16) (Nov/Dec 2004) (Reg. 2001)
3. Explain clearly various processes which explain electric breakdown in vacuum. (CO2,U) (8) (May 2012) (Nov/Dec 2017)
4. Describe the breakdown in composite dielectrics due to partial discharge. (CO2,U) (8) (Nov 2011)
5. What are the preferred properties of gaseous dielectrics for high voltage applications? Draw the characteristics of D.C. breakdown strength of typical solid, liquid and gas and vacuum insulators in uniform fields. (CO2,U) (16) (April/May 2005)
6. Explain the characteristics of liquid dielectrics. (CO2,U) (16) (April/May 2005)
7. Deduce an expression for Townsend‘s criteria for breakdown of Gaseous medium. (CO2,AN) (16) (Nov/Dec 2005)
8. Explain the Townsend‘s secondary ionization processes which leads to current growth in gaseous mediums. (CO2,U) (16) (Nov/Dec 2005)
9. Deduce the Townsend‘s break down criteria. Also define the Townsend‘s primary and secondary ionization coefficients. (CO2,AN) (16) (May/June 2006)
10. Explain the various theories of breakdown mechanism of the commercial liquid dielectrics. (CO2, U) (16) (May/June 2006) Explain clearly various processes which explain electric breakdown in vacuum. (CO2,U) (8) (May 2012) (Nov/Dec 2017)
11. Define Townsend‘s first and second ionization coefficients. How is the condition for breakdown obtained in Townsend‘s discharge? (CO2, AN) (16) (Nov/Dec 2006)
12. In an experiment of gas, it was found that at a steady current of 5.5×10^{-8} A with 0.4 cm separation between the plates. For constant field, if the separation reduces to 0.1 cm, results in a current of 5.5×10^{-9} A. Find Townsend‘s primary ionization coefficient. (CO2, AN) (16) (Nov/Dec 2006) (Reg. 2004)

13. Explain the different mechanisms by which breakdown occurs in solid dielectric in practice. (CO2, U) (16) (May/June 2007) (Reg. 2004)
14. A co-axial capacitor is to be designed with an effective length of 20 cm. The capacitor is expected to have a capacitance of 1000 pF and to operate at 15 kV, 500 Hz. Find the dimensions of electrode. Assume the dielectric material is having relative permeability of 2.3. (CO2,AN) (16) (May/June 2007) (Reg. 2004)
15. State the criteria for sparking potential and hence obtain the relation between sparking potential and (pd) values (Paschens Law). Discuss on the nature of variations of sparking potential with (pd) values. (CO2,AN) (16) (May/June 2013) (Reg. 2008) (Nov/Dec 2007)
16. (i) State why the very high intrinsic strength of solid dielectrics is not fully realized in practice. Discuss in detail any one mechanism of break down in solid dielectrics. (CO2,U) (12) (Nov/Dec 2007) (Reg. 2004)
    (ii) Name some of the important practical solid dielectrics and mention their dielectric properties. (CO2,U) (4) (Nov/Dec 2007) (Reg. 2004)
17. (i) Define uniform and non-uniform field. (CO2,U) (4) (April/May 2008) (Reg. 2004)
    (ii) Explain why electronegative gases have high breakdown stress. (CO2,U) (4) (April/May 2008)
    (iii) Discuss Meek‘s theory of breakdown in gases under non-uniform fields. (CO2,U) (8) (April/May 2008)
18. (i) Define intrinsic strength of a solid dielectric material. Explain why intrinsic strength is not fully realized in practice. (CO2,U) (8) (April/May 2008)
    (ii) Discuss the phenomenon of thermal breakdown in solid dielectrics. (CO2, U) (8) (April/May 2008)

20. From the fundamental principles, derive Townsend‘s criteria for the breakdown of gaseous dielectric medium. (CO2, AN) (16) (Nov/Dec 2016) (Reg. 2013), (16) (April/May 2015) (Reg. 2008)

21. Explain the various breakdown theories involved in commercial liquid dielectrics. (CO2, U) (16) (Nov/Dec 2016) (Reg. 2013)

22. Explain the Streamer theory of breakdown in gases. (CO2, U) (8) (May/June 2016) (Reg. 2008)

23. Describe any two mechanisms of Vacuum breakdown. (CO2, U) (8) (May/June 2016) (Reg. 2008)

24. Explain the various theories of breakdown in commercial liquid dielectrics. (CO2, U) (10) (May/June 2016) (Reg. 2008)

25. State and explain the properties of composite dielectrics. (CO2, U) (6) (May/June 2016) (Reg. 2008)

26. A certain dielectric can be considered to be represented by the equivalent circuit shown in figure. What is the maximum voltage that can be applied across the dielectric, if partial discharges in air to be avoided? State any assumptions made. (CO2, U) (16) (April/May 2015) (Reg. 2008)

27. Derive the condition for breakdown in gaseous dielectric and hence obtain Paschen‘s law. Show the variations of sparking potential with (pd) values and explain for such variations. (CO2, U) (16) (Nov/Dec 2014) (Reg. 2008)

28. Discuss the breakdown mechanism of composite dielectrics. (CO2, U) (8) (Nov/Dec 2014) (Reg. 2008)

29. Discuss the two important theories of breakdown in commercial liquids. (CO2, U) (8) (Nov/Dec 2014) (Reg. 2008)

30. Discuss the streamer theory of breakdown in gases. (CO2, U) (8) (May/June 2014) (Reg. 2008)

31. Explain the various mechanism of vacuum breakdown. (CO2, U) (8) (May/June 2014) (Reg. 2008)

32. Explain thermal breakdown mechanism in solid dielectrics. Derive an expression for critical thermal breakdown voltage (V_c) and critical electric field (E_c) for the same. State clearly the assumption made. (CO2, AN) (16) (May/June 2014) (Reg. 2008)

33. Describe the various mechanisms of vacuum breakdown. (CO2, U) (8) (Nov/Dec 2013) (Reg. 2008)

34. What are treeing and trenching? Explain clearly the two processes in solid dielectrics. (CO2, U) (8) (Nov/Dec 2013) (Reg. 2008)

35. Explain the various theories that explain breakdown in commercial liquid dielectrics. (CO2, U) (8) (Nov/Dec 2013) (Reg. 2008)

36. What is corona discharge? Explain clearly anode and cathode coronas. (CO2, U) (8) (Nov/Dec 2013) (Reg. 2008)

37. Explain the breakdown mechanism involved in commercial liquid dielectrics. (CO2, U) (16) (May/June 2013) (Reg. 2008)

38. Discuss the characteristics of liquid dielectrics. (CO2, U) (10) (Nov/Dec 2012) (Reg. 2008)

39. List out the problems caused by corona discharges. (CO2, U) (6) (Nov/Dec 2012) (Reg. 2008)

40. Explain composite dielectrics and how the breakdown occurs in it? (CO2, U) (16) (Nov/Dec 2012) (Reg. 2008)

41. Explain the breakdown mechanisms involving in solid dielectric breakdown. (CO2, U) (16) (May/June 2012) (Reg. 2008)

42. Explain the phenomena of corona discharge and breakdown mechanism in non-uniform fields. (CO2, U) (16) (May/June 2012) (Reg. 2008)

43. Explain in detail the breakdown mechanism in non-uniform fields and phenomenon of Corona. (CO2, U) (16) (Nov/Dec 2011) (Reg. 2008)

44. Describe the ageing and breakdown in composite dielectrics due to partial discharge. (CO2, U) (8) (Nov/Dec 2011) (Reg. 2008)

45. Describe the thermal breakdown mechanism of solid dielectrics. (CO2, U) (8) (Nov/Dec 2011) (Reg. 2008)

46. Explain the breakdown mechanism involving in solid dielectrics breakdown.(16) (April-May‘18)

47. (i) Explain the townsends criterion for a spark.(8) (April-May-18)
(ii)List out the problems caused by corona discharges. (8) (April-May-18)

48. Explain in detail about the various mechanism of breakdown in vaccum.(16) (Nov-Dec-17)

49. Explain the various theories of breakdown mechanism of the commercial liquid dielectrics.(16) (Nov-Dec-16)
50. Discuss about the various properties of composite dielectrics. (April-May-17)
51. From the fundamental principles, derive Townsends criteria for the the breakdown of gaseous dielectric medium. (April-May-18)
52. (i) Explain clearly breakdown in non-uniform fields and corona discharges.(8) (Nov-Dec-17)
    (ii) Explain about time lag in gas breakdown. (8) (Nov-Dec-17)

UNIT – III

GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS

1. What are the advantages of cascaded transformer method? (CO3, U) (Nov/Dec 2011) (May/June 2011)

For higher voltage requirements, a single unit construction becomes difficult and costly due to insulation problems. Also erection and transportation is difficult. So cascaded transformer is preferred.

2. Give the different forms of high voltages. (CO3, R)

(i) High dc voltages

(ii) High ac voltages of power frequency

(iii) High ac voltages of high frequency

(iv) High transient or impulse voltages of very short duration

(v) Transient voltages of longer duration.

3. Give the circuits that produce high dc voltages. (CO3, R) (May/June 2006)

(i) Half wave and full wave rectifier circuit

(ii) Voltage doubler circuit

(iii) Voltage multiplier circuit

(iv) Vande Graff generator

3. On what factors does ripple δV depend? (CO3, AN)

(i) The supply voltage frequency, f

(ii) The time constant CRL

(iii) The reactance of the supply transformer, XL

4. Give the circuits that produce high dc voltages. (CO3, U) (Nov/Dec 2006)

(i) Cascade transformers

(ii) Resonant transformers

5. How is ripple voltage kept low? (CO3, AN)

The ripple voltage is kept as low as possible with the proper choice of the filter capacitor and the transformer reactance for a given load RL.

6. What is the use of regulator circuit? (CO3, U)

The Dc voltage regulator consists of detecting elements actuated by the detector in such a manner as to correct the changes.

7. What are the types of regulator? (CO3, U)

(i) Series type

(ii) Shunt or parallel type

8. What are the chief advantages of resonant transformers? (CO3, U) (May/June 2004)

(i) It gives an output of pure sine wave.

(ii) Power requirement are less

(iii) No high power arcing and heavy current surges occur if the test object fails, as resonance ceases at the failure of the test object

(iv) Cascading is also possible for very high voltages.

(v) Simple and compact test arrangement

(vi) No repeated flashovers occur in case of partial failures of the test object and insulation recovery.

9. Give the advantages of high frequency transformers. (CO3, U)

(i) The absence of iron core in cost and size

(ii) Pure sine wave output

(iii) Slow build-up of voltage over a few cycles and hence no damage due to switching surges.

(iv) Uniform distribution of voltage across the winding coils due to subdivision of coil stack into a number of units.

10. What are the components of multistage impulse generator? (CO3, U) (Nov/Dec 2006)

(i) DC charging set

(ii) Charging resistors

(iii) Generator capacitors and spark gaps

(iv) Wave shaping resistors and capacitors

(v) Triggering system.

(vi) Voltage dividers

(vii) Gas insulated impulse generator.

11. What are the different circuits that are used for producing switching impulse voltage? (CO3, U) (Nov/Dec 2009)

(i) Impulse generator circuit modified to give longer duration wave shapes

(ii) Power transformers or testing transformers excited by dc voltages giving oscillatory waves and these include tesla coil.

12. Define standard switching impulse voltage. (CO3, U) (May/June 2012)

Standard switching impulse voltage is defined both by the Indian standards and the IEC, as 250/2500 μs wave, with the same tolerance for time to front and time to tail as those for the lightning impulse voltage wave and time to half value of (2500±500) μs.

13. Define duration of wave. (CO3, U)

The duration of the wave is defined as the total time of the wave during which the current is at least 10% of its peak value.

14. What are the essential parts of impulse current generator? (CO3, U) (May/June 2010)

(i) DC charging unit giving a variable voltage to the capacitor bank.

(ii) Capacitors of high value each with very low self inductance, capable of giving high short-circuit currents.

(iii) An additional air cored inductor of high current value

(iv) Proper shunts and oscillograph for measurement purposes

(v) A triggering unit and spark gap for the initiation of the current generator.

15. Define peak to peak ripple. **(CO3, U)**

Peak to peak ripple is defined as the difference between maximum and minimum dc voltages.

16. Define time to front if an impulse voltage waveform. (CO3, U) (May/June 2012)(Nov/Dec2017)

Time to front of an impulse voltage waveform is defined as 1.25 times the interval between0.1 to 0.9 of peak value **17. What is the use of tesla coil? (CO3, U)**

Tesla coil is used for generation of high frequency ac voltages.

18. what are the advantages of Van De Graff generator (CO3, U)(Nov/Dec 2017)

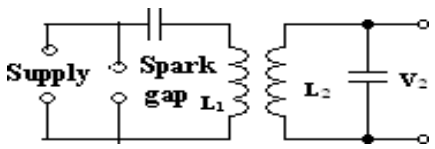
A Van de Graaff generator is an electrostatic generator which uses a moving belt to accumulate electric charge on a hollow metal globe on the top of an insulated column, creating very high electric potentials. It produces very high voltage direct current (DC) electricity at low current levels.

19. What is trigatron gap? (CO3, U)

A trigatron gap consists of a high voltage spherical electrode of suitable size, an earthed main electrode of spherical shape and a trigger electrode through the main electrode.

20. What is a tesla coil? (CO3, U) (Nov/Dec 2016) (Reg. 2013)

High frequency resonant transformer is the Tesla coil. It is a doubly tuned resonant circuit.



21. What is Deltatron circuit? (CO3, U) (Nov/Dec 2016) (Reg. 2013)

The Deltatron or Engetron circuit is a sophisticated cascade transformer HVDC generator circuit. It consists of series connection of transformers but do not have any iron core. These transformers are coupled by using series

capacitors C_s which is used to compensate for stray inductance of transformers. Capacitors C_p is connected in parallel to compensate magnetizing currents. This circuit is loaded by a terminating resistor (R).

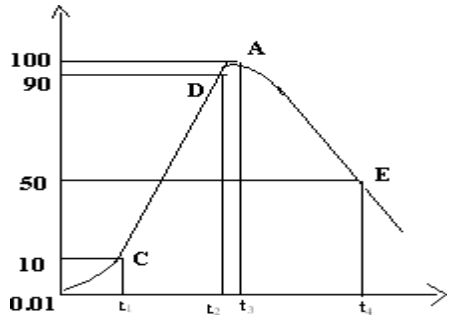
22. What is cascaded transformer? (Ap/May 2018)

For high voltage measurements a single unit construction becomes difficult and costly due to insulation problems. Erection and transportation problem becomes difficult. These drawbacks can be overcome by series connection or cascading of several identical units of transformer, wherein H.V windings of all units effectively connected in series.

23. What are advantages of Vande-Graff generator? (Nov/Dec 2017)

- Very high D.C voltage can be generated easily
- Ripple free output
- Precision and flexibility of control
- Stability of voltage can be achieved

24. Draw the standard impulse waveform. (Nov/Dec 2017)



25. What is trigatron gap? (Ap/May 2017)

The trigatron gap consists of main electrode,earthed electrode of sphere or hemisphere and trigger electrode

26. What is deltatron circuit? (Nov/Dec 2016)

The deltatron circuit is a sophisticated cascade transformer HVDC generator circuit. It consists of series connection of transformers which do not have any iron core.

27. What is the front and tail time of a standard impulse wave? What are the tolerances allowed as per the specifications. (Nov/Dec 2017)

Front time:

It is the time required for the response to rise from 10% to 90% or 0 to 100% of the final value at the very first instance. Front time Standard impulse wave=1.2μs

Tail time:

It is the time to reach 50% peak value. Tail time of standard impulse wave=50 μs

28. How is the circuit inductance controlled and minimized in impulse current generator.

(Nov/ Dec 2018)

Effectiveness inductance of the unit can be reduced by sub-dividing the capacitance into groups of smaller units in parallel.Co-axial cables can be used because of inherently very low inductance between the capacitors.

PART – B

1. Explain the simple voltage doubler circuit operation. (CO3, U) (4) (May 2012) (Nov 2011)
2. Explain in detail the methods of switching surge generation from impulse generator and from power transformer (CO3, U) (12) (may 2012)
3. How impulse current is generated using capacitor bank. (CO3, AN) (8)(Nov 2011)
4. What are the different forms of high voltages classified? Explain any one method of voltage multiplier circuits. (CO3, U) (16) (Nov/Dec 2004)
5. Draw and explain the circuits for producing impulse waves. (CO3, U) (16) (Nov/Dec 2004)
6. Discuss with diagram the operation of Van de Graff generator. (CO3, U) (16) (April/May 2005), (May 2012) (Nov 2011) (Nov/Dec 2017)
7. Describe the cascade transformer connection to generate high alternating voltages. (CO3, U) (16) (April/May 2005)
8. With a neat sketch explain the working principle of Van de Graaff generator. (CO3, U) (16) (Nov/Dec 2005)
9. Explain any one method of generating HV AC at power frequency and discuss its limitation/feature. (CO3, U) (16) (Nov/Dec 2005)
10. With a neat circuit explain the working principle of a Cockcroft – Walton voltage multiplier circuit. (CO3, U) (16) (May/June 2006)
11. Give the Marx circuit – multistage impulse generator. How the basic arrangements are modified to accommodate the wave time control resistances? (CO3, U & AN) (16) (May/June 2006)
12. A 100 KVA, 250 V/200 KV feed transformer has R and X of 1% and 5% respectively. This transformer is used to test a cable at 400 KV at 50 Hz. The cable takes a charging current of 0.5 A at 400 KV. Determine the series inductance required. Assume 1% resistance for inductor. Also determine the input voltage to the transformer. Neglect dielectric loss of a cable. (CO3, AN) (16) (Nov/Dec 2006)
13. Describe with neat diagram the principle of operation, advantages, limitations and applications of Van de Graaff generator. (CO3, U) (16) (Nov/Dec 2006)
14. What is a Tesla coil? How are damped high frequency oscillations obtained from a Tesla coil? (CO3, U & AN) (16) (May/June 2007) (Nov/Dec 2017)
15. Give the Marx circuit arrangement for multistage impulse generators. How is the basic arrangement modified to accommodate the wave time control resistances? (CO3, U & AN) (16) (May/June 2007)

16. (i) Explain the need for generating high voltages. (CO3, U) (4) (Nov/Dec 2007)
    (ii) Draw the circuit of an n-stage Cockcroft – Walton circuit for generating very high DC voltages and explain its operation. Also derive an expression for the ripple content in the output wave form. (CO3, U & AN) (12) (Nov/Dec 2007)
17. (i) Starting from the basic ‗MARX' circuit, develop the circuit of a modern multi-stage impulse generator and explain its operation. Discuss on the significance of various parameters. (CO3, U) (10) (Nov/Dec 2007)
    (ii) Explain tripping of impulse generators. (CO3, U) (6) (Nov/Dec 2007)
18. Discuss the merits of Cascaded transformer over a two winding transformer for producing very high ac voltages. (CO3, U) (6) (April/May 2008)
19. What are the different forms of high voltages classified? Explain any one method of voltage multiplier circuits. (CO3, U) (16) (Nov/Dec 2004)
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25. With a neat circuit explain the working principle of a Cockcroft – Walton voltage multiplier circuit. (CO3, U) (16) (May/June 2006)
26. Give the Marx circuit – multistage impulse generator. How the basic arrangements are modified to accommodate the wave time control resistances? (CO3, U & AN) (16) (May/June 2006)
27. A 100 KVA, 250 V/200 KV feed transformer has R and X of 1% and 5% respectively. This transformer is used to test a cable at 400 KV at 50 Hz. The cable takes a charging current of 0.5 A at 400 KV. Determine the series inductance required. Assume 1% resistance for inductor. Also determine the input voltage to the transformer. Neglect dielectric loss of a cable. (CO3, AN) (16) (Nov/Dec 2006)
28. Describe with neat diagram the principle of operation, advantages, limitations and applications of Van de Graaff generator. (CO3, U) (16) (Nov/Dec 2006)
29. What is a Tesla coil? How are damped high frequency oscillations obtained from a Tesla coil? (CO3, U & AN) (16) (May/June 2007)
30. Give the Marx circuit arrangement for multistage impulse generators. How is the basic arrangement modified to accommodate the wave time control resistances? (CO3, U) (16) (May/June 2007)

31. (i) Explain the need for generating high voltages. (CO3, U) (4) (Nov/Dec 2007)

    (ii) Draw the circuit of an n-stage Cockcroft – Walton circuit for generating very high DC voltages and explain its operation. Also derive an expression for the ripple content in the output wave form. (CO3, U & AN) (12) (Nov/Dec 2007)

32. (i) Starting from the basic ‗MARX' circuit, develop the circuit of a modern multi-stage impulse generator and explain its operation. Discuss on the significance of various parameters. (CO3, U) (10) (Nov/Dec 2007) (May/June 2011)

    (ii) Explain tripping of impulse generators. (CO3, U) (6) (Nov/Dec 2007)

33. (i) Discuss the merits of Cascaded transformer over a two winding transformer for producing very high ac voltages. (CO3, U) (6) (April/May 2008)

34. Mention the necessity of generating high DC voltages. (CO3, U) (4) (Nov/Dec 2016) (Reg. 2013)

35. Explain with a neat diagram the generation of high DC voltages using Van-de-graff generator. State the factors which limit the voltage developed. (CO3, U) (12) (Nov/Dec 2016) (Reg. 2013)

36. Explain the working principle of Cockroft-Walton voltage multiplier circuit. Derive an expression for total voltage drop and total ripple voltage of n-stage voltage multiplier circuit and hence deduce the condition for optimum number of stages. (CO3, U & AN) (16) (Nov/Dec 2016) (Reg. 2013)

37. Describe with a neat diagram, the working principle of the following high voltage producing apparatus:

    (i) Van de Graaff generator (10)

    (ii) Resonant transformer (6) (CO5, U) (May/June 2016) (Reg. 2008)

38. What are the essential parts of an impulse current generator? (CO5, U) (4) (May/June 2016) (Reg. 2008)

39. An impulse generator has eight stages with each condenser rated for 0.16 µF and 125 kV. The load capacitor available is 1000 pF. Find the series resistance and the damping resistance needed to produce 1.2/50 µs impulse wave. What is the maximum output voltage of the generator, if the charging voltage is 120 kV? (CO5, U) (12) (May/June 2016) (Reg. 2008)

40. Discuss with diagram the operation of Van de Graff generator. What are the factors that limit the maximum voltage obtained. (CO3, U) (April/May 2005), (May 2012) (Nov 2011) (Nov/Dec 2017)

41. Explain with neat diagram the generation of high DC voltage using vande-Graff generator.State the factors which limit the ultimate voltage developed.(16) *(April-May'18)*

42. Explain the Marx circuit arrangement for multistage impulse generator.How is the basic arrangement modified to accommodate the wavetime control resistance.(16) *(Nov-Dec-18)*

43. A cockraft Walton type voltage multiplier has 8 stages with capacitances,all equal to 0.05µF.The supply transformer secondary voltage is 125KV at a frequency of 125Hz. If the load current to be supplied is 4.5mA. Find 1) the % ripple 2) the regulation.(8) *(April-May-17)*

44. An impulse generator has 8 stages with each condenser rated for 0.16µF and 125kV. The load

capacitor available is 1000pF.Find the series resistance and the damping resistance needed to produce 1.2/50μs impulse wave.what is the maximum output voltage of the generator, if the charging voltage is 120kV.(16)*(May-June -2016)*

UNIT – IV

MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS

1. Why is measurement of high voltages and high current necessary? (CO4, AN) (May/June 2009)

In industrial testing and research laboratories, it is essential to measure the voltages and currents accurately, ensuring perfect safety to the personnel and equipment.

2. What are the methods available for measuring dc voltages? (CO4, U) (Nov/Dec 2007)

(i) Series resistance micro ammeter

(ii) Resistance potential divider

(iii) Generating voltmeter

(iv) Sphere and other spark gaps

3. What are the methods available for measuring ac voltages of high frequency? (CO4, U)

(i) Potential dividers with a cathode ray oscillograph

(ii) Peak voltmeters

(iii) Sphere gaps

4. What are the methods available for measuring ac voltages of power frequency? (CO4, U) (May/June 2007) (Nov/Dec2017)

(i) Series impedance ammeters

(ii) Potential dividers

(iii) Potential transformers

(iv) Electrostatic voltmeters

(v) Sphere gaps

5. What are the methods available for measuring dc current? (CO4, U)

(i) Resistive shunts with milli ammeter

(ii) Hall effect generators

(iii) Magnetic links

6. What are the methods available for measuring ac current of high frequency? (CO4, U)

(i) Resistive shunts

(ii) Magnetic potentiometers

(iii) Magnetic links

(iv) Hall effect generators

7. What are the methods available for measuring ac current of power frequency? (CO4, U)

(i) Resistive shunts

(ii) Electromagnetic current transformers

8. What are limitations in the series resistance design? (CO4, U)

(i) Power dissipation and source loading

(ii) Temperature effects and long time stability

(iii) Voltage dependence or resistive elements

(iv) Sensitivity to mechanical stresses.

9. What is generating voltmeter? (CO4, U) (Nov/Dec 2010)

A generating voltmeter is a variable capacitor electrostatic voltage generator which generates current proportional to the applied external voltage. The device is driven by an external synchronous or constant speed motor and does not absorb power or energy from the voltage measuring source.

10. What are the advantages and limitations of generating voltmeter? (CO4, U)

Advantages: (i) No source loading by the meter

(ii) No direct connection to high voltage electrode

(iii) Scale is linear and extension of range is easy

(iv) A very convenient instrument for electrostatic Devices.

Limitations:

(i) They require calibration

(ii) Careful construction is needed and is cumbersome instrument requiring an auxiliary drive

(iii) Disturbance in position and mounting of the electrodes make the calibration invalid.

11. Give the different methods of measuring dc electric field strength. (CO4, U)

(i) Variable capacitor field meter

(ii) Vibrating plate field meter

(ii) A.C field strength meter: capacitor probe

12. How series capacitance is formed in voltmeter for measurement? (CO4, AN)

The series capacitance is formed as a parallel plate capacitor between the high voltage terminal of the transformer and a ground plate suspended above it.

13. What are the advantages of capacitance voltage transformers (CVT)? (CO4, U) (May/June 2012)(Nov/Dec2017)

(i) Simple design and easy installation

(ii) Can be used both as a voltage measuring device for meter and relaying purposes and also as a coupling condenser for power line carrier communication and relaying. (iii) Frequency independent voltage distribution

along elements as against conventional magnetic potential transformers which require additional insulation design against surges.

(iv) Provides isolation between the high voltage terminal and low voltage metering.

14. What are the sources that contribute to the error? (CO4, U)

(i) The effective value of the capacitance being different from the measured value of C.

(ii) Imperfect rectifiers which allows small reverse currents

(iii) Non-sinusoidal voltage waveforms with more than one peak or maxima per half cycle.

(iv)Deviation of the frequency from that of the value used for calibration.

15. What are the different ways by which sphere gap can be arranged? (CO4, U) (May/June 2010)

Sphere gaps can be arranged either (i) Vertically with lower sphere grounded or (ii) horizontally with both sphere connected to the source voltage or one sphere grounded. In horizontally configurations, it is generally arranged such that both spheres are symmetrically at high voltage above the ground. The two shapes used are identical in size and shape.

16. Why is series resistance connected between the source and sphere gap? (CO4, AN)

A series resistance is usually connected between the source and the sphere gap to (i) limit the breakdown current and (ii) to suppress unwanted oscillations in the source voltage when breakdown occurs.

17. Give the factors that affect the spark over voltage of sphere gap. (CO4, U)

(i) Nearby earthed objects

(ii) Atmospheric conditions and humidity

(iii) Irradiation

(iv) Polarity and rise time of voltage waveform.

18. For what rod gaps are used? (CO4, U) A rod gaps are used for approximate measurement of peak values of power frequency voltages and impulse voltage. IEEE recognizes that this method gives accuracy within 8%.

19. What are the elements that cause different error in the potential divider for impulse voltage measurement? (CO4, U)

(i) Residual inductance in the elements.

(ii) Stray capacitance occurring

(a) Between the elements

(b) From sections and terminals of the elements to ground.

(c) From the high voltage lead to the elements or sections.

(iii) The impedance errors due to

(a) Connecting leads between the divider and the test objects

(b) Ground return leads and extraneous current in ground lead

(iv) Parasitic oscillations due to lead and cable inductance and capacitance of high voltage terminal to ground.

20. What are the different techniques for impulse current measurement? (CO4, U) (May/June 2010)

(i) Rogowski coil

(ii) Magnetic links

(iii) Hall generators

(iv) Faraday generator

(v) Current transformer

21. How is delay obtained in cathode ray oscillograph for impulse measurement? (CO4, AN)

(i) A long interconnecting coaxial cable 20 to 50 m long. The required triggering is obtained from an antenna whose induced voltage is applied to the external trigger terminal.

(ii) The measuring signal is transmitted to the CRO by a normal coaxial cable. The delay is obtained by an externally connected coaxial long cable to give the necessary delay.

(iii) The impulse generator and the time base of the CRO are triggered from an electronic tripping device. A first pulse from the device starts the CRO time base and after a predetermined times a second pulse triggers the impulse generator.

22. State the disadvantages of CVT method of measurement. (CO4, U) (May/June 2012)

(i) Voltage ratio is susceptible to temperature variations.

(ii) In the presence of capacitance and choke, the problem of Ferro-resonance occurs in power system.

23. What are the advantages of generating voltmeters? (CO4, U) (Nov/Dec 2016) (Reg. 2013)

- Scale is linear and extension of voltage range is easy.
- It can measure wide range of voltages.
- Source loading is zero.
- There is no direct connection to H.V. electrode.

24. List some advantages of Faraday generator. (CO4, U) (Nov/Dec 2016) (Reg. 2013)

- No electric connection between the source and the device.
- No thermal problems even for large currents of several kA.
- No insulation problem arises for EHV system, because signal transmission is through optical system.

25. How the stray effect is reduced in resistive shunt type of measurements?(Ap/May 2018)

To reduce stray effects,the resistance shunt is designed as follows:

- Bifilar flat strip design
- Coaxial tube design
- Coaxial squirrel cage design

26. Explain the basic principle of hall generator? (Ap/May 2018)

Whenever an electric current flows through a metal plate placed in a magnetic field perpendicular to it, Lorentz force will deflect the electrons in the metal plate in a direction perpendicular to both the magnetic field and the flow of current. The change in displacement generates an emf called hall voltage

27. What are the advantages of CVT measurements in HVAC? (Nov/Dec 2017)

- Simple design and easy installation
- Can be used both as a voltage measuring device for meter and relaying purpose and as a coupling condenser for power line carrier communication and relaying
- Frequency independent voltage distribution along elements as against conventional magnetic potential transformer which require additional insulation design
- Provides isolation between the high voltage terminal and low voltage testing.

28. What type of measuring devices preferred for measurement of high frequency impulse current?(Nov/Dec 2017)

Park‘s tubular shunt (or) coaxial tube is preferred for measurement of impulse current of short duration.

PART – B

1. Explain the faraday generator method of measurement. (CO4, U) (8) (May/June 2012)
2. Explain the electro optical method of high frequency alternating current measurement. (CO4, U) (8) (May/June 2012)
3. Tabulate the high voltage and high current measurement techniques for different types of voltages and currents. (CO4, AN) (16) (Nov/Dec 2004)
4. Explain sphere gap for measurement of high voltage with diagrams. (CO4, U) (16) (Nov/Dec 2004)
5. Explain with diagram the extended series resistance for high a.c. voltage measurements. (CO4, U) (16) (April/May 2005)
6. Describe a new scheme of current transformer measurements introducing electro-optical technique for EHV systems. (CO4, U) (16) (April/May 2005)
7. With a neat sketch explain the principle of operation of an electrostatic voltmeter for HV AC measurement. What are the merits and demerits? (CO4, U) (16) (Nov/Dec 2005) (May/June 2012) (Nov/Dec 2011)(Nov/Dec2017)
8. What is CVT? Explain through phasor diagram how a tuned CVT can be used for HV AC measurement in substations. (CO4, U) (16) (Nov/Dec 2005)
9. With a neat sketch explain the Sphere gap measurements for peak voltage measurement. (CO4, U) (16) (May/June 2006)
10. Discuss the various techniques for the measurement of impulse voltage. (CO4, U) (16) (May/June 2006) (May 2011)

11. A Rogowski coil is required to measure impulse current of 8 KA having rate of change of current of 10^{10} A/sec. The voltmeter is connected across the integrating circuit which reads 8 volts for full scale deflection. The input to integrating circuit is from Rogowski coil. Determine the mutual inductance of coil, R and C for the integrating circuit. (CO4, AN) (16) (Nov/Dec 2006)
12. What is Capacitance Voltage Transformer? Explain with phasor diagram how a tuned CVT can be used for high voltage measurement in power systems. (CO4, U) (16) (Nov/Dec 2006)
13. The effective diameter of the moving disc of an Electrostatic voltmeter is 15 cm with a separation of 1.5 cm. Find the weight in grams that is necessary to be added to balance the moving plate when measuring a voltage of 50 kV d.c. Derive any formula used. What is force of attraction between the plates when they are balanced? (CO4, AN) (16) (May/June 2007)
14. What is CVT? Explain with phasor diagram how a tuned capacitance voltage transformer can be used for voltage measurement in power system? (CO4, U) (16) (May/June 2007)
15. (i) Explain why we resort to statistical approach for impulse studies. (CO4, U) (4) (Nov/Dec 2007)
    (ii) Define 50% impulse disruptive discharge voltage and discuss in detail any one method of obtaining the same. (CO4, U) (12) (Nov/Dec 2007)
16. Explain the measurement of very high voltages using sphere gaps. Mention the merits and demerits of using sphere gaps. (CO4, U) (16) (Nov/Dec 2007)

17. (i) Compare the merits and demerits of measuring very high voltages using sphere gaps and potential dividers. (CO4, AN) (8) (April/May 2008)

(ii) Describe the generating voltmeter method for measuring high d.c. voltages? (CO4, U) (8) (April/May 2008) (Nov/Dec2017)

16. (i) Define 50 percent disruptive discharge voltage as applied to impulse voltages. (CO4, U) (4) (April/May 2008)

(ii) Mention the methods adopted to obtain 50% disruptive discharge voltage and discuss any one method in detail. (CO4, U) (12) (April/May 2008)

17. Enumerate digital peak voltmeter. (CO4, U) (8) (Nov/Dec 2016) (Reg. 2013)

18. What is CVT? Explain how CVT can be used for high voltage AC measurement. (CO4, U) (8) (Nov/Dec 2016) (Reg. 2013)

19. Explain how a sphere gap can be used to measure the peak value of voltages? Also discuss the parameters and factors that influence such voltage measurement. (CO4, U) (16) (Nov/Dec 2016) (Reg. 2013)

20. Explain any two methods to measure high impulse current. (16) (April-May-18)

21. A Rogowski coil is required to measure impulse current of 8kA having a rate of change of currwnt of 1010A/sec.The voltmeter is connected across the integrating circuit which reads 8v for full scale

deflection.The input of integrating circuit is from the coil.Determine M,L and C of the integrating circuit.(16)(April-May-11)

22. A coaxial shunt is to be designed to measure an impulse current of 40kA. If the bandwidth of the shunt is to be atleast 10MHz and if the voltage drop across the shunt should not exceed 50V.Find the ohmic value of the shunt and its dimensions. (8)(April-May-17)

UNIT – V

HIGH VOLTAGE TESTING AND INSULATION COORDINATION

1. What is the necessity of high voltage testing? (CO5, U) (May/June 2012)

It is essential to ensure that the electrical equipment is capable of withstanding the over voltages that are met with in service. The over voltages may be either due to natural causes like lightning or system originated ones such as switching or power frequency transient voltages. Hence, testing for over voltages is necessary.

2. What are the classifications of over voltage test? (CO5, U) (Nov/Dec 2009)

(i) Power frequency voltage test

(ii) Impulse voltage test.

3. Define disruptive discharge voltage. **(CO5, U)(Nov/Dec2017)**

Disruptive discharge voltage is defined as the voltage which produces the loss of dielectric strength of insulation. It is that voltage at which the electrical stress in the insulation causes a failure which includes the collapse of voltage and passage of current.

4. Define withstand voltage. (CO5, U) (Nov/Dec 2008)

The voltage which has to applied to a test object under specified conditions in a withstand test is called the withstand voltage.

5. Define fifty percent flashover voltage. (CO5, U) (Nov/Dec 2016) (Reg. 2013)

This is the voltage which has a probability of 50% flashover, when applied to test object.

6. What are hundred percent flashover voltages? (CO5, U)

The voltage that causes a flashover at each of its applications under specified conditions, when applied to test objects as specified , is hundred per cent flash over voltage.

7. Define creepage distance. (CO5, U)

It is the shortest distance on the contour of the external surface of the insulator unit or between two metal fittings on the insulator.

8. Give the absolute parameters for testing. (CO5, U)

(i) Temperature: 27 degrees

(ii) Pressure: 1013millibars

(iii) Absolute humidity: 17 gm / m3

9. What is type test and routine test? (CO5, U) (May/June 2012)

Type test are intended to prove or check the design features and the quality. The routine tests are intended to check the quality of the individual test piece.

10. Give the different power frequency test. (CO5, U)

(i) Dry& wet flashover test

(ii) Wet & dry flashover test

11. What is dry& wet flashover test? (CO5, U)

If the test is conducted under normal conditions without any rain or precipitation it is called dry flash over test. If the test is done under conditions of rain it is called wet flash over test.

12. Give the different impulse test. (CO5, U) (May/June 2006)

(i) Impulse withstand voltage test.

(ii) Impulse withstands flash over test.

(iii) Pollution test.

13. Define the impulse withstand voltage test. (CO5, U) (Nov/Dec 2007)

This is the test done by applying standard impulse voltage of specified value under dry conditions with both positive and negative polarities of the wave. If five consecutive waves do not cause a flash over or puncture, the insulator is deemed to have passed the test.

14. What is the various type of pollution? (CO5, U)

(i) Dust, micro organisms, bird secretions flies

(ii) Industrial pollution

(iii) Coastal pollution

(iv) Desert pollution

(v) Ice and fog deposits.

15. What are the different types of power frequency test for bushing? (CO5, U)

(i) Power factor voltage test

(ii) Internal or partial discharge test

(iii) Momentary withstand test at power frequency.

(iv) One minute wet with stand test at power frequency

(v) Visible discharge test at power frequency.

16. What are the different types of impulse voltage test for bushing? (CO5, U) (Nov/Dec 2007)

(i) Full wave withstand test

(ii) Chopped wave with stand and switching surge test.

(iv) Temperature rise and thermal stability tests.

17. Define an isolator. (CO5, U)

An isolator or a disconnector is a mechanical switching device, which provides in the open position, an isolating distance in accordance with special requirements.

18. What does testing of circuit breaker intended to evaluate? (CO5, U)

(i) The constructional and operational characteristics

(ii) The electrical characteristics of the circuit which the switch or breaker has to interrupt or make.

19. Give the different characteristics of circuit breaker. (CO5, U)

(i) (a) The electrical characteristics which determine the arcing voltage , the current chopping characteristics , the residual current, the rate of decrease of conductance of the arc space and the plasma, and the shunting effects in interruption.

(b) Other physical characteristic including the media in which the arc is extinguished, the pressure developed or impressed at the point of interruption, the speed of the contact travel, the number of breaks, the size of the arcing chamber and the materials and configuration of the circuit interruption.

(ii) The characteristics of the circuit include the degree of electrical loading, the normally generated or applied voltage, the type of fault in the system which the breaker has to clear, the time of interruption, the time constant, the natural frequency and the power factor of the circuit, the rate of rise of recovery voltage, the restriking voltage, the decrease in the a.c. component of the short circuit current and the degree of asymmetry and the dc component of the short circuit current.

20. Give the advantage and disadvantages on field test. (CO5, U)

Advantages:

(i) The circuit breaker is tested under actual conditions

(ii) Special occasions

(iii) To assess the thermal and dynamic effects of short circuit currents, to study applications of safety devices and to revise the performance test procedures.

Disadvantages:

(i) The circuit breaker can be tested at only a given rated voltage and network capacity.

(ii) The necessity to interrupt the normal service and to test only at light load conditions.

(iii) Extra inconvenience and expenses in installation of controlling and measuring equipment in the field.

21. What are the different test conducted on circuit breaker and isolator? (CO5, U)

(i) The dielectric test

(ii) The temperature rise test

(iii)The mechanical test

(iii) The short circuit test.

22. What are the different tests available for testing cables? (CO5, U) (Nov/Dec 2010)

(i) Mechanical test

(ii) Thermal duty tests

(iii) Dielectric power factor test

(iv) Power frequency withstand voltage test

(v) Impulse withstand voltage test

(vi) Partial discharge test

(vii) Life expectancy test.

23. Give the methods of testing transformers. (CO5, U) (May/June 2009)

(i) Induced over voltage test

(ii) Partial discharge test.

24. What is the purpose of impulse testing of transformers? (CO5, U) (Nov/Dec 2007)

The purpose of the impulse test is to determine the ability of the insulation of the transformers to withstand the transient voltages due to lightning, etc.

25. What is the sequence of impulse testing? (CO5, U)

(i) Applying impulse voltage of magnitude 57% of the Basic impulse Level (BIS) of the transformer under test.

(ii) One full wave voltage of 100% BIL.

Two chopped waves of 100% BIL

(iv) One full wave of 100% BIL

(v) One full wave of 75% BIL

26. What are the different methods by which fault in transformer insulation is located in impulse test? (CO5, U)

(i) General observations

(ii) Voltage oscillogram method

(iii) Neutral current method.

(iv) Transferred surge current method.

27. Give the various test methods on surge arresters. (CO5, U)

(i) Power frequency spark over test

(ii) Hundred percent standard impulse spark over test

Front of wave spark over test

(iv) Residual voltage test

28. What are the conditions for surge arrester to pass the test? (CO5, U)

(i) The power frequency spark over voltage before and after the test does not differ by more than 10%.

(ii) The voltage and current waveforms of the diverter do no differ significantly in the two applications

(iii) The non-linear resistance elements in the diverter do not show any sign of puncture or external flashover.

29. Give the conditions for diverter to pass the test. (CO5, U)

(i) The power frequency spark over voltage before and after the application of the current wave does not differ by 10%.

(ii) The voltage across the arrester at the first and the last application does not differ by more than 8%.

(iii) There is no sign of puncture or other damage.

30. What are the conditions for arrester to pass the test? (CO5, U)

(i) The average power frequency spark over voltage before and after the test does not differ by more than 10%

(ii) The residual voltage at the rated current does not vary by more than 10%

(iii)The follow-on power frequency current is interrupted each time

(iv) No significant change signs of flashover or puncture occur to the prorated unit.

31. Give the other tests that are conducted on surge arrester. (CO5, U) (Nov/Dec 2011)

(i) Mechanical test like porosity test, temperature cycle test, etc

(ii) Pressure relief test

The voltage withstand test on the insulator housing of the diverter

(iv) The switching surge flashover test

(v) The pollution test.

32. What are the requirements of a protective device connected in parallel? (CO5, U)

(i) It should not usually flashover for power frequency over voltages

(ii) The volt-time characteristic of the device must lie below the withstand voltage of the protected apparatus or insulation. The marginal difference between the above two should be adequate to allow for the effects of distance, polarity, atmospheric conditions, changes in the characteristics of the devices due to ageing, etc.

(iv) It should be capable of discharging high energies contained in surges and recover insulation strength quickly.

(v) It should not allow power frequency follow-on current to flow.

33. On what factors does the selection of surge arrester depend on? (CO5, U)

(i) The rate of rise of voltage

(ii) The type of system to be handle

(iv) Operating characteristics of the arrester.

34. What is insulation coordination? (CO5, U) (May/June 2012), (Nov/Dec 2011) (Nov/Dec2017)

The selection of suitable values for the insulation levels of the various components in any electrical system and their arrangement in a rational manner is called insulation coordination.

35. What are the tests need to be conducted on power transformer? (CO5, U) (Nov/Dec 2016) (Reg. 2013)

(a) Induced over voltage test.

(b) Partial discharge test.

(c) Impulse testing.

36. **Define Disruptive discharge voltage.** ***(Nov/Dec 2017)***

This is defined as the voltage which produces the loss of dielectric strength of an insulation. It is that voltage at which the electrical stress in the insulation causes a failure which includes the collapses of voltage and passage of current.

37. **List out the various electrical tests to be carried out for bushings.** ***(Ap/May 2017)***

i. Power frequency voltage test
ii. Impulse voltage test

Power frequency test can be classified into

1. Power factor voltage test
2. Internal or partial discharge test
3. Momentary withstand test at power frequency
4. One minute wet withstand test at power frequency test
5. Visible discharge test at power frequency Impulse voltage tests can be classified into

a) Full wave withstand test
b) Chopped wave withstand and switching surge test

C]Temperature rise and thermal stability tests are also used for testing of bushings.

38. **Define 50% flash over voltage.** ***(Nov/Dec 2016)***

The voltage which has a probability of 50% flashover, when applied to test object. This is normally applied in impulse test in which the loss of insulation strength is temporary.

39. **What is the significance of power factor tests?** ***(Ap/May 2018)***

Improves the power factor and rises the test voltage between the cable core and the sheath to the required value

40. **What is meant by insulation co-ordination?** ***(Ap/May 2018)***

Insulation co-ordination of suitable values for the insulation levels of the various components in any electrical system and their management in a rational manner is called insulation co-ordination Insulation co-ordination of the insulation of the electrical equipment and circuits with the characteristics of the protective devices in such a manner that the insulation is well protected from the excessive over voltages.

PART – B

1. What are the tests conducted on circuit breakers and isolator switches? Explain about any one of the tests. (CO5, U) (8) (Nov/Dec 2004)

2. What are the different tests conducted on cables? Explain any one of them. (CO5, U) (8) (Nov/Dec 2004), (May/June 2012) (16) (Nov/Dec 2011)

3. Explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating the failure? (CO5, U) (16) (May/June 2011)

4. Explain the different aspects of insulation design and insulation co-ordination adopted in EHV systems. (CO5, U) (May/June 2011)

5. Discuss the method of impulse testing of high voltage transformers. (CO5, U) (8) (April/May 2005)

6. Mention the different electrical tests done on insulators and circuit breakers. Explain any one of them. (CO5, U) (8) (April/May 2005)

7. Explain in sequence the various high voltage tests being carried out in a power transformer. (CO5, U) (16) (Nov/Dec 2016) (Reg. 2013), (April/May 2015) (Reg. 2008)

8. What is the significance of impulse tests? Briefly explain the impulse testing of insulators. (CO5, U) (16) (Nov/Dec 2005)

9. Explain the following terms used in HV testing as per the standards:

   (i) Disruptive discharge voltage

   (ii) Creepage distance

   (iii) Impulse voltage

   (iv) 100% flash over voltage. (CO5, U) (16) (Nov/Dec 2005)

10. With a neat sketch explain the impulse testing on the power transformer. (CO5, U) (16) (May/June 2006)

11. Discuss the various tests carried out in a circuit breaker at HV labs. (CO5, U) (16) (May/June 2006)

12. Explain the terms:

   (i) With stand voltage

   (ii) Flash over voltage

   (iii) 50% flash over voltage

   (iv) Wet and dry power frequency tests as referred to HV testing. (CO5, U) (16) (Nov/Dec 2006)

13. Briefly discuss the various tests carried out the insulator. (CO5, U) (16) (Nov/Dec 2006)

14. What are the different power frequency tests done on Bushings? Mention the procedure for testing. (CO5, U) (16) (May/June 2007) (Nov 2011)

15. What is the significance of Short Circuit tests on Circuit Breakers? How are they conducted in HV Laboratories? (CO5, U) (16) (May/June 2007)

16. What are the needs for high voltage testing of electrical apparatus? (CO5, U) (4) (Nov/Dec 2007)

17. Discuss in detail the power frequency voltage test withstand on a 66 kV porcelain insulator. (CO5, U) (12) (Nov/Dec 2007)

18. Explain the need for recording supplementary oscillograms during impulse testing of transformers. (CO5, U) (4) (Nov/Dec 2007)

19. Give the detailed procedure for impulse voltage withstand test on a 500 kVA, 11 kV/415 V, delta/star distribution transformer. (CO5, U) (12) (Nov/Dec 2007)

20. Explain the need for high voltage testing of electrical apparatus. (CO5, U) (4) (April/May 2008)

21. Mention the different types and nature of tests conducted. (CO5, U) (4) (April/May 2008)

22. Discuss the arrangement with detailed procedure for conducting wet withstand tests and state specification for water used in such tests. (CO5, U) (8) (April/May 2008)

23. Discuss with circuit arrangements, the detailed procedure for conducting impulse voltage withstand test on a 33kV post insulator. (CO5, U) (16) (April/May 2008)

24. With neat diagram, explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating the failure? (CO5, U) (16) (May/June 2016) (Reg. 2008)

25. What is meant by Insulation Coordination? Explain how the protective devices are chosen for optimum insulation level in a power system. (CO5, U) (16) (May/June 2016) (Reg. 2008)(Nov/Dec 2017)

26. With neat diagram explain the various HV testing‘s carried out on Insulators and Bushings. (CO5, U) (April/May 2015) (Reg.2008)

27. Explain with a neat diagram of synthetic testing of circuit breakers. Why is synthetic testing advantages over direct method for short circuit test? (CO5, U & AN) (16) (Nov/Dec 2014) (Reg. 2008)

28. What is meant by 50% disruptive discharge as applied to impulse voltage. Discuss the procedure of two important methods to obtain the same. (CO5, U) (16) (Nov/Dec 2014) (Reg. 2008)

29. What are volt-time curves? Explain the procedure for constructing volt-time curves with neat sketch. Give its significance in power system studies. (CO5, U) (10) (May/June 2014) (Reg. 2008)

30. Explain the modern trends in the insulation design of EHV and UHV substations. (CO5, U) (16) (May/June 2014) (Reg. 2008)

31. Discuss the various tests carried out in a surge arrester at high voltage laboratories. (CO5, U) (16) (May/June 2014) (Reg. 2008)

32. Describe the various tests to be carried out on a circuit breaker. (CO5, U) (16) (Nov/Dec 2013) (Reg. 2008)

33. Discuss the different aspects of insulation design and insulation co-ordination adopted for EHV systems. (CO5, U) (8) (Nov/Dec 2013) (Reg. 2008)

34. Explain the function of discharge device used in power capacitor and explain the test for efficacy of this device. (CO5, U) (8) (Nov/Dec 2013) (Reg. 2008)

35. Explain the various tests conducted in high voltage insulators. (CO5, U) (16) (May/June 2013) (Reg. 2008)

36. Explain the tests conducted on high voltage cables. (CO5, U) (16) (May/June 2013) (Reg. 2008)

37. Discuss the different high voltage tests conducted on bushings. (CO5, U) (16) (Nov/Dec 2012) (Reg. 2008)

38. Explain the following:

(i) Flashover voltage

(ii) Withstand voltage

(iii) Impulse voltage

(iv) Creepage distance. (CO5, U) (16) (Nov/Dec 2012) (Reg. 2008)

39. What are the tests conducted on isolators and circuit breakers. Explain in detail. (CO5, U) (16) (May/June 2012) (Reg. 2008)

40. What are the tests conducted in high voltage cables? Explain the partial discharge measurement technique in detail. (CO5, U) (16) (May/June 2012) (Reg. 2008)

41. Explain the power frequency and impulse voltage test conducted on bushings. (CO5, U) (16) (Nov/Dec 2011) (Reg. 2008)

42. Discuss the dielectric power factor test and partial discharge test conducted on high voltage cables. (CO5, U) (16) (Nov/Dec 2011) (Reg. 2008)

43. Explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating the failure? (CO5, U) (16) (April/May 2011) (Reg. 2008)

44. Explain the direct and indirect testing of isolators and circuit breakers in detail. (CO5, U) (8) (April/May 2005) (Nov/Dec2017)

45. Explain the impulse testing procedure for insulators.(16)(April-May-18)

46. Explain the different high voltage tests conducted on bushings. (16)(April-May-18)

UNIT COVERED: 1
BATCH-1

1. Explain the technique of modeling the lightning. (CO1,U)
2. What are causes of power frequency over voltages in power system? Explain them in detail. (CO1,U)
3. Explain the operation of expulsion gap lightning arrester along with advantages and disadvantages. (CO1,U)
4. Explain the sources and characteristics of switching surges. (CO1,U)
5. Give the origin and characteristics of switching surges and explain the causes of over voltage due to switching surges in EHV and UHV system. (CO1,U)

BATCH-2

1. What are the methods used to control of over voltages due to switching? Explain briefly. (CO1,U)
2. Explain the selection of surge arresters for E.H.V. system. Explain the V-I characteristics of typical surge arresters. (CO1,U)
3. What are the causes for switching and power frequency over voltage? How are they controlled in power systems? (CO1,U)
4. Explain lightning phenomena. (CO1,U)
5. Give the mathematical model of lightning discharges and explain them. (CO1,U)

BATCH-3

1. Give a brief note on protection of transmission lines using protection devices. (CO1,U) (8)
2. Explain briefly about power frequency over voltages in power systems. (CO1,U)
3. Show the charge distribution patterns in the cloud following Wilson‘s and Simpson‘s theories. (CO1,AN) (
4. Describe about various types of shunt protected devices used for overhead lines against lightning stroke. (CO1,U) (
5. An underground cable of inductance 0.150 mH/km and of capacitance 0.2 μF/km is connected to an overhead line having an inductance of 1.2 mH/km and capacitance of 0.006 μF/km. Calculate the transmitted and reflected voltage and current waves at the junction, if a surge of 200 kV travels to the junction, (1) along the cable and (2) along the overhead line. (CO1,AN)

ASSIGNMENT-2
UNIT COVERED: 2
BATCH-1

1. Explain the breakdown mechanisms involving in solid dielectric breakdown. (CO2, U) (16)
2. Explain the phenomena of corona discharge and breakdown mechanism in non-uniform fields. (CO2, U)
3. Explain in detail the breakdown mechanism in non-uniform fields and phenomenon of Corona. (CO2, U)
4. Describe the ageing and breakdown in composite dielectrics due to partial discharge. (CO2, U)
5. Describe the thermal breakdown mechanism of solid dielectrics. (CO2, U)

BATCH-2

1. Define Townsend's first and second ionization coefficients. How is the condition for breakdown obtained in Townsend's discharge? (CO2, AN)
2. In an experiment of gas, it was found that at a steady current of 5.5×10^{-8} A with 0.4 cm separation between the plates. For constant field, if the separation reduces to 0.1 cm, results in a current of 5.5×10^{-9} A. Find Townsend's primary ionization coefficient. (CO2, AN)
3. Explain the different mechanisms by which breakdown occurs in solid dielectric in practice. (CO2, U)
4. A co-axial capacitor is to be designed with an effective length of 20 cm. The capacitor is expected to have a capacitance of 1000 pF and to operate at 15 kV, 500 Hz. Find the dimensions of electrode. Assume the dielectric material is having relative permeability of 2.3. (CO2,AN)
5. State the criteria for sparking potential and hence obtain the relation between sparking potential and (pd) values (Paschens Law). Discuss on the nature of variations of sparking potential with (pd) values. (CO2,AN)

BATCH-3

1. Explain clearly breakdown in non-uniform fields and corona discharges. (CO2,U)
2. Classify the various breakdown mechanisms occurring on solid dielectrics and explain them briefly. (CO2,U)
3. Explain clearly various processes which explain electric breakdown in vacuum. (CO2,U) Describe the breakdown in composite dielectrics due to partial discharge. (CO2,U)
4. What are the preferred properties of gaseous dielectrics for high voltage applications? Draw the characteristics of D.C. breakdown strength of typical solid, liquid and gas and vacuum insulators in uniform fields. (CO2,U)

ASSIGNMENT-3
UNIT COVERED: 3
BATCH-1

45. Explain the simple voltage doubler circuit operation. (CO3, U)
46. Explain in detail the methods of switching surge generation from impulse generator and from power transformer (CO3, U)
47. How impulse current is generated using capacitor bank. (CO3, AN)
48. What are the different forms of high voltages classified? Explain any one method of voltage multiplier circuits. (CO3, U)
49. Draw and explain the circuits for producing impulse waves. (CO3, U)

BATCH-2

1. Give the Marx circuit – multistage impulse generator. How the basic arrangements are modified to accommodate the wave time control resistances? (CO3, U & AN)
2. A 100 KVA, 250 V/200 KV feed transformer has R and X of 1% and 5% respectively. This transformer is used to test a cable at 400 KV at 50 Hz. The cable takes a charging current of 0.5 A at 400 KV. Determine the series inductance required. Assume 1% resistance for inductor. Also determine the input voltage to the transformer. Neglect dielectric loss of a cable. (CO3, AN)
3. Describe with neat diagram the principle of operation, advantages, limitations and applications of Van de Graaff generator. (CO3, U)
4. What is a Tesla coil? How are damped high frequency oscillations obtained from a Tesla coil? (CO3, U & AN)
5. Give the Marx circuit arrangement for multistage impulse generators. How is the basic arrangement modified to accommodate the wave time control resistances? (CO3, U & AN)

BATCH-3

1. (i) Explain the need for generating high voltages. (CO3, U)
   (ii) Draw the circuit of an n-stage Cockcroft – Walton circuit for generating very high DC voltages and explain its operation. Also derive an expression for the ripple content in the output wave form. (CO3, U & AN)
2. (i) Starting from the basic _MARX' circuit, develop the circuit of a modern multi-stage impulse generator and explain its operation. Discuss on the significance of various parameters. (CO3, U)
   (ii) Explain tripping of impulse generators. (CO3, U)
3. (i) Discuss the merits of Cascaded transformer over a two winding transformer for producing very high ac voltages. (CO3, U)
4. Mention the necessity of generating high DC voltages. (CO3, U)
5. Explain with a neat diagram the generation of high DC voltages using Van-de-graff generator. State the factors which limit the voltage developed. (CO3, U)

ASSIGNMENT-4

UNIT COVERED: 4

BATCH-1

17. A Rogowski coil is required to measure impulse current of 8 KA having rate of change of current of 10^{10} A/sec. The voltmeter is connected across the integrating circuit which reads 8 volts for full scale

deflection. The input to integrating circuit is from Rogowski coil. Determine the mutual inductance of coil, R and C for the integrating circuit. (CO4, AN)

18. What is Capacitance Voltage Transformer? Explain with phasor diagram how a tuned CVT can be used for high voltage measurement in power systems. (CO4, U)
19. The effective diameter of the moving disc of an Electrostatic voltmeter is 15 cm with a separation of 1.5 cm. Find the weight in grams that is necessary to be added to balance the moving plate when measuring a voltage of 50 kV d.c. Derive any formula used. What is force of attraction between the plates when they are balanced? (CO4, AN)
20. What is CVT? Explain with phasor diagram how a tuned capacitance voltage transformer can be used for voltage measurement in power system? (CO4, U)
21. (i) Explain why we resort to statistical approach for impulse studies. (CO4, U)
    (ii) Define 50% impulse disruptive discharge voltage and discuss in detail any one method of obtaining the same. (CO4, U)

BATCH-2

1. Explain the faraday generator method of measurement. (CO4, U) (8) (May/June 2012)
2. Explain the electro optical method of high frequency alternating current measurement. (CO4, U)
3. Tabulate the high voltage and high current measurement techniques for different types of voltages and currents. (CO4, AN)
4. Explain sphere gap for measurement of high voltage with diagrams. (CO4, U) (
5. Explain with diagram the extended series resistance for high a.c. voltage measurements. (CO4, U)

BATCH-3

1. Describe a new scheme of current transformer measurements introducing electro-optical technique for EHV systems. (CO4, U)
2. With a neat sketch explain the principle of operation of an electrostatic voltmeter for HV AC measurement. What are the merits and demerits? (CO4, U)
3. What is CVT? Explain through phasor diagram how a tuned CVT can be used for HV AC measurement in substations. (CO4, U)
4. With a neat sketch explain the Sphere gap measurements for peak voltage measurement. (CO4, U)
5. Discuss the various techniques for the measurement of impulse voltage. (CO4, U)

ASSIGNMENT-5
UNIT COVERED: 5
BATCH-1

1. What are the tests conducted on circuit breakers and isolator switches? Explain about any one of the tests. (CO5, U)

2. What are the different tests conducted on cables? Explain any one of them. (CO5, U)

3. Explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating the failure? (CO5, U)

4. Explain the different aspects of insulation design and insulation co-ordination adopted in EHV systems. (CO5, U)

5. Discuss the method of impulse testing of high voltage transformers. (CO5, U)

BATCH-2

1. Discuss the various tests carried out in a surge arrester at high voltage laboratories. (CO5, U)

2. Describe the various tests to be carried out on a circuit breaker. (CO5, U)

3. Discuss the different aspects of insulation design and insulation co-ordination adopted for EHV systems. (CO5, U)

4. Explain the function of discharge device used in power capacitor and explain the test for efficacy of this device. (CO5, U)

5. Explain the various tests conducted in high voltage insulators. (CO5, U)

BATCH-3

1. Discuss the various tests carried out in a circuit breaker at HV labs. (CO5, U) (16)

2. Explain the terms:

    (i) With stand voltage

    (ii) Flash over voltage

    (iii) 50% flash over voltage

    (iv) Wet and dry power frequency tests as referred to HV testing. (CO5, U)

3. Briefly discuss the various tests carried out the insulator. (CO5, U) (16) (Nov/Dec 2006)

4. What are the different power frequency tests done on Bushings? Mention the procedure for testing. (CO5, U)

5. What is the significance of Short Circuit tests on Circuit Breakers? How are they conducted in HV Laboratories? (CO5, U)

EE8702 POWER SYSTEM OPERATION AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

To impart knowledge on the following topics

- Significance of power system operation and control
- Real power-frequency interaction and design of power-frequency controller.
- Reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- Economic operation of power system.
- SCADA and its application for real time operation and control of power systems

UNIT I PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL 9

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.

UNIT II REAL POWER - FREQUENCY CONTROL 9

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER – VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM 9

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram. 84

TOTAL:45PERIODS

OUTCOMES:

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute-to-minute variation of system demand.
- Ability to understand the significance of power system operation and control.

- Ability to acquire knowledge on real power-frequency interaction.
- Ability to understand the reactive power-voltage interaction.
- Ability to design SCADA and its application for real time operation.

TEXT BOOKS:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.

2. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.

3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES

1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.

2. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

3. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

EE8702 – POWER SYSTEM OPERATION AND CONTROL

UNIT I PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL 9 Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.

1. What is load curve? (Nov/Dec 2009) (U)

The curve drawn between the variations of load on the power station with reference to time is known as load curve. There are three types, Daily load curve, Monthly load curve, Yearly load curve

2. What is daily load curve? (April/May 2012) (U)

The curve drawn between the variations of load with reference to various time period of day is known as daily load curve.

3. What is monthly load curve? (April/May 2011) (Nov/Dec 2013) (U)

It is obtained from daily load curve. Average value of the power at a month for a different time periods are calculated and plotted in the graph which is known as monthlyload curve.

4. What is yearly load curve? (U)

It is obtained from monthly load curve which is used to find annual load factor.

5. What is connected load? (April/May 2011) (U)

It is the sum of continuous ratings of all the equipments connected to supply systems.

6. What is Maximum demand? (April/May 2015) (U)

It is the greatest demand of load on the power station during a given period.

7. What is Demand factor? (Nov/Dec 2009) (April/May 2012) (April/May 2013) (U)

It is the ratio of maximum demand to connected load.Demand factor= (max demand)/ (connected load)

8. What is Average demand? (April/May 2015) (Nov/Dec 2015) (U)

The average of loads occurring on the power station in a given period (day or month or year) is known as average demand.

Daily average demand = (no of units generated per day) / (24 hours)

Monthly average demand = (no of units generated in month) / (no of hours in a month)
Yearly average demand = (no of units generated in a year) / (no of hours in a year)

9. What is Load factor? (Nov/Dec 2013) (U)

The ratio of average load to the maximum demand during a given period is known as load factor.
Load factor = (average load) / (maximum demand)

10. What is Diversity factor? (April/May 2012) (U)

The ratio of the sum of individual maximum demand on power station is known as diversity factor.

Diversity factor = (sum of individual maximum demand) / (maximum demand).

11. What is Capacity factor? (Nov/Dec 2015) (U)

This is the ratio of actual energy produced to the maximum possible energy that could have been produced during a given period.

Capacity factor= (actual energy produced) / (maximum energy that have been produced)

12. What is Plant use factor? (April/May 2013) (Nov/Dec 2014) (U)

It is the ratio of units generated to the product of plant capacity and the number of hours for which the plant was in operation.

Units generated per annum= average load * hours in a year

13. What is Load duration curve? (U)

When the load elements of a load curve are arranged in the order of descending magnitudes the curve then obtained is called load duration curve.

14. Classify the system load. (May/June 2016) (R)
(a) Lighting and heating load

(b) Induction motors
(c) Electronic devices.

15. What is spinning reserve? (May/June 2016) (Nov/Dec 2018) (U)

The units that can be started within a short duration of time to meet the change in load when a particular unit falls in the power system is called spinning reserve.
Example: Gas turbine, Diesel power plant .

16. What is the need for frequency regulation in power system? (Nov/Dec 2016) (U)

(d) In any power system, if the frequency changes, there won‘t be required voltage at the receiving end. If we connected two systems in parallel, it will spoil the system.

(e) The generator turbines are designed to operate at a very precise speed that can be maintained by regulating frequency.

(f) Constant turbine speed is an important requirement.

(g) Unusual deviations in the frequency can be detected earlier.

17. Define load duration curve. (Nov/Dec 2016) (U)

When the load elements of a load curve are arranged in the order of descending magnitudes the curve then obtained is called load duration curve.

18. What is the need for load forecasting in power systems? (April/May 2017) (U)

(h) To meet out the future demand.

(i) Long-term forecasting is required for preparing maintenance schedule of the generating units, planning future expansion of the system.

(j) For day-to-day operation, short term load forecasting is needed in order to commit enough generating capacity for the forecasting demand and for maintaining the required spinning reserve.

(k) Very short-term load forecasting is used for generation and distribution. (i.e.,) economic generation scheduling and load dispatching.

(l) Medium term load forecasting is needed for predicted monsoon acting and hydro availability and allocating spinning reserves.

19. What are brownouts? (April/May 2017) (U)

20. Define the term Load curve and Load duration curve. (Nov/Dec 2017) (U)

The curve drawn between the variations of load on the power station with reference to time is known as load curve. There are three types. i.e., Daily load curve, Monthly load curve, Yearly load curve.

When the load elements of a load curve are arranged in the order of descending magnitudes the curve then obtained is called load duration curve.

21. What is load forecasting in power system? (Nov/Dec 2017) (U)

Forecasting is a systematic procedure for quantitatively defining future loads. Forecasting techniques are classified as extrapolation, correlation, or combination of both.

22. Write the implications of high diversity factor and list any two methods employed to increase the diversity factor. (April/May 2018) (U)

If diversity factor is more or high, the cost of generation of power is low.

Methods to increase the diversity factor are:

(m) Giving incentives to some consumers to use electricity in the night or light load periods.

(n) Using day-light saving.

(o) Staggering the office timings.

(p) Having two-part tariff in which consumer has to pay an amount dependent on the maximum demand of consumer uses.

23. State the factors affecting the load forecasting. (April/May 2018) (R)

24. What is the need for load forecasting? (Nov/Dec 2018) (U)

(q) To meet out the future demand.

(r) Long-term forecasting is required for preparing maintenance schedule of the generating units, planning future expansion of the system.

(s) For day-to-day operation, short term load forecasting is needed in order to commit enough generating capacity for the forecasting demand and for maintaining the required spinning reserve.

(t) Very short-term load forecasting is used for generation and distribution. (i.e.,) economic generation scheduling and load dispatching.

(u) Medium term load forecasting is needed for predicted monsoon acting and hydro availability and allocating spinning reserves.

PART – B

1. A generating station has the following daily load cycle:

Time (hours)	0-6	6-10	10-12	12-16	16-20	20-24
Load(MW)	20	25	30	25	35	20

Draw the Load curve (1) and load duration curve (1) and find

i. Maximum demand(2)

ii. Units generated per day(2)

iii. Average Load(2)

iv. Load Factor.(2) **(Nov/Dec 2015) (April/May 2015) (E)**

2 .Consider an inductive Load of type Z=R+jX.

i. By how much percentage, the real load drop, if the voltage is reduced by 5%?

ii. How would 2% drop in frequency affect the real load, if the load power factor is 0.8? Derive the relations used. **(16) (May/June 2016)** (**An & E)**

3. A Power station has to meet the following demand. **(16)** (**April/May 2011)** (**April/May 2012) (Nov/Dec 2014) (E)**

Group A: 200kW between 8 A.M and 6 P.M

Group B: 100kW between 6 A.M and 10 A.M

Group C: 50kW between 6 A.M and 10 A.M

Group D: 100kW between 10 A.M and 6 P.M and 6 P.M and 6 A.M

Plot the daily load cure and load duration curve and determine

(i) Diversity factor

(ii) Units generated per day

(iii) Load factor. **(16)** (**April/May 2013) (U)**

4. Explain about load forecasting & weather sensitive load model **(16) (April/May 2016) (U)**

5. Explain plant level control. **(8)** (**Nov/Dec 2009) (April/May 2012) (U)**

6. Explain system level control. **(8) (April/May 2015) (April/May 2017) (U)**
7. Explain static and dynamic characteristics of power system load. **(16)** (**Nov/Dec 2013) (Nov/Dec 2015 (U)**
8. A power station has to meet the following load demands:

Load A : 50kW between 10 AM and 6 PM
Load B : 30kW between 6 AM and 10 PM
Load C : 20kW between 4 PM and 10 AM

Plot the daily load curve and determine i) diversity factor, ii) units generated per day, iii) load factor. **(16) (May/June 2016) (E)**

9. A generating station has the following daily loads: 0-6 hrs 4500 kW; 6-8 hrs 3500 kW; 8-12 hrs 7500 kW; 12-14 hrs 2000 kW; 14-18 hrs 8000 kW; 18-20 hrs 2500 kW; 20-24 hrs 5000 kw. Sketch the load duration curve and determine the load factor and plant capacity factor, if the capacity of the plant is 12MW. **(8) (Nov/Dec 2016) (E)**
10. Discuss the importance of load forecasting with a suitable example. **(8) (Nov/Dec 2018) (U)**
11. Peak demand of a generating station is 90MW. The load factor and the plant capacity factor are 0.6 and 0.5 respectively. Determine

1. daily energy produced
2. installed capacity
3. reserve capacity
4. utilization factor. **(10) (Nov/Dec 2016) (E)**

12. What is the significance of load factor and diversity factor? **(6) (Nov/Dec 2016) (U)**
13. A power system has a maximum demand of 25000 kW, Load factor of 60%, plant capacity factor of 50% and a plant use factor of 72%. Find

(i) Daily energy produced.
(ii) Reserve capacity of the plant
(iii) Maximum energy that could be produced daily if the plant operating in accordance with operating schedule is fully loaded when in operation. **(16) (April/May 2017) (An & E)**

14. Explain plant level and system level controls in a power system. **(16) (April/May 2017) (U)**
15. A generating station has following daily load cycle:

Time in Hrs.	0-6	6-10	10-12	12-16	16-20	20-24
Load in MW	40	50	60	50	70	40

Draw the load curve and calculate:

(a) Maximum Demand
(b) Units generated per day
(c) Average load
(d) Load factor. **(10) (Nov/Dec 2017) (13) (Nov/Dec 2018) (E)**

16. Explain the different types of load forecasting method in a power system operation.

(6) (Nov/Dec 2017) (U)

17. The recorded peak load from 2006 to 2012 of an area are shown below project the load up to 2019 by using Extrapolation method of Exponential curve.

Year	2006	2007	2008	2009	2010	2011	2012
Peak Load (MW)	570	590	740	750	810	890	990

(6) (Nov/Dec 2017) (E)

18. Explain briefly about plant level and system level control of a power system. **(6) (Nov/Dec 2017) (U)**
19. Classify broad categories of system loads and describe its load characteristics. **(7) (April/May 2018) (R)**

20. A power plant supplies the following loads with maximum demand as below:

Type of load	Individual Maximum Demand (MW)
Industries	100
Domestic	15
Commercial	12
Agriculture	20

The maximum demand on the power station is 110 MW. The total units generated in the year is 322 x 10^6 kWh. Determine the load factor and Diversity factor. **(6) (April/May 2018) (E)**

21. Compare load curve and load duration curve. **(6) (April/May 2018) (An)**

22. Demonstrate the basic approach of quadratic curve fitting technique of load forecasting with a suitable example. **(7) (April/May 2018) (An)**

23. Discuss the overview of system operation and control? **(13) (Nov/Dec 2018) (U)**

UNIT II REAL POWER - FREQUENCY CONTROL 9

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFCPART – A

1. What is the major control loops used in large generators? (U)

The major control loops used in large generators are

1. Automatic voltage regulator (AVR)

2. Automatic load frequency control (ALFC).

2. What is the use of secondary loop? (April/May 2013) (April/May 2016) (Nov/Dec2018) (U)

A slower secondary loop maintains the fine adjustment of the frequency, and also by reset action maintains proper MW interchange with other pool members. This loop is insensitive to rapid load and frequency changes but focuses instead on drift like changes which take place over periods of minutes.

3. What are the advantages of AVR loop over ALFC? (April/May 2011) (Nov/Dec2013) (U)

AVR loop is much faster than the ALFC loop and therefore there is a tendency, for the VR dynamics to settle down before they can make themselves felt in the slower load frequency control channel.

4. What is the difference between large and small signal analysis? (Nov/Dec 2009) (April/May 2012) (April/May 2015) (An)

Large signal analysis is used where voltage and power may undergo sudden changes of magnitude that may approach 100 percent of operating values. Usually this type of analysis leads to differential equations of non-linear type. Small signal analysis

is used when variable excursions are relatively small, typically at most a few percent of normal operating values.

5. What is the exciter? (Nov/Dec 2015) (U)

The exciter is the main component in AVR loop. It delivers the DC power to the generator field. It must have adequate power capacity and sufficient speed of response (rise time less than 0.1 sec).

6. What is the function of AVR? (April/May 2013) (Nov/Dec 2014) (April/May2015) (U)

The basic role of the AVR is to provide constancy of the generator terminal voltage during normal, small and slow changes in the load.

7. Explain about static AVR loop? (Nov/Dec 2009) (April/May 2012) (U)

In a static AVR loop, the execution power is obtained directly from the generator terminals or from the station service bus. The AC power is rectified by thyristor bridges and fed into the main generator field via slip rings. Static exciters are very fast and contribute to prove transient stability.

8. Write the static performance of AVR loop? (April/May 2011) (Nov/Dec 2013) (U)

The AVR loop must regulate the terminal |V| to within required static accuracy limit. Have sufficient speed of response. Be stable.

9. What are the disadvantages of high loop gain? How is to be eliminated? (Nov/Dec 2015) (U)

High loop gain is needed for static accuracy but this causes undesirable dynamic response, possibly instability. By adding series AND/OR feedback stability compensation to the AVR loop, this conflicting situation can be resolved.

10. What are the effects of generator loading in AVR loop? (U)

Added load does not change the basic features of the AVR loop; it will however affect the values of both gain factor Kf and the field constant. High loading will make the generator work at higher magnetic saturation levels. This means smaller changes in |E| for incremental increases in if, translating into the reduction of KF. The field time constant will likewise decreases as generator loading closing the armature current paths. This circumstance permits the formation of transient stator currents the existence of which yields a lower effective field induction.

11. What are the functions of ALFC? (U)

The basic role of ALFC‟s is to maintain desired MW output of a generator unit and assist in controlling the frequency of large interconnection. The ALFC also helps to keep the net interchange of power between pool members at predetermined values. Control should be applied in such a fashion that highly differing response characteristics of units of various types are recognized. Also unnecessary power output changes should

be kept at a minimum in order to reduce wear of control valves.

12. Specify the disadvantages of ALFC loop? (U)

The ALFC loops will main control only during normal changes in load and frequency. It is typically unable to provide adequate control during emergency situations, when large MW imbalances occur.

13. How is the real power in a power system controlled? (An)

The real power in a power system is being controlled by controlling the driving torque of the individual turbines of the system.

14. What is the need for large mechanical forces in speed-governing system? (U)

Very large mechanical forces are needed to position the main valve against the high stream pressure and these forces are obtained via several stages of hydraulic amplifiers

15. What is the objective of tie-line bias control? (May/June 2016) (U)

The control strategy is termed as tie line bias control and is based upon the principle that all operating pool members must contribute their share to frequency control in addition to taking care of their own net interchange.

16. Define area control error. (May/June 2016) (R)

Area Control Error (ACE) is the change in area frequency which when used in integral control loop forced the steady state frequency error to zero.

$ACE = \Delta P_{tie} + b \cdot \Delta f$ p.u. MW (for multi area system)

$ACE = \Delta f$ (for single area system)

Where, b = Area frequency bias

ΔP_{tie} = Change in tie-line power

Δf = Change in frequency

17. Define control area. (Nov/Dec 2016) (Nov/Dec 2018) (R)

It is possible to divide an extended power system (say, National Grid) into sub-areas in which the generators are tightly coupled together so as to form a coherent group, i.e., all the generators respond in unison to changes in load or speed changer settings. Such a coherent area is called a control area in which the frequency is assumed to be the same throughout in static as well as dynamic conditions.

18. What do you understand by control area? (April/May 2017) (U)

It is possible to divide an extended power system (say, National Grid) into sub-areas in which the generators are tightly coupled together so as to form a coherent group, i.e., all the generators respond in unison to changes in load or speed changer settings. Such a coherent area is called a control area in which the frequency is assumed to be the same throughout in static as well as dynamic conditions.

19. Give the two conditions for proper synchronizing of alternators. (Nov/Dec 2017) (U)

1. The terminal voltage of the incoming machine must be exactly equal to that of the others, or of the bus-bars connecting them.

2. The speed of the incoming machine must be such that, its frequency equals bus-bar frequency.

3. The phase of the incoming machine voltage must be the same as that of the bus-bar voltage relative to the load.

4. The phase sequence of the incoming machine is the same as that of the bus-bars.

20. List the components of speed governing mechanism. (April/May 2018) (U)

The components of speed governing mechanism are:

(a) Fly Ball Speed Governor
(b) Speed Changer
(c) Hydraulic Amplifier
(d) Linkage Mechanism

PART – B

1. Using a simplified functional diagram explain the operating features of a speed governing system. **(U)**
2. Develop a linear mathematical model of a speed governing system. **(C)**
3. Explain the static and dynamic response of ALFC control loop. **(U)**
4. Explain the technique involved in load frequency control (LFC) of a single area system. **(8) (April/May 2012) (Nov/Dec 2013) (U)**
5. Explain the principle, involved in tie line frequency control in case of two area system. (8) (April/May 2015) (U)
6. Develop a linear mathematical model of two area system. **(8) (Nov/Dec 2009) (C)**
7. Explain the tie line bias control of two area system. **(8) (Nov/Dec 2010) (U)**
8. Briefly discuss the LFC control of single area systems. **(16) (Nov/Dec 2011) (Nov/Dec 2009 (U)**
9. Explain the dynamic response of two area system. **(8) (Nov/Dec 2012) (Nov/Dec 2015(U)**
10. Develop a linear mathematical model of two area system. (**C)**
11. Explain the tie line bias control of two area system. **(6) (April/May 2011) (Nov/Dec 2013(U)**
12. Describe the expression for Critical gain. **(U)**
13. A single area controlled system has the following data.

    Area capacity =2000MW
    Operating Load=1000MW
    R=2.4Hz/p.u.MW

    Find K_I and find the nature of roots for K_I=1. **(An & E)**
14. Determine the primary ALFC loop parameter for a control area having the following data : (**Nov/Dec 2013)**

    Total rated area capacity, P_r =2000MW
    Normal Operating Load, P_d=1000MW
    Inertia constant, H= 5 sec

R=2.4Hz/p.u. MW (all area generators)

We shall assume that the load frequency dependency as linear meaning that the old load would increase 1% for 1% frequency increases**. (April/May 2012) (U)**

15. A single area controlled system has the following data. **(8) (Nov/Dec 2013) (April/May 2013) (Nov/Dec 2014)**

Area capacity =3000MW
Operating Load=1500MW
R=3%
H=5 sec and frequency=50 Hz

Compute steady state drop in frequency in Hz for a step load changing of 25MW.

(Ap)

16. Two 50 Hz power station are connected by means of an interconnected cable ofnegligible impedance so that the station are in parallel. Station A has a full load capacity of 15 MW and uniform speed regulation of 3%, Station B has a capacity of 4MW and a uniform speed regulation of 4%. The load on the bus bar of station A is 10MW and B is 4MW. Calculate the generated output of each station. The power transmitted by the interconnected and the operating frequency .Assume frequency governor action and the speed changer of generator were set to have a frequency of 50 Hz**.**

17. Draw the block diagram of uncontrolled of two area ALFC system and explain the salient features under the static and dynamic conditions. **(16) (May/June 2016) (U)**

18. Determine the steady state frequency in HZ for an isolated control area having the following data. Total rated area capacity, Pr = 300 MW, frequency , f = 50 Hz, inertia constant, H = 5 s, regulation, R = 0.05 pu, turbine time constant = 0.5 sec, governor time constant = 0.2 sec, load change = 60 MW. The load varies by 0.8 % for a 1% in frequency. **(8) (May/June 2016) (An & E)**

19. Obtain the state variable model of single area ALFC system. **(8) (May/June 2016) (U)**

20. Derive the block diagram of state variable model for ALFC. **(8) (Nov/Dec 2016) (U)**

21. A power system has a total load of 1250 MW at 50 Hz. The load varies 1.5 % for every 1% change in frequency. Find the steady-state frequency deviation when a 50MW load is suddenly tripped, if

(1) There is no speed control;

(2) The system has 250 MW of spinning reserve evenly spread among 500 MW of generating capacity with 5% regulation based on this capacity. Assume that the effect of governor dead bands is such that only 80% of the governor respond to the reduction in system load. **(8) (Nov/Dec 2016) (An & E)**

22. Derive the transfer function model and draw the block diagram for a single control area provided with governor system. From the transfer function derive the expression for steady state frequency error for a step change. **(16) (Nov/Dec 2016) (U)**

23. Develop linear model for single area ALFC and explain the static and dynamic analysis for controlled input. **(16) (April/May 2017) (U)**

24. A two area system connected by a tie line has the following parameters with base MVA for each area with the frequency of 50 Hz and synchronizing power co-efficient T_{12} = 2 pu. A load change of 400 MW occurs in area 1. Determine the steady state frequency deviation and the change in tie line flow.

Area	1	2
Turbine output power	2000 MVA	1000 MVA
Inertia constant	3%	4%
Generator gain constant	50 Hz/pu MW	40
Governor time constant	0.3	0.2
Turbine time constant	0.6	0.4

(16) (April/May 2017) (An & E)

25. With a neat block diagram, explain the single area load frequency control system with different modules. **(16) (Nov/Dec 2017) (U)**

26. Explain the tie-line bias control of two area system. **(16) (Nov/Dec 2017) (U)**

27. What is the need of a governing mechanism? Illustrate with neat diagram the operation of a speed governing mechanism. **(7) (April/May 2018) (U)**

28. Analyze the governor speed-droop characteristics, the basics of load sharing between two synchronous machines in parallel. **(6) (April/May 2018) (An)**

29. The two system connected by a tie line describe the following characteristics:

Area 1	Area 2
R = 0.01 pu	R = 0.02 pu
D = 0.8 pu	D = 1.0 pu
Base MVA = 500	Base MVA = 500

A load change of 100 MW (0.2 pu) occurs in area 1. What is the new steady state frequency what is the change in tie flow? Assume both area were at nominal frequency (60 Hz). **(13) (April/May 2018) (E)**

30. Draw the transfer function block diagram for a single – area system provided with static analysis of uncontrolled case and controlled case. **(13) (Nov/Dec 2018) (U)**

31. Two generators rated 400 MW and 700 MW are operated in parallel. The droop characteristics of their governors are 3% and 4% respectively from no-load to full-load. Assuming that the governors are operating in 50 Hz at no load, how would a load of 1000 MW be shared between them? What will be the system frequency at this load? Assume linear governor operation. Determine the full load speed for each machine. **(13) (Nov/Dec 2018) (An & E)**

UNIT III REACTIVE POWER – VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

PART – A

1. What are the sources of reactive power? How it is controlled? (April/May 2011) (April/May 2015) (U)

The sources of reactive power are generators, capacitors, and reactors. These are controlled by field excitation.

Give some excitation system amplifier. The excitation system amplifiers are,

a) Magnetic amplifier
b) Rotating amplifier
c) Modern electronic amplifier.

2. When is feedback stability compensation used? (April/May 2012) (Nov/Dec 2013) (Nov/Dec 2015) (U)

High loop gain is needed for static accuracy but this causes undesirable dynamic response, possibly instability. This conflicting situation is resolved by adding feedback stabling compensation to the AVR loop.

3. Give the characteristics of line compensators? (Nov/Dec 2009) (April/May 2011) (April/May 2013) (U)

The characteristics of line compensatorsare, a. Ferranti effect is minimized.

a. Under excited operation of synchronous generator is not required.

4. What is known as bank of capacitors? How it is adjusted?(Nov/Dec 2014) (Nov/Dec 2015) (U)

When a number of capacitors are connected in parallel to get the desired capacitance, it is known as bank of capacitors. These can be adjusted in steps by switching (mechanical).

5. What is the disadvantage of switched capacitors are employed forcompensation? (Nov/Dec 2009) (Nov/Dec 2013) (U)

When switched capacitors are employed for compensation, these should be disconnected immediately under light load conditions to avoid excessive voltage rise and Ferro resonance in presence of transformers.

6. What are the effects of capacitor in series compensation circuit? (April/May2012) (April/May 2013) (U)

The effects of capacitor in series compensation circuit are,
Voltage drop in the line reduces.
Prevents voltage collapse.
Steady state power transfer increases.
Transient stability limit increases.

7. Give two kinds of capacitors used in shunt compensator? (U)

The two kinds of capacitors used in shunt compensator are, a. Static Var Compensator (SVC): These are banks of capacitors (sometimes inductors also for use under light load conditions).

8. What is synchronous condenser? (U)

It is a synchronous motor running at no-load and having excitation adjustable over a wide range. It feeds positive VARs into the line under overexcited conditions and negative VARs when under excited.

9. Write about Static VAR Compensator (SVC). (Nov/Dec 2014) (U)

These comprise capacitor bank fixed or switched or fixed capacitor bank and switched reactor bank in parallel. These compensators draw reactive power from the line thereby regulating voltage, improve stability (steady state and dynamic), control overvoltage and reduce voltage and current unbalances. In HVDC application these compensators provide the required reactive power and damp out sub harmonic oscillations.

10. What is Static VAR Switches or Systems? (U)

Static VAR compensators use switching for var control. These are also called static VAR switches or systems. It means that terminology wise SVC=SVS. And we will use these interchangeably.

11. Give some of the Static compensators schemes. (U)

a. Saturated reactor
b. Thyristor-Controlled Reactor (TCR)
c. Thyristor Switched capacitor (TSC)
d. Combined TCR and TSC compensator.

12. What is tap changing transformers? (April/May 2015) (U)

All power transformers and many distribution transformers have taps in one or more windings for changing the turn‘s ratio. It is called tap changing transformers.

13. Write the types of tape changing transformers. (U)

a. Off- load tap changing transformers.
b. Tap changing under load transformers.

14. What is the use of off-load tap changer and TCUL? (Nov/Dec 2009) (U)

The off- load tap changers are used when it is expected that the ratio will need to be changed only infrequently, because of load growth or some seasonal change. TCUL is used when changes in ratio may be frequent or when it is undesirably to de-energize the transformer to change the tap.

14. What is SVC? (May/June 2016) (U)

Static VAR Compensators are located in receiving substations and distribution systems for smooth and stepless variation of compensation of reactive power injected into line, by shunt capacitors and shunt reactors.

15. What are the various functions of an excitation system? (Nov/Dec 2016) (U)

The basic function of an excitation system is to provide direct current to the synchronous machine. In addition, the excitation system performs control and protective functions essentially to the satisfactory performance of the power system by controlling the field voltage, thereby the field current.
The control function includes, the control of voltage and reactive power flow and the enhancement of system stability. The protective function ensures that the capability limits of the synchronous machine, excitation system and other equipment are not exceeded.

16. Comment on the use of series capacitors in transmission lines. (April/May 2017) (An)

It is connected in series to compensate the inductive reactance of line. This reduces the transfer reactance between the buses to which the line is connected. It increases maximum power that can be transmitted and reduces reactive power loss. The reactive power produced by the series capacitor increases with increase in power transfer; a series capacitor is self-regulating in this regard.

17. What is exciter ceiling voltage? (April/May 2017) (U)

It is the maximum voltage that may be attained by an exciter under specific conditions.

18. What is the function of load frequency control? (Nov/Dec 2017) (U)

The function of load frequency control on a power system is to change the control valve or gate openings of the prime movers as a function of load variations in order to hold system frequency constant.

19. What are the advantages and disadvantages of synchronous compensators? (Nov/Dec 2017) (U)

Advantages:

1. Flexibility of operation for all load conditions.
2. As the losses are considerable compared with static capacitors and the power factor is not zero.

Disadvantages:

1. The cost of installation is high.
2. Losses of synchronous condensers are much higher compared to those of capacitors.

20. What are the different types of Static VAR Compensator? (Nov/Dec 2018) (U)

(a) Reactors with direct current controlled saturation.
(b) Thyristor controlled shunt reactors.
(c) Thyristor controlled high impedance transformer.
(d) Thyristor controlled reactor compensator.

PART – B

1. (a) Discuss generation and absorption of Reactive Power. **(U)**
   (b) Explain how voltage control can be effected by injection of Reactive Power **(Nov/Dec 2015 (An)**

   (a) Draw the composite SVS power system characteristics **(April/May 2011) (Nov/Dec 2013 (U)**
   (b) What are the applications of SVS? **(Nov/Dec 2015) (April/May 2017) (U)**
   Explain different types of static VAR compensators with a phasor diagram **(April/May 2015) (U)**

4. A 3Φ, 230 kV transmission line having the following parameters operates at no-load. R=20ohm, X= 80 ohm, B= $4x10^{-4}$ mho. If the receiving end voltage is 210kV find the sending end voltage representing the transmission line as π model. **(16) (April/May 2013) (April/May 2016) (U)**

5. The load at receiving end of a 3Φ overhead line is 30 MW, 0.8 pf lag at the line voltage of 66kV. A synchronous compensator is situated at sending end and the voltage at both ends of the line is maintained at 66kV. Calculate the MVAR of compensator. The line has a resistance and reactance of 6ohm/ph, 24 ohm/ph, respectively. **(16) (Nov/Dec 2009) (April/May 2012) (Nov/Dec 2014) (U)**

6. A 415 kV line is fed through a 132/415kVtransformer from a constant 132kV supply. At the load end of the line, the voltage is reduced by another transformer of ratio 415/132kV. The total impedance of the line is (30+j60)Ω. Both transformers are equipped with tap-changing, the product of the two off-nominal setting is unity. If the load on the system is 200 MW at 0.8of lagging. Calculate the settings of the tap-changer required to maintain the voltage at 132kV. **(16) (April/May 2011) (April/May 2015) (U)**

7. Two sub-station are connected by two lines in parallel with negligible impedance, but each containing a tap-changing transformer of reactance 0.22pu on the basis of its rating of 200 MVA. Find the net absorption of reactive power when the transformer, taps are set to 1:1.08, and 1:0.95 respectively. Assume pu voltages to be equal at the two ends. **(Nov/Dec 2009) (April/May 2012) (Nov/Dec 2013) (April/May 2013) (16) (U)**

8. (i)Explain the modeling of excitation system.
   (ii) Explain the static and dynamic analysis of AVR.

9. Develop the block diagram of AVR and obtain its transfer function and explain the static and dynamic response. **(16) (May/June 2016) (April/May 2017) (An & U)**

10. Explain the role of tap changing transformer in voltage control. **(16) (May/June 2016) (U)**

11. The load at the receiving end of a 3 phase overhead line is 25 MW at 0.8 power factor lagging at a line voltage of 33kV.The line has a resistance 5 ohm per phase and an inductive reactance at 20 ohm per phase. Calculate the sending

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM 9

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

PART – A

1. Define economic dispatch problem? (Nov/Dec 2015) (R)

The objective of economic dispatch problem is to minimize the operating cost ofactive power generation.

2. Define incremental cost? (Nov/Dec 2009) (Nov/Dec 2013) (R)

The rate of change of fuel cost with active power generation is called incremental cost.

3. Define base point? (April/May 2012) (R)

The present operating point of the system is called base point.

4. Define participation factor? (April/May 2013) (Nov/Dec 2014) (R)

The change in generation required to meet power demand is called as participation factor.

5. Define hydrothermal scheduling problem? (Nov/Dec 2013) (R)

The objective is to minimize the thermal generation cost with the constraints of water availability.

6. Define Uncommitment? (April/May 2011) (Nov/Dec 2015) (R)

Commitment of minmum generator to meet the required demand.

7. Define spinning reserve? (R)

It is the term describes the total amount of generation availability from all units synchronized on the system.

8. What is meant by scheduled reserve? (Nov/Dec 2009) (Nov/Dec 2014) (U)

These include quick start diesel turbine units as well as most hydro units and pumped storage hydro units that can be brought online, synchronized and brought up to full capacity quickly.

9. What are the thermal unit constraints? (April/May 2015) (U)

Minimum up time, minimum down time & crew constraints.

10. Define minimum up time? (R)

Once the unit is running, it should not be turned off immediately.

11. Define minimum down time? (April/May 2012) (R)

Once the unit is decommitted, there is a minimum time before it can be recommitted.

12. Define crew constraints? (Nov/Dec 2018) (R)

If a plant consist of two (or) more units, all the units cannot be turned on at the same time since there are not enough crew members to attend both units while starting up.

13. What are the two approaches to treat a thermal unit to operating temperature?(U)

The first allow the unit boiler to cool down and then heat backup to operating temperature in time for a scheduled turn on. The second requires that sufficient energy be input to the boiler to just maintain operating temperature.

14. What are the techniques for the solution of the unit commitment problem? (U)

Priority list method dynamic programming Lagrange relation

15. What are the assumptions made in dynamic programming problem?(April/May 2011) (April/May 2013) (U)

A state consists of an array of units with specified units operating and the rest of the time. The startup cost of a unit is independent of the time it has been offline. There are no costs for shutting down the units.

16. Define long range hydro scheduling problem? (April/May 2015) (R)

The problem involves the long range of water availability and scheduling of reservoir water releases. For an interval of time that depends on the reservoir capacities.

17. What are the optimization techniques for long range hydro scheduling problem? (U)

Dynamic programming composite hydraulic simulation methods statistical production cost.

18. Define short range hydro scheduling problem? (U)

It involves the hour by hour scheduling of all generators on a system to achieve minimum production condition for the given time period.

19. Define system blackout problem? (U)

If any event occurs on a system that leaves it operating with limits violated, the event may be followed by a series of further actions that switch other equipment out of service. If the process of cascading failures continues, the entire system of it may completely collapse. This is referred as system blackout.

20. What is meant by cascading outages? (U)

If one of the remaining lines is now too heavily loaded, it may open due to relay action, thereby causing even more load on the remaining lines. This type of process is often termed as cascading outage.

21. What is meant by priority list method? (May/June 2016) (U)

Priority list method is the simplest unit commitment solution method which consists of creating a priority list of units.

The priority list can be obtained by noting the full-load average production cost of each unit.

22. What are the constraints in unit commitment? (April/May 2017) (R)

(a) Spinning reserve

(b) Thermal constraints

- Minimum uptime
- Minimum downtime
- Crew Constraint

(c) Other constraints

- ✓ Must run constraint
- ✓ Fuel constraint

23. What is meant by FLAPC? (Nov/Dec 2017) (U)

Full load average production cost = Net heat rate at full load X Fuel cost

$= C_i(P_{Gi}) / P_{Gi}$

24. Compare unit commitment and economic dispatch problems. (April/May 2018) (An) (or) Distinguish between Economic dispatch and Unit commitment. (Nov/Dec 2018) (An)

S.No	Unit Commitment	Economic Load Dispatch
1.	Optimum allocation of number of units to be operated (to determine the units of a plant that should operate for a given load is the problem of unit commitment.	Optimum allocation of generation to each station. (At each generating station at various station load levels).
2.	There are number of subsets of the complete set of ‗n' units that would satisfy the expected demand.	The problem assumes that there are ‗n' units already connected to the system.
3.	Purpose of unit commitment is to find the optimal subset among the subsets which provide the minimum operating cost.	Purpose of economic dispatch problem is to find the optimum operating policy for these ‗n' units.

PART – B

1. (a) Explain briefly the constraints on unit commitment problem. (8)
   (b) What is spinning reserve and does this reserve help in operating a power system efficiently? **(Nov/Dec 2013) (April/May 2013) (U)** (8)

2. Explain Priority list method using full load average production cost. State the merits and demerits. **(16) (Nov/Dec 2009) (Nov/Dec 2014) (April/May 2015)**

(U)

3. Explain with a neat flowchart the procedure for finding the solution for unit commitment problems using forward DP method. **(16) (April/May 2011) (April/May 2012) (U)**

4. There are three thermal generating units which can be committed to take the system load. The fuel cost data and generation operating unit data are given below: (**Nov/Dec 2009) (April/May 2015) (A)**

$F1 = 392.7 + 5.544\ P_1 + 0.001093\ P_1^2$ $F2 = 217 + 5.495\ P_2 + 0.001358\ P_2^2$
$F3 = 65.5 + 6.695\ P_3 + 0.004049\ P_3^2$, P1, P2, P_3 in MW

Generation limits : $150 \le P_1 \le 600$ MW $100 \le P_2 \le 400$ MW $50 \le P_3 \le 200$ MW

There are no other constraints on system operation. Obtain an optimum unit commitment table. Adopt Brute force enumeration technique. Show the details of economic schedule and the component and total costs of operation for each feasible combination of units for the load level of 900 MW. **(16)**

5. The input –output curve characteristics of three units are:

$F1=750+6.49\ P_{G1}+0.0035P_{G1}$

$F2=870+5.75\ P_{G2}+0.0015P_{G2}^2$

$F3=620+8.56\ P_{G3}+0.001P_{G3}^2$

The fuel cost of unit 1, 2, 3 is 1.0 Rs / Mbtu. Total load is 800 MW. Use participation factor method to calculate the dispatch for a load is increased to 880 MW? **(April/May 2011) (A)** **(16)**

6.Obtain the priority list of unit commitment using full load average production cost for the given data for the load level of 900 MW. **(A)**

$F1 = 392.7 + 5.544\ P_1 + 0.001093\ P_1^2$
$F2 = 217 + 5.495\ P_2 + 0.001358\ P_2^2$
$F3 = 65.5 + 6.695\ P_3 + 0.004049\ P_3^2$, P_1, P_2, P_3 in MW

Generation limits : $150 \le P_1 \le 600$ MW $100 \le P_2 \le 400$ MW $50 \le P_3 \le 200$ MW

There are no other constraints on system operation. Obtain an optimum unit commitment

table. (16)

7. Derive the expression for base point and participation method. **(April/May 2013) (April/May 2016) (U)** (16)

8. Give iteration algorithm for solving economic scheduling problem, without transmission loss. **(Nov/Dec2015)(U)** (16)

9. Derive coordination equation for economic dispatch including losses, in the power system. Give steps for economic dispatch calculation. Neglecting losses. **(April/May 2011) (Nov/Dec 2013) (U)** (16)

10. Consider the following three units:

$I_{C1} = 7.92 + 0.003124\ P_{G1}$
$I_{C2} = 7.85 + 0.00388\ P_{G2}$
$I_{C3} = 7.97 + 0.00964\ P_{G3}$
$P_D = 850$ MW
$P_{G1} = 392.2$ MW, $P_{G2} = 334.6$ MW, $P_{G3} = 122.2$ MW

Determine the optimum schedule if the load is increased to 900 MW by using Participation Factor method. **(16) (April/May 2012) (Nov/Dec 2015) (An & E)**

11. Write the algorithm for iterative solution of economic dispatch without and with losses co-ordinated. **(16) (May/June 2016) (An & U)**

12. Discuss the various constraints in unit commitment. **(8) (May/June 2016) (U)**

13. Explain dynamic programming solution for unit commitment with flowchart. **(8) (May/June 2016) (U)**

14. A two bus systems shown in fig.14 (a). If 100 MW is transmitted from plant 1 to the load, a transmission loss of 10MW is incurred. Find the required generation for each plant and power received by load when the system incremental cost is rs.25 MW-hr. The cost equation of the two plants are given below.

$F_1 = 0.01P_1^2 + 16P_1 + 180$ Rs/hr $F_2 = 0.02P_2^2 + 20P_2 + 160$ Rs/hr.

Fig. 14 (a) Two Unit system (16) (Nov/Dec 2016) (An & E)

15. Explain with a neat flow chart the lambda iteration method for solving the economic dispatch problem without loss. **(8) (Nov/Dec 2016) (U)**

16. What are the constraints in solving the unit commitment problem? **(8) (Nov/Dec 2016) (U)**

17. The fuel cost functions for the three thermal plants in Rs/h are given by

$F_1 = 0.004\ P_1^2 + 5.3\ P_1 + 500\ Rs/Hr$
$F_2 = 0.006\ P_2^2 + 5.5\ P_2 + 400\ Rs/Hr$
$F_3 = 0.009\ P_3^2 + 5.3\ P_3 + 200\ Rs/Hr$

Where P_1, P_2 and P_3 are in MW. The total load is 800 MW. Find the optimal dispatch and the total cost in Rs/h. **(8) (April/May 2017) (An & E)**

18. Write the algorithm for iterative solution of economic dispatch with losses co-ordinated. **(8) (April/May 2017) (U)**

19. Explain with the neat flowchart the procedure for finding solution for unit commitment using forward dynamic programming method. **(8) (April/May 2017) (U)**

20. Explain priority list method using full load average production cost. **(8) (April/May 2017) (U)**

21. State the unit commitment problem. With the help of a flow chart, explain forward dynamic programming solution method of unit commitment problems. **(16) (Nov/Dec 2017) (R & U)**

22. The fuel inputs per hour of plants 1 and 2 are given below as:

$F1 = 0.2p1^2 + 40p1 = 120$ Rs./hr.

$F2 = 0.25\ p2^2 + 30p2 + 150$ Rs./hr.

Determine the economic operating schedule and the corresponding cost of generation. The Maximum and Minimum loading on each unit is 100 MW and 25 MW. Assume that the transmission losses are ignored and the total demand is 180 MW. Also determine the saving obtained if the load is equally shared by both the units. **(16) (Nov/Dec 2017) (An & E)**

23. The cost characteristics of two units in a plant are

$C_1 = 0.4P_1^2 + 160P_1 + K_1$ Rs./h

$C_2 = 0.45P_1^2 + 120P_1 + K_2$ Rs./h

Where P_1 and P_2 are power output in MW. Find the optimum load allocation between the two units, when the total load is 162.5 MW. What will be the daily loss if the units are loaded equally? **(13) (April/May 2018) (An & E)**

24. Determine the simple shut-down algorithm used in priority List scheme. **(6) (April/May 2018) (U)**

25. Outline the steps for forward dynamic programming approach for solving the unit commitment problems. **(7) (April/May 2018) (U)**

26. Determine the economic generation schedules of three generating units in a power system to meet the system load of 925 MW. The operating limit and cost function is given below.

Operating limits $250\ MW \leq P_{G1} \leq 450\ MW$

$200\ MW \leq P_{G2} \leq 350\ MW$

$125\ MW \leq P_{G3} \leq 225\ MW$

Cost function is $F_1 (P_{G1}) = 0.0045\ P_{G1}^2 + 5.2\ P_{G1} + 580$

$F_2 (P_{G1}) = 0.0056\ P_{G2}^2 + 4.5\ P_{G2} + 640$

$F_3 (P_{G1}) = 0.0079\ P_{G3}^2 + 5.8\ P_{G3} + 820$. **(13) (Nov/Dec 2018) (An & E)**

27. Explain in detail, with the help of a flow chart the forward dynamic programming solution method of unit commitment problem. **(13) (Nov/Dec 2018) (U)**

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations – SCADA and EMS functions - state estimation problem – measurements and errors – weighted least square estimation - various operating states - state transition diagram. 84

PART – A

1. What are the functions of control center? (Nov/Dec 2013) (U)

System monitoring contingency analysis security constrained optimal power flow.

2. What is the function of system monitoring? (U)

System monitoring provides up to date information about the power system.

3. Define scada system? (Nov/Dec 2009) (Nov/Dec 2014) (R)

It stands for supervisory control and data acquisition system, allows a few operators to monitor the generation and high voltage transmission systems and to take action to correct overloads.

4. What are the states of power system? (April/May 2012) (U)

Normal state alert mode, contingency mode, emergency mode.

5. Define normal mode?

The system is in secure even the occurrence of all possible outages has been simulated the system remain secure is called normal mode.

6. Define alert mode? (April/May 2011) (April/May 2013) (R)

The occurrence of all possible outages the system does not remain in the secure is called alert mode.

7. What are the distribution factors? (U)

Line outage distribution factor, generation outage distribution factor.

8. Define state estimation? (May/June 2016) (R)

State estimation is the process of assigning a value to an unknown system state variable based on measurements from that system according to some criteria.

9. Define maximum likelihood criterion? (Nov/Dec 2009) (R)

The objective is to maximize the probability that estimate the state variable x, is the true value of the state variable vector (i.e, to maximize the P(x)=x).

10. Define weighted least-square criterion? (April/May 2012) (Nov/Dec 2018) (Nov/Dec 2014) (R)

The objective is to minimize the sum of the squares of the weighted deviations of the estimated measurements z, from the actual measurement.

11. Define minimum variance criterion. (R)

The objective is to minimize the expected value of the squares of the deviations of the estimated components of the state variable vector from the corresponding components of the true state variable vector.

12. Define must run constraint. (April/May 2013) (R)

Some units are given a must run status during certain times of the year for reason of voltage support on the transmission network.

13. Define fuel constraints. (April/May 2011) (R)

A system in which some units have limited fuel or else have constraints that require them to burn specified amount of fuel in a given time.

14. What are the assumptions made in priority list method? (U)

No load costs are zero unit input-output characteristics are linear between zero output and full load there are no other restrictions startup cost are affixed amount.

15. State the advantages of forward DP approach? (U)

If the startup cost of a unit is a function of the unit is a function of the time it has been offline, then a forward dynamic program approach is more suitable since the previous history of the unit can be computed at each stage.

16. State the disadvantages of dynamic programming method. (April/May 2015)(U)

It has the necessity of forcing the dynamic programming solution to search over a small number of commitment states to reduce the number of combinations that must be tested in each period.

17. What are the known values in short term hydro scheduling problem? (U)

The load, hydraulic inflows & unit availabilities are assumed known.

What is meant by telemetry system? The states of the system were measured and transmitted to a control center by means of telemetry system.

18. What are the functions of security constraints optimal power flow? (U)

In this function, contingency analysis is combined with an optimal power flow which seeks to make changes to the optimal dispatch of generation. As well as other adjustments, so that when a security analysis is run, no contingency result in violations.

19. Define the state of optimal dispatch? (R)

This is the state that the power system is in prior to any contingency. It is optimal with respect to economic operation but may not be secure.

20. Define post contingency? (R)

This is the state of the power system after a contingency has occurred. Define secure dispatch? This is state of the power system with no contingency outages, but with correction to the operating parameters to account for security violations.

21. What are the priorities for operation of modern power system? (April/May2015) (Nov/Dec 2018) (U)

Operate the system in such a way that power is delivered reliably. Within the constraints placed on the system operation by reliability considerations, the system will be operated most economically.

22. What is meant by linear sensitivity factor? (Nov/Dec 2015) (U)

Many outages become very difficult to solve if it is desired to present the results quickly. Easiest way to provide quick calculation of possible overloads is linear sensitivity factors.

23. What are linear sensitivity factors? (U)

Generation shift factors line outage distribution factors.

24. What are the uses of line distribution factor? (U)

It is used to apply to the testing for overloads when transmission circuits are lost.

25. What is meant by external equivalencing? (Nov/Dec 2015) (U)

In order to simplify the calculations and memory storage the system is sub divided into 3 sub-systems called as external equivalencing.

25. What are the functions of SCADA? (May/June 2016) (Nov/Dec 2016)

- Monitoring
- Alarm
- Control and indication of AGC
- Data logging
- Data acquisition
- ON/OFF control
- RAISE/LOWER command to speed changer
- Display

26. What are the major functions that are carried out in an operational controlcentre? (Nov/Dec 2016)

(a) Monitoring

(b) Data acquisition and control

Load forecasting, system planning, unit commitment, maintenance scheduling, security monitoring, state estimation, economic dispatch, load frequency control.

27. List out the conditions for normal operation of a power system. (April/May 2017)

28. Define energy control centre. (April/May 2017)

When the power systems increases in size, their operation and interaction become more complex. So, it becomes essential to monitor this information simultaneously for the total system which is called Energy Control Centre.

29. What is SCADA? (Nov/Dec 2017)

The Supervisory Control And Data Acquisition System allows a few operators to monitor the generation and HV transmission system.

30. Define state estimation. (Nov/Dec 2017)

State estimation is the process of assigning a value to an unknown system state variable based on measurements from that system according to some criteria i.e., minimizing the sum of the squares of the differences between the estimated and true values of a function.

31. State the Weighted Least Square Criterion. (April/May 2018)

The objective is to minimize the sum of the squares of the weighted deviations of the estimated measurements (F[X]) from the actual measurements [Z].

32. List the basic functions of EMS. (April/May 2018)

(a) System load forecasting – Hourly energy, 1 to 7 days
(b) Unit commitment – 1 to 7 days
(c) Fuel scheduling to plants
(d) Hydro-thermal scheduling – up to 7 days
(e) MW interchange evaluation – with neighbouring system
(f) Transmission loss minimization
(g) Security constrained dispatch
(h) Maintenance scheduling
(i) Production cost calculation.

PART – B

1. Briefly explain various functions of SCADA with a neat diagram. **(16) (May/June 2016) (U)**

2. Draw a state transition diagram of a power system and explain the different control actions. **(16) (May/June 2016) (April/May 2017) (U)**

3. Explain with state transition diagram, the different state of the power system and the various control actions taken under every state to maintain or bring back the system to normal operating mode. **(16) (Nov/Dec 2016) (U)**

4. Explain briefly the typical functions of the ECC. What are the main functions common to all SCADA system and the main tasks of control centre at different levels?

(16) (Nov/Dec 2016) (U)

5. Describe SCADA system for power system, its hardware components and applications. **(16) (April/May 2017) (U)**

6. Draw the block diagram to show the hardware configuration of a SCADA for a power system operation and explain the application of SCADA in monitoring and control of power system. **(16) (Nov/Dec 2017) (U)**

7. Enumerate the various operating states and the control strategies of a power system. (16) (Nov/Dec 2017) (U)

8. Construct with neat schematic diagram, the information flow between various functions in an operational energy control centre computer system. **(13) (April/May 2018) (U)**

9. Discuss with neat state transition diagram outlining the various operating state transitions and control strategies in Power system. **(13) (April/May 2018) (U)**

10. What are the functions of energy control centre or load dispatch centre and explain its operation? **(13) (Nov/Dec 2018) (U)**

11. Explain the hardware components and functional aspects of SCADA system using a fundamental block diagram. **(13) (Nov/Dec 2018) (U)**

12. Write short notes on state estimation? Explain the help of flow chart the weighted least square estimate. **(15) (Nov/Dec 2018) (U)**

EE8703 SPECIAL ELECTRICAL MACHINES **L T P C** **3 0 0 3**

Course outcomes

CO.1	Ability to understand the working principle,torque equation, and EMF equation of synchronous reluctance motor and improve its performance by designing the electrical circuits to solve engineering problems.
CO.2	Ability to gain knowledgein analyzing the principle of operationof stepper motor and to design interfacing circuits for real - time applications.
CO.3	Ability to understand and design the electrical circuits with the closed loop control of switched reluctance motor to solve complex .
CO.4	Ability to develop the skills in analyzing the magnetic circuits ,EMF and Torque equations and design the power controller circuits of the Permanent magnet brushless DC motor.
CO.5	Ability to handle different types of permanent magnet synchronous motor and design power controller circuits using the knowledge of phasor diagram, torque –speed characteristics and volt –ampere requirements.

UNIT I SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance Motors – Voltage and Torque Equations - Phasor diagram - performance characteristics – Applications

UNIT II STEPPING MOTORS 9

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi-stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle– Applications.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features – Rotary and Linear SRM - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control-Applications.

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Permanent Magnet materials – Minor hysteresis loop and recoil line-Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power Converter Circuits and their controllers – Motor characteristics and control– Applications

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements– Applications.

TOTAL : 45 PERIODS

OUTCOMES

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives',Clarendon Press, Oxford, 1989.
3. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

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1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

UNIT – I - SYNCHRONOUS RELUCTANCE MOTORS

Part A

1. What is a synchronous reluctance motor? **(Nov 2011) (RE)**

A reluctance motor that utilizes an ac rotating field, which allows for the possibility of extremely smooth torque and good operation to low speeds.

2. What are the types of rotor in synchronous reluctance motor? **(Nov 2012) (RE)**

1: Salient rotor 2. Radially laminated rotor 3. Axially laminated rotor

3. Mention some applications of synchronous reluctance motor..**(April/may 2010) (AP)**

1. Fiber-spinning mills2. Industrial process equipment 3. Metering pumps
4. Wrapping and folding machines

4. What are the advantages of increasing LdILq ratio in synchronous reluctance motor? **(Nov 2012) (UN)**

1. Motor power factor increases.
2. 12R losses reduced.3. Reduced volt-ampere ratings of the inverter driving the machine.

5. Compare synchronous reluctance motor and induction motor.**(Nov 2011)(** AN)

	Synchronous reluctance motor	Induction motor
1.	Better efficiency	Efficiency is low compared with synchronous reluctance motor.
2.	Highcost	Lowcost
3.	Low power factor.	High power factor.
4.	Used for low and medium power application.	Used for high power application.

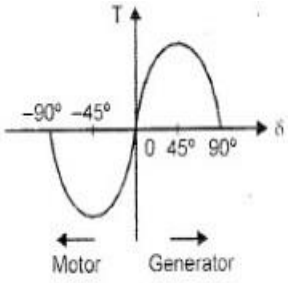
6. Write down the torque equation of synchronous reluctance motor.(**Nov/Dec2010)(EV)**

$$T = \frac{3}{\omega_s} V^2 \left(\frac{X_{sd} - X_{sq}}{2 X_{sd} X_{sq}} \right) \sin 2\delta$$

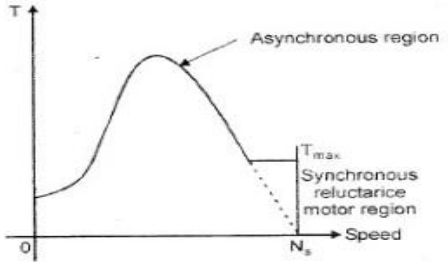
where, V = supply voltage, δ = load angle,

ω_s = synchronous speed, X_{sd}, X_{sq} = synchronous reactances of d and q axis

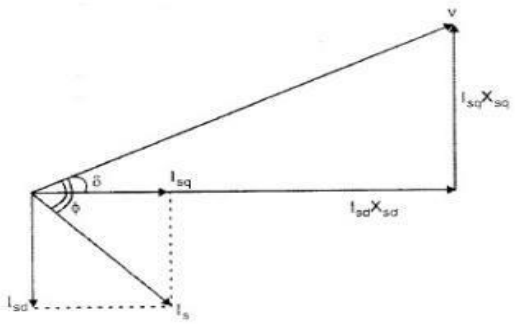
7. Draw the torque-angle characteristics of synchronous reluctance motor. (**May2012)** (Nov/Dec 2018) **(CR)**



8. Draw the speed-torque characteristics of synchronous reluctance motor. **(April/may 2010) (CR)**



9. Draw the steady-state phasor diagram of synchronous reluctance motor. **(Nov/Dec2011)(CR)**



10. What is Vernier motor?(RE)

Vernier motor is a permanent magnet motor and has a high torque at low speed. It operateson the principles of a Vernier.

11. What is the application of Vernier motor? **(Nov 2012)(AP)**

The Vernier motor is mainly used where require low speed and high torque.

12. Mention some advantages and disadvantages of synchronous reluctance Motor. (AN)
Advantages
1. There is no concern with demagnetization, hence synchronous reluctance.
2. There need be no excitation field at zero torque, thus eliminating electromagnetic spinning losses.
3. Synchronous reluctance machine rotors can be constructed entirely from high strength ,low-cost materials.

Disadvantages
1. Compared to induction motor it is slightly heavier and has low power factor. But Increasing the saliency ratio, the power factor can be improved.
2. High cost than induction motor.
3. Need speed synchronization to inverter output frequency by using rotor position sensor and sensor less control.

13. Write down any two properties of synchronous reluctance motor.(RE)
1. High output power capability.
2. Ability of the rotor to withstand high speeds.
3. Negligible zero-torque spinning losses.
4. High reliability.
14. What is reluctance torque is synchronous reluctance motor? (Nov/Dec 2018)

(Nov 2011) (UN)

The torque exerted by the reluctance motor because of the tendency of the salient poles to align themselves in the minimum reluctance position. This torque is called reluctance torque.

15. What arc the design considerations in synchronous reluctance motor? **(Nov/Dec2012) (CR)**

1. Power factor 2. Copper loss and core loss3. Cost 4. Efficiency

PART –B

1. Explain in detail about classification of synchronous reluctance motor.(UN)
2. Draw the phasor diagram of synchronous reluctance motor. (Nov/Dec 2018) (AP)
3. Derive the torque equation of synchronous reluctance motor. (AN)

4. Draw and explain the characteristics of synchronous reluctance motor.(AP)
5. Explain in detail about vernier motor.(UN)
6. Explain the construction and working principle of synchronous reluctance motor (NOV 2011) (NOV/DEC 2016) (UN)
7. Draw the steady state phasor diagram of synchronous reluctance motor and derive the expression for torque equation of synchronous reluctance motor. (NOV/DEC 2016)(CR)
8. draw and explain the speed torque characteristics of synchronous reluctance motor. (Nov/Dec 2018)

UNIT II – STEPPER MOTOR

Part A

1. What is stepper motor? **(Nov/Dec2007) (RE)**
A stepper motor is a digital actuator whose input is in the form of programmed energization of the stator windings and whose output is in the form of discrete angular rotation.

2. Define the term step angle.**(April/may 2010) (RE)**
Step angle is defined as the angle through which the stepper motor shaft rotates for each command pulse. It is denoted as β.

Formula for step angle (β)

$$\beta = \frac{N_s - N_r}{N_s . N_r} \times 360$$

$$\beta = \frac{360}{m\,Nr}$$

where

N_s – No.of stator poles or stator teeth
N_r – No.of rotor poles or rotor teeth
m – No.of stator phases

3. Define slewing. .**(April/may 2011) (RE)**
The stepper motor may be operate at very high stepping rates i.e., 25000 steps per second. A stepper motor operates at high speeds is called slewing.

4. Write down the formula for motor speed of stepper motor. **(Nov/Dec2008) (RE)**

Motor speed

$$n = \frac{\beta \times f}{360^\circ} \text{ rps}$$

where

β – Step angle

f – Stepping frequency or pulse rate in pulses per second (pps)

5. Define resolution. **.(April/may 2010) (RE)**
It is defined as the number of steps needed to complete one revolution of the rotor shaft.

6. State some applications of stepper motor. **(Nov/Dec2009) (AP)**
1. Floppy disk drives
2. Quartz watches
3. Camera shutter operation
4. Dot matrix and line printers
5. Machine tool applications
6. Robotics

7. What are the advantages and disadvantages of stepper motor?**(April/may 2010) (UN)**
Advantages
1. It can driven open loop without feedback.2. Responds directly to digital control signals, so stepper motors are natural choice for digitalcomputer controls.3. It is mechanically simple.4. It requires little or no maintenance.

Disadvantages
1. Low efficiency with ordinary controller.2. Fixed step angle.3. Limited ability to handle large inertia load4. Limited power output and sizes available.

8. What are the different types of stepper motor? **.(April/may 2011) (UN)**
(Nov/Dec 2018)

1. Variable reluctance stepper motor 2. Permanent magnet stepper motor 3. Hybrid stepper motor

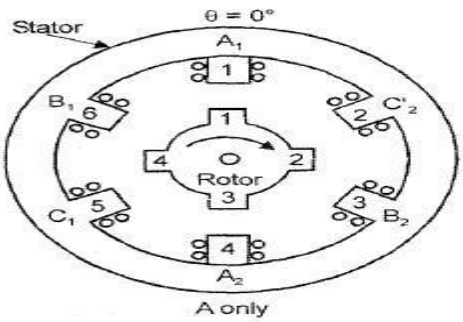
9. What are the different modes of excitation in a stepper motor? **.(April/may 2010) (RE)**
1 - Phase on or full - step operation2. 2-phase on mode3. Half- step operation (Alternate 1-phase on and 2-phase on mode) 4. Micro stepping operation

10. What is meant by full-step operation? (RE)

It is the one-phase on mode operation. It means, at that time only one winding is energized.By energizing one stator winding, the rotor rotates some angle. It is the full-step operation.

11. What is meant by half- step operation? **(Nov/Dec2009) (RE)**
It is the alternate one-phase on and 2-phase on mode operation. Here, the rotor rotate an eachstep angle is half of the full-step angle.

12. Sketch the diagram of a VR stepper motor.**(April/may 2009) (AP)**
VR Stepper motor



11. What is meant by micro stepping in stepper motor? **(Nov/Dec2009) (RE)**
Micro stepping means, the step angle of the VR stepper motor is very small. It is also calledmini - stepping. It can be achieved by two phases simultaneously as in 2-phase on mode butwith the two currents deliberately made unequal.

14. What is the main application of micro stepping VR stepper motor? **(Nov/Dec2010) (RE)**
Micro stepping is mainly used where very fine resolution is required. The applications are printing and photo type setting. AVR stepper motor with micro stepping provides very smooth low - speed operation and high resolution.

15. What is a multi - stack VR stepper motor? **(Nov/Dec2011) (RE)**
Micro stepping of VR stepper motor can be achieved by using multi stack VR stepper motion. It has three separate magnetically isolated sections or stacks. Here the rotor an stator teeth are equal.

16. What are the advantages and disadvantages of VR stepper motor?**(April/may 10) (AN)**
Advantages
1. Low rotor inertia
2. High torque to inertia ratio
3. Light weight
4.Capable of high stepping rate.
5. Ability to freewheel
Disadvantages
1. Normally available in 3.6° to 30 step angles.

2. No detente torque available with windings de – energized

17.What are the advantages & disadvantages of permanent magnet stepper motor? (AN)

Advantages

1. Low power requirement
2. High detente torque as compared to VR motor
3. Rotor do not require external exciting current
4. It produces more torque per ampere stator current

Disadvantages

1. Motor has higher inertia
2. Slower acceleration

18. What is hybrid stepper motor? **(May/June 2008) (RE)**

A hybrid stepper motor combines the features of both PM and VR stepping motors.

19. What are the advantages and disadvantages of hybrid stepper motor? (AN)

Advantages

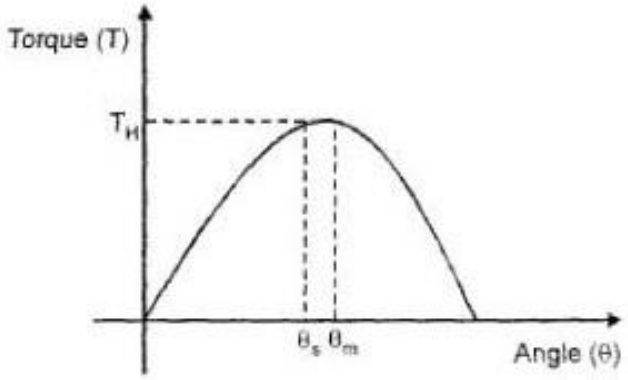
1. Less tendency to resonate 2. Provide deterte torque with windings de-energized 3. Higher holding torque capability4. High stepping rate capability

Disadvantages

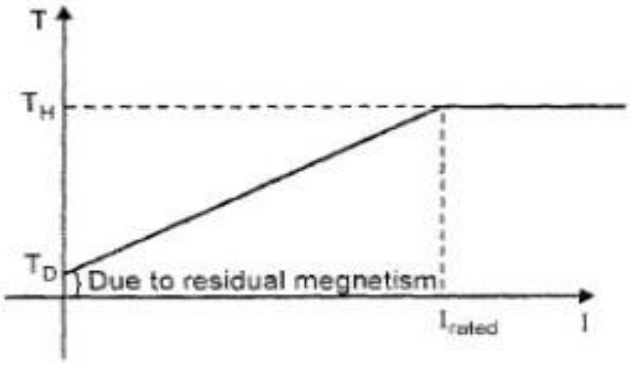
1. Higher inertia and weight due to presence of rotor magnet.2. Performance affected by change in magnetic strength.

20. Draw the typical static characteristics of a stepper motor. **(April/may 2011) (AN)**

T-θ Characteristic



T-I Characteristic



21. Differential between VR, PM and hybrid stepper motor. **(April/may 2011) (AN)**

	VR Stepper motor	PM Stepper motor	Hybrid stepper motor
1.	Low rotor inertia	high inertia	High inertia
2.	Less weight	More weight	More weight
3.	No detente torque available windings de-energized	Provides detente torque	Provides détente torque with windings de-energized
4.	Rotor is no permanent magnet	rotor is permanent magnet	rotor is permanent magnet
5.	Rotor is a salient pole type	rotor is a cylindrical type	rotor is a salient pole type

22. Define holding torque **(May/June 2009) (RE)**

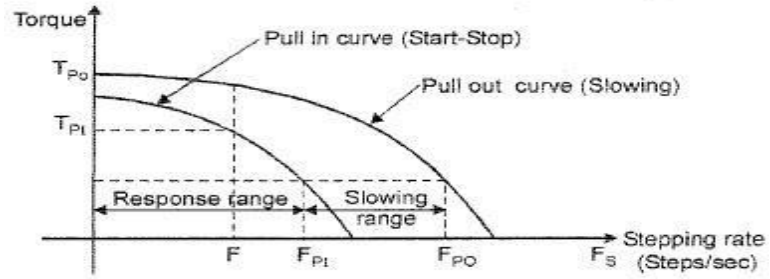
Holding torque is the maximum load torque which the energized stepper motor can withstand without slipping from equilibrium position.

23. Define detente torque.(RE) (Nov/Dec 2018)
Detente torque is the maximum load torque which is un energized stepper motor can withstand without slipping. It is also known as cogging torque.

24. Define torque constant. **(May/June 2010)(RE)**

Torque constant of the stepper motor is defined as the initial slope of the torque current curveof the stepper motor. It is also called as torque sensitivity.

25. Draw the typical dynamic characteristics of a stepper motor. (AN)



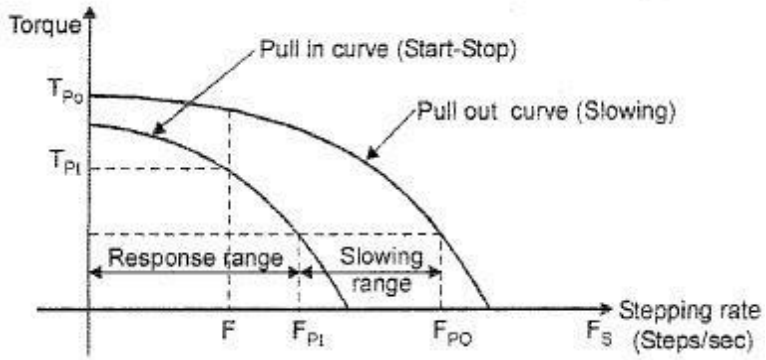
26. Define pull-in torque. (RE)
It is the maximum torque the stepper motor can develop in start - stop mode at a given stepping rate F (steps/sec), without losing synchronism,

27. Define pull-out torque. **(May/June 2011) (RE)**
It is the maximum torque the stepper motor can develop at a given stepping rate F (steps/sec), without losing synchronism.

28. Define pull-in rate.(RE)
It is the maximum stepping rate at which the stepper motor will start or stop, without losing synchronism, against a given load torque.

29. Define pull-out rate. **(May/June 2009) (RE)**
It is the maximum stepping rate at which the stepper motor will slow, without losing synchronism against a given load torque.

30. What is a response range? (RE)



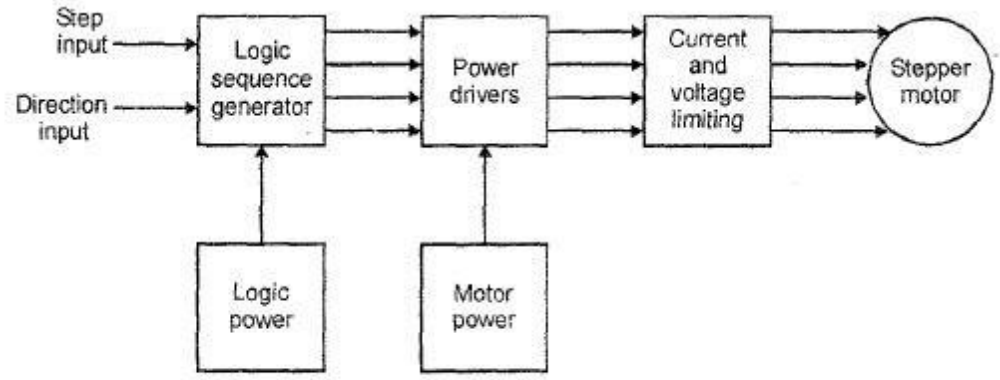
It is the range of stepping rates at which the stepper motor can start or stop with losing synchronism, at a given load torque. Response range spans stepping rates the pull in rate.

31. What is a slewing range? (RE)
It is the range of stepping rates at which the stepper motor can run in the slov mode, with losing synchronism, at a given load torque.The slewing range spans stepping rates

32. What is synchronism in stepper motor? **(May/June 2011) (RE)**
It is the one-to-one correspondance between the number of pulses applied to stepper motor controller and the number of steps through which the motor has actually moved.

33. What is mid - frequency resonance in stepper motor? **(Nov/Dec2009) (RE)**
In the pull in curve of a stepper motor, suddenly dips very low in particular range of steppingrates. This phenomenon is known as mid-frequency resonance. This phenomenon is amanifestation of instability of motor operation.

34. Draw the block diagram of the drive system of a stepping motor (AN)



$F_{PI} \le F_{PI} \le F_{PO}$ $F_s \le F_{PI}$,

35. What is logic sequencer? **(May/June 2009) (RE)**

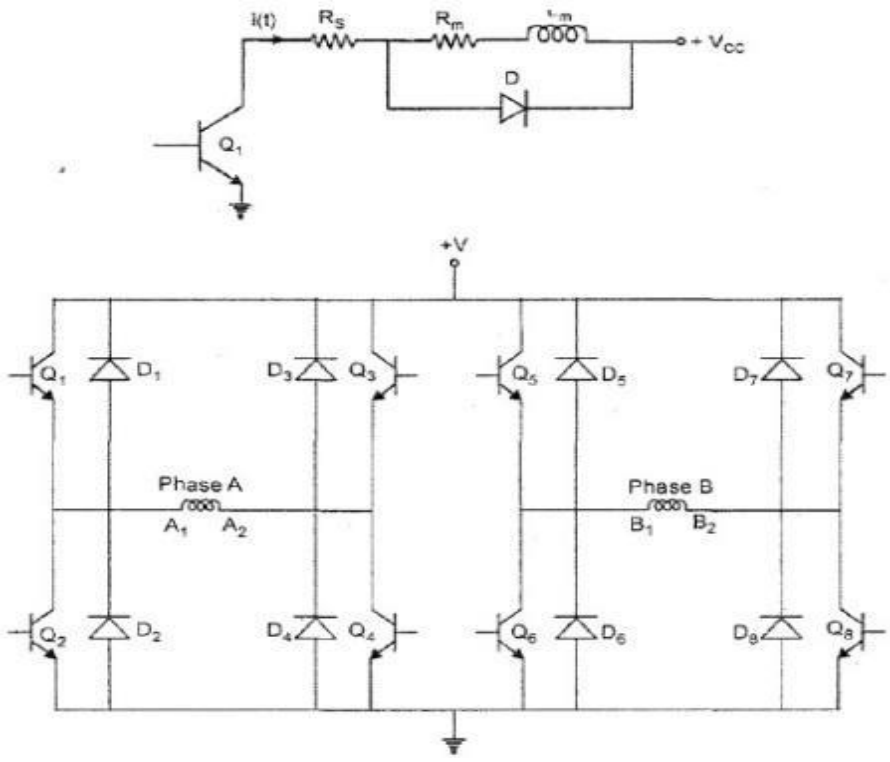
Logic sequence generator generates programmed logic sequences require for operation of a stepper motor.

36. What is meant by power drive circuit in stepper motor? **(Nov/Dec2010) (RE)**
The output from the logic sequence generator signals are low level signals which are too weak to energize stepper motor windings. To increase the voltage, current and power levels of the logic sequence output by using power semiconductor switching circuit. This circuit is called power drive circuit.

37. What is the use of current suppression circuit? (RE)
This circuits are used to ensure fast decay of current through the winding when the transistor is turned off

38. What are the types of current suppression circuits? **(Nov/Dec2009) (RE)**
1. Diode suppression2. Diode resistor suppression3. Diode - zener diode suppression4. Active suppression

39. Draw any two drive circuits for stepper motor (AN)



40.How is the step of permanent magnet stepper motor controlled? ((EV)
The step of the permanent magnet stepper motor is controlled by energization of phase winding with positive or negative current.

41. How is the step of permanent magnet stepper motor controlled? **(Nov/Dec2009) (EV)**

The step of the permanent magnet stepper motor is controlled by energization of phase winding with positive or negative current.

PART B

1.Explain the construction and various modes of excitation of VR stepper motor. (UN) (Nov/Dec 2018)
2.Explain the construction and various modes of excitation of PM stepper motor. (UN)
3.Explain the construction and working principle of Hybrid Stepper motor. (UN)
4. State and explain the static and dynamic characteristics of a stepper motor. ((RE)(UN) (Nov/Dec 2018)
5. Explain in detail about different types of power drive circuits for stepper motor. (UN)
6. Explain the mechanism of torque production in VR stepper motor. (UN)
7. Draw and explain the drive circuits for stepper motor. (AN)
8. Explain in detail the multi stack construction of stepper motor(NOV/DEC 2016)(UN)
9. Explain the modes of excitation of a stepper motor(NOV/DEC 2016)(UN)
10. A stepper motor has a resolution 180 steps/rev . Find the pulse rate required in order to obtain a rotor speed of 2400 rpm(NOV/DEC 2016)(EV)
11. Explain in detail the static and dynamic characteristics of a stepper Motor(NOV/DEC 2016)(UN)
12. Explain with neat diagram the microprocessor based control of switched reluctance motor(NOV/DEC 2016)(UN)
13. Derive the expression for static torque in SRM(NOV/DEC 2016)(CR) (Nov/Dec 2018)
14. Explain with neat diagram any two topologies for SRM(NOV/DEC 2016)(UN)
15. Explain the torque speed characteristics of SRM in detail.(NOV/DEC 2016)(UN)

UNIT III- SWITCHED RELUCTANCE MOTOR

Part A

1. What are the types of power controllers used for switched reluctance motor?(RE)
i) Using two power semiconductors and two diodes per phase ii) (n ± 1) power switching devices and (n + 1) diodes per phase iii) Phase windings using Bifilar wiresiv) Dump C- converter v) Split power supply converter

2. Why rotor position sensor is essential for the operation of switched reluctance motor?(AN) **(April/may 2008)**

It is normally necessary to use a rotor position sensor for commutation and speed feed back.The turning ON and OFF operation of the various devices of power semiconductor switchingcircuit are influenced by signals obtained from rotor position sensor.

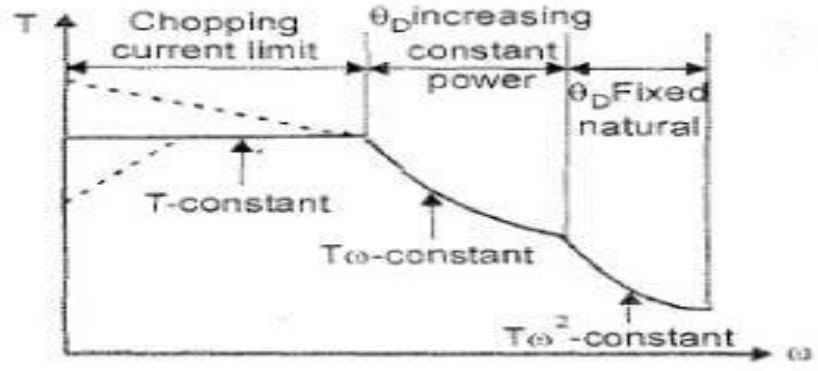
3. List are the disadvantages of a switched reluctance motor? **(April/may 2010) (RE)**

1. Stator phase winding should be capable of carrying magnetizing current.
2. For high speed operation developed torque has undesirable ripples develops undesirable noises (or) acoustic noises.3. For high speed current wave form has undesirable harmonics to suppress this effect large size capacitor is to be connected.4. It requires position sensors.

4. What are the advantages of switched reluctance motor? **(April/may 2009)(RE)** (Nov/Dec 2018)

1. Construction is simple and robust.2, Rotor carries no windings, no slip rings, no brushes, less maintenance.3. There is no permanent magnet.4. Ventilating system is simpler as losses takes place mostly in the stator.5. Power semi conductor switching circuitry is simpler 6. No shoot through fault likely to happen power short circuits,7. Developed torque doesn‘t depends upon the polarity of current in the phaseWinding.8. The operation of the machine can be easily change from motoring mode to generating mode by varying the region of conduction.9. It is possible to get very high speed.10. Depending upon the requirement T-ω characteristics can be achieved.11. It is the self starting machine.12. Energy stored in the phase winding is fed back to the supply through the feedback diodes during off period.

5. Draw the general torque - speed characteristics of switched reluctance motor.(AN)



6. What arc the applications of SRM **(Nov/Dec2009)(RE)**
1. Washing machines2. Vacuum cleaners 3. Fans4. Future automobile applications5. Robotics control applications

7. What is Switched Reluctance Motor?(RE)
The switched reluctance motor is a double salient, singly-excited motor. This means that ithas salient pole on both the rotor and the stator, but only one member crries windings. Therotor has no windings, magnets (or) cage winding. It works on vai1é reluctance principle.

8. What are the two types of current control techniques?(UN)
1. Hysteresis type control2. PWM type control

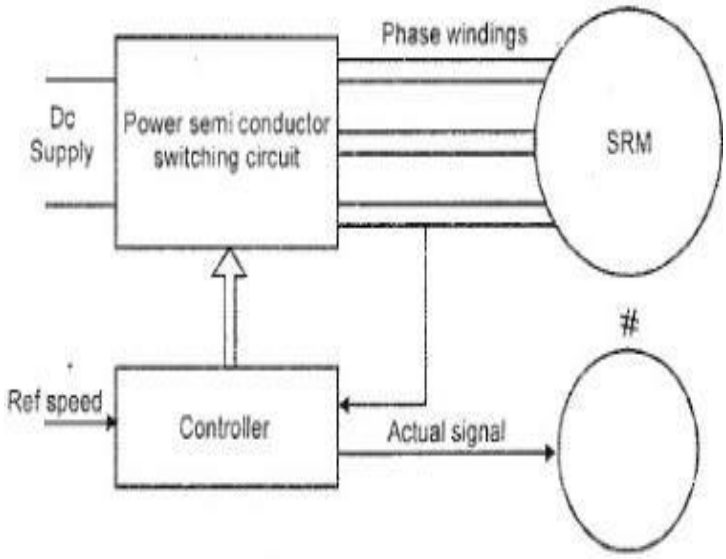
9. What is meant by energy ratio? **(April/may 2009)(RE)**

$$\text{Energy ratio} = \frac{W_m}{W_m + R} \simeq 0.45$$

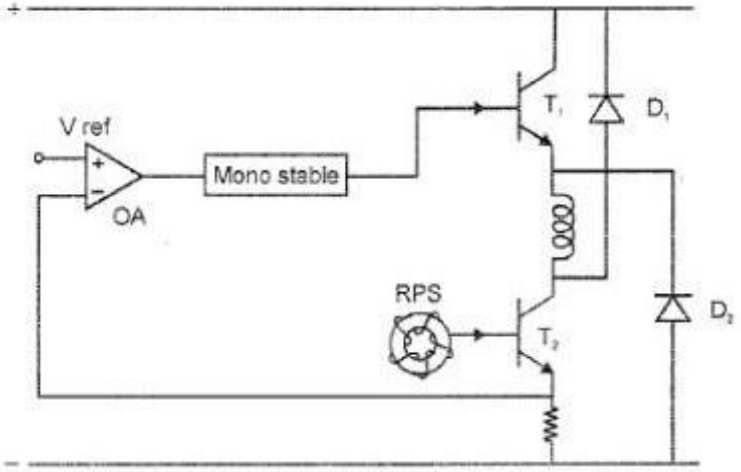
W_m = mechanical energy transformed.

This energy ratio cannot be called as efficiency. As the stored energy R is not wasted as a loss but it is feedback to the source through feed back diodes.

10. Draw the simple block diagram of SRM.(AN)



11. Draw the circuit of PWM type current control. **(Nov/Dec2010)(AN)**



12. What are phase windings?(RE)

Stator poles carrying field coils. The field coils of opposite poles are connected in series such that mmfs are additive and they are called –Phase windings‖ of SRM.

13. What are the essential difference between SRM and Stepper Motor?(RE)

SRM	Stepper Motor
1. SRM is designed for continuous rotation.	Stepper motor is designed to rotate in step by step rotation,
2. SRM requires a rotor-position sensor.	It does not require rotor-position sensor.

14. Write the torque equation for a switched reluctance motor drive.(RE)

$$T = \frac{1}{2} i^2 \frac{\partial L}{\partial \theta}$$

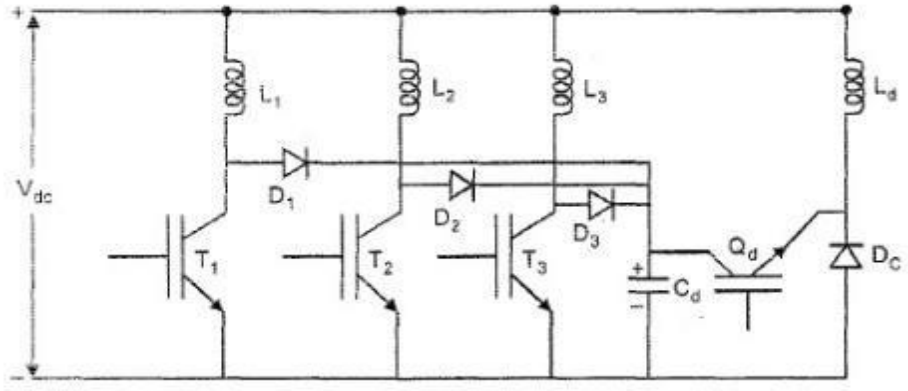
where

T = motor torque

i = current

$\frac{\partial L}{\partial \theta}$ = change of inductance with respect to rotor angle

15. Sketch the C-dump converter circuit for switched reluctance motor. **(April/may 2010)(AP)**



16. What is hysteresis current control?(RE)

This type of current controller maintains a more or less constant current throughout the conduction period in each phase. This controller is called hysteresis type controller.

17. Define Chopping and single pulse mode of operation of SRM . **(Nov/Dec2009)(RE)**

Chopping Mode

In this mode, also called low-speed mode, each phase winding gets excited for a Period which is sufficiently long.

Single-pulse mode

In single-pulse mode, also called high-speed mode, the current rise is within limits during the small time interval of each phase excitation.

PART -B

1. Explain the construction and working principle of switched reluctance motor. (16)(UN) (Nov/Dec 2018)

2. Describe the various power controller circuits applicable to switched reluctance

motor and explain the operation of any one scheme with suitable circuit diagram.(16) (Nov/Dec 2018) (UN)

3. Draw a schematic diagram and explain the operation of a ‗C' dump converter used for the control of SRM. (16)(AN)(UN)
4.(a).Derive the torque equation of SRM. (8)(CR)
(b). write note on the power controllers used in switched reluctance motors (8)(RE)
5. Draw and explain the general torque-speed characteristics of SRM and discuss the type of control strategy used for different regions of the curve. Sketch the typical phase current waveforms of low speed operation. (16)(AN)(UN)
6.Describe the hysteresis type and PWM type current regulator for one phase of a SRM with relevant circuit diagrams (16)(UN)
7.With neat diagram , explain the microprocessor based control of switched reluctance motor (16)(UN)

UNIT –IV –PERMANENT MAGNET BRUSHLESS DC MOTOR

Part A

1. What are the advantages and disadvantages of brushless dC motor drives?(RE)

Advantages(Nov/Dec 2018)

1. There is no field winding so that field copper loss is neglected.2. Length of the motor is very small as there is no mechanical commutator, so thatsize becomes very small.3. Better ventilation because of armature accommodated in the stator.4, Regenerative braking is possible.5. Speed can be easily controllable.6. Motor can be designed for higher voltages subjected to the constraint caused bythe power semi conductor switching circuit.7. It is possible to have very high speeds.

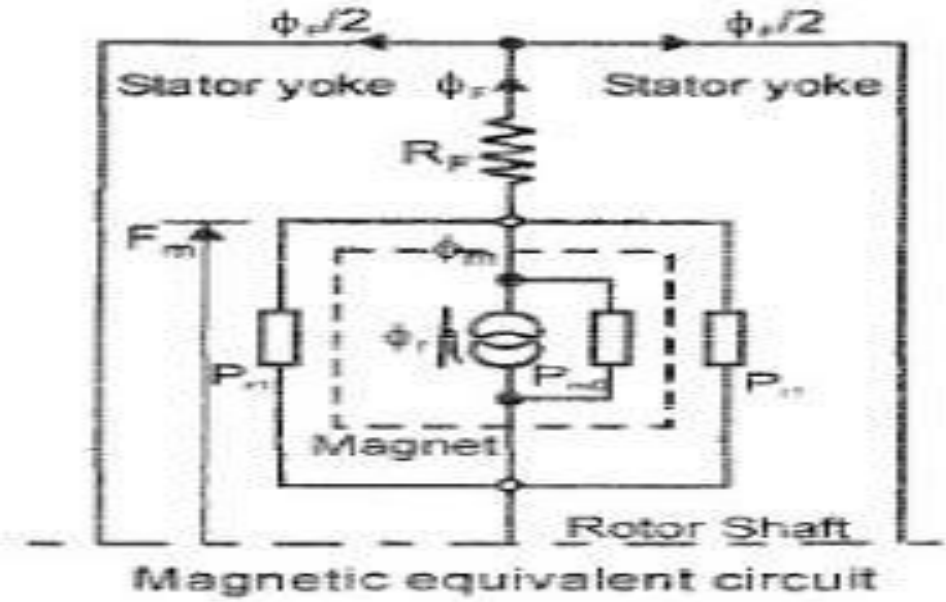
Disadvantages

1. Motor field cannot be controlled2. Power at1g is restricted because of the maximum available size of permanent Magnets.3. It requires a rotor position sensor.4. It requires a power semi conductor switching circuit.

2. List the various permanent magnet materials. **(Nov/Dec2010) (RE)**

1. Alnico
2. Rare - earth magnet
3. Ceramic magnet
4. NdFeB magnet
5. $Sm_2 CO_{17}$ magnet

3. Draw the magnetic circuit of 2 pole permanent magnet brushless de motor (AN)



Magnetic equivalent circuit

4. What are the differences between mechanical and electronic commutators? **(April/may 2010)(RE)** (Nov/Dec 2018)

Mechanical Commutator	*Electronic Commutator*
Commutator is made up of commutator segments and mica insulation. Brushes are made up of carbon or graphite.	Power electronic switching devices are used in the commutator.
Commutator arrangement is located in the rotor.	Commutator arrangemet is located in the stator.
Shaft position sensing is inherent in the arrangement	It requires a separate rotor position sensor.
Number of commutator segments are very high.	Number of switching devices is limited to 6.
Sliding contact between commutator and brushes.	No sliding contacts.
Sparking takes place.	There is no sparking
It requires a regular maintenance	It is possible to get the feed back from the stored energy in the magnetic field to the mains. It require less maintenance.
Difficult to control the voltage available across tappings.	Voltage available across armature tappings can be controlled by PWM techniques.
Highly reliable	Reliability can be improved by specially designed devices and protecting circuits.

5. Write the torque and Emf equation of square wave brushless motor (UN)

Emf equation: $e_{ph} = 4 B_g r \ell T_{ph} \omega_m$ volts

where B_g = flux density in the airgap, r = radius of the airgap,

ℓ = length of the armature, ω_m = angular velocity in mech. rad/sec.

T_{ph} = number of turns per phase

Torque equation: $T = 4 B_g r \ell T_{ph} I$ N – m

where I = current flow through the motor.

6. Mention some applications of PMBL DC motor.(AN)
   1. Power alternators 2. Automotive applications3. Computer and Robotics applications 4. Textile and Glass industries

7. Compare conventional dc motor and PMBLDC motor. **(April/may 2009)(AN)**

Features	Conventional DC motor	PMBL DC motor
Mechanical structure	Field magnets on the stator	Field magnets on the rotor
Maintenance	Maintenance is high	Low maintenance
Winding connection	Ring connection The simplest: Delta connection	The highest grade: Dell or star- connected three phase connection. Normal: star-connected
Commutation method	Mechanical contact between brushes and commutator	three phase winding with grounded neutral point or four-phase connection. The simplest: Two-phase connection.
Detecting method	Automatically detected by brushes	Electronic switching using power semi conductor devices ie. transistors, MOSFETS.
Reversing method	By a reverse of terminal voltage.	Rotor position can be detected by using sensor i.e., Hall sensor; optical encoder. Rearranging logic sequencer

8. Why is the PMBLDC motor called electronically commutated motor?(AP)
The PMBL DC motor is also called electronically commutated motor because the phase windings of PMBL DC motor is energized by using power semiconductor switching circuits, Here, the power semiconductor switching circuits act as commutator.

9. What are the classifications of BLPM dc motor? **(April/may 2011)(RE)**
1. BLPM square wave motor 2. BLPM sine wave motor

10. What are the two types of BLPM SQW DC motor? **(Nov/Dec2010)(RE)**

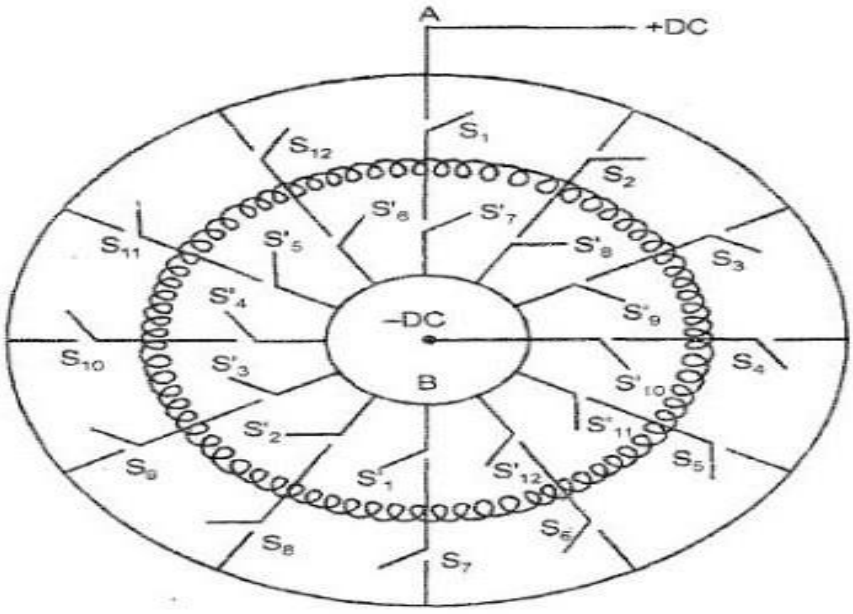
1. 180° pole arc BLPM square wave motor 2. 120° pole arc BLPM square wave
motor

11. Name the position sensors that are used for PMBLDC motor? (UN)
1. Optical position sensor 2. Hall effect position sensor

12. What are the materials used for making Hall IC pallet?(RE)
1. Indium - antimony2. Gallium – arsenide

13. What are the relative merits of the brushless dc motor drives? **(Nov/Dec2011)(RE)**
Merits:
1. There is no field winding so that field copper loss is neglected.2. Length of the motor is very small as there is no mechanical commutator, so that size becomes very small.3. Better ventilation because of armature accommodated in the stator.4. Regenerative braking is possible.5. Speed can be easily controllable.6. Motor can be designed for higher voltages subjected to the constraint caused by the power semi conductor switching circuit.

14. Draw the circuit diagram of electronic commutator.(AN)



15. Compare PMBLDC motor and switched reluctance motor. **(Nov/Dec2011)(AN)**

	PMBLDC motor	*Switched Reluctance Motor*
1.	Rotor is a permanent magnet.	No permanent magnet in the rotor.
2.	High cost.	Cost is less compared with PMBLDC motor.
3.	Torque = $4 B_g r \ell I T_{ph}$	$T = \frac{1}{2} i^2 \frac{\partial L}{\partial \theta}$
4.	More efficient.	Less efficient.

16. What is hail sensor? (RE)
A sensor is operated with half effect principle. It is called hail sensor. it is used sense the rotor position of the BLPMDC motor.

17. What is optical sensor?(RE)
A sensor is operated with photo transistor, it is the optical sensor. it is mainly red to sense the rotor position of the BLPMDC motor.

18. What are the types of permanent magnet DC motor?(RE)
1. PMBL square ware motor 2. PMBL sine wave motor

19. What is permanent magnet DC commutator motor?(RE)
A DC motor consists of permanent magnet in the stator and armature winding, commutator in the rotor. This motor is called permanent magnet DC commutator motor.

16 MARKS:

1.Explain the construction and principles of operation of PMBL dc motor with neat diagram (16)(UN)
2. Describe the operation of power controllers for PMBLDC motor with neat diagram. (16)(UN) (Nov/Dec 2018)
3. Derive the expressions for the emf and torque of a PMBLDC motor. (16)(CR) (Nov/Dec 2018)
4. Explain the closed loop control scheme of a permanent magnet brushless DC motor drive with a suitable schematic diagram (16)(UN)
5(a).Explain with neat diagram and wave forms of the full wave inverter based PMBLDC motor (8) (UN)
(b).Draw and explain the speed –torque characteristics of PMBLDC motor (8)(AN) (UN)
6. Explain the construction and principle of operation of PMBDLC motor. (NOV/DEC 2016)(UN)

7. Explain in detail the power controller for PMBLDC motor (NOV/DEC 2016) (UN)
8. A BLPM motor has a no load speed of 6000 rpm when connected to a 120V DC supply. The armature resistance is 2 Ω .Rotational and iron losses may be neglected. Determine the speed when the supply voltage is 60V and the torque is 0.5 N-m (NOV/DEC 2016) (EV)

UNIT –V PERMANENT MAGNET SYNCHRONOUS MOTOR.

1. What are the features of PM synchronous motor? (RE) (Nov/Dec 2018)
1. Robust, compact and less weight.2. No field current or rotator current in PMSM, unlike in induction motor.3. Copper loss due to current flow which is largest loss in motors is about half that Of induction motor.4. High efficiency.

2. What are the advantages of load commutation? (RE)
1. It does not require commutation circuits.2. Frequency of operation can be higher.3. It can be operate power levels beyond the capability of forced commutation.

3. What are the applications of PMSM?(RE)
1. Used as a direct drive traction motor.2. Used as high speed and high power drives for compression, blowers, conveyors, fans, pumps, conveyors, steel rolling mills, main line traction, aircraft test facilities. 3. Fiber spinning mills.

4. What are the features of closed loop speed control of load commutated inverter fed synchronous motor drive?(RE)
1. Higher efficiency.2. Four quadrant operations with regeneration braking is possible.3. Higher power ratings and run at high speeds (6000 rpm).

5.What are the merits of PMSM? (RE)
1. It runs at constant speed.2. No field winding, no field loss, better efficiency.3. No sliding contacts. O it requires less maintenance.

6. What are the demerits of PMSM? **(Nov/Dec2009) (RE)**
1. Power factor of operation cannot be controlled as field winding cannot becontrolled.2. It leads to losses and decreases efficiency.

7. What are the assumptions made in derivation of Emf equation for PMSM.(RE)
1. Flux density distribution in the air gap is sinusoidal.2. Rotor rotates with an uniform angular velocity.3. Armature winding consists of full pitched, concentrated similarly located coilsof equal number of turns.

8. Why PMSM operating in self controlled Mode?(AN)

Load side controller performs some what similar function as commutator in a dcmachine. The load side converter and synchronous motor combination functions similar to a dc machine.First, it is fed from a dc supply and secondly like a dc machine. The stator androtor field remain stationary with respect to each other all speeds. Consequently, the driveconsisting of load side conveter and synchronous motor is known as ‖commutator less dcmotor‖.

9. What is pulsed mode? (RE)
For speeds below 10% of base speed, the commutation of load side converter thyristors is done by forcing the current through the conducting thyristors to zero.This is realized by making source side converter to work as inverter each timeload side converter thyristors are to be turned off.Since the frequency of operation of load side converter is very low compared to source frequency. Such an operation can be realized. The operation of inverter is termed as pulsed mode.

10. What is load commutation?(RE)
Commutation of thyristors by induced voltages of load is known as Load commutation. Here frequency of operation is higher and it does not require commutation circuits.

11. What is meant by self control?(RE)
As the rotor speed changes the armature supply frequency are also changes proportionally so that the armature field always moves at the same speed as the motor. The armature and rotor field move in synchronism for all operating points. Here accurate tracking of speed by frequency is realized with the help of rotor position sensor.

12. Differentiate the SRM and PMSM. **(April/may 2010)(AN)**

S.No	SyRM	PMSM
1	Rotor has no permanent magnet	Rotor has permanent magnet
2	Less cost	High cost
3	Low efficiency	High efficiency

13. How are PMBLDC motor and PMSM different? **(Nov/Dec2012) ((AN)**
PMBLDC Motor
1. Rectangular distribution of magnetic flux in the airgap.2. Rectangular current waveforms.3. Concentrated stator winding.

PMSM
1. Sinusoidal or quasi –sinusoidal distribution of magnetic flux in the air gap.2. Sinusoidal or quasi-sinusoidal current waveforms.3. Quasi-sinusoidal distribution of stator conductors.

14. State the two classifications of PMSM and the types in each.(RE)
1. Sinusoidal PMSM.2. Trapezoidal PMSM.

15. What is meant by slot less motor? (RE)
The stator teeth are removed and resulting space is partially filled with addition copper.

16. Differentiate between self control and vector control of PMSM.(AN)

Self control	Vector control
Dynamic performance is poor	Better performance
Control circuit is simple	Control circuit is complex

17. What is brushless a.c motor?(RE)
The sinusoidal current fed motor, which has distributed winding on the stator inducing sinusoidal voltage is known as brushless a.c motor. It is used in high power drives. The brushless a.c motor is also known as PMSM.

18. What are the types of PMSM? **(April/may 2009)(RE)**
1. General classification.
1. Surface mounted motor.2. Interior motor.
The surface mounted motor is further classified as,
1. Projected type.2. Insert type.
2. Based on rotor classification.1. Peripheral2. Interior.3. Claw-pole
4. Transverse.

19. What are the merits and demerits of PMSM? **(April/may 2012)(RE)**
Merits
i It runs at constant speed.ii) No field winding, no field loss, better efficiency.
iii No sliding contacts. So it requires less maintenance.
Demerits
i Power factor of operation cannot be controlled as field winding cannot be controlled.ii) It leads to losses and decreases efficiency.

20. What are assumptions made in derivation of emf equation for PMSM? **(Nov/Dec2010)(RE)**
Assumptions
I. Flux density distribution in the air gap is sinusoidal.2. Rotor rotates with an uniform angular velocity of wm (r/sec).3. Armature winding consists of full pitched, concentrated similarly located coils of equalnumber of turns.

21. Why PMSM operating in self controlled mode is known commutator less dc motor? **(April/may 2011)(AN)**

Load side controller performs some what similar function as commutator in a dC machine. The load side converter and synchronous motor combination functions similar to a dc machine.First, it is fed from a dc supply and secondly like a dc machine. The stator and rotcfield remain stationary with respect to each other at all speeds. Consequently.drive consisting of load side converter and synchronous motor is known as –Commutuless dc motor‖.

PART -B

1. Explain the construction and performance of a permanent magnet synchronous motor with neat diagram(16)(UN)
2. Derive the emf and torque equations permanent magnet synchronous motor (16)(CR)
3. (a).Explain the speed -torque characteristics of PMDC. (8)(UN) (Nov/Dec 2018)
   (b).Explain with phasor diagram & measurement of Ld and Lq in PMSM. (8)(UN)
4. (a).Explain the speed- torque characteristics of PMSM. (8)(UN)
   (b). Explain the working of microprocessor based control in PMSM. (8)(UN) (Nov/Dec 2018)
5. Derive the torque equation of PMSM along with the phasor diagram.(8). (NOV/DEC 2016)(CR)
6. Derive the EMF equation of PMSM(NOV/DEC 2016)(CR)
7. Explain the torque speed characteristics of PMSM(NOV/DEC 2016)(UN)

GE8074 Human Rights

UNIT I

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

1) **Why HR for Engineers? [CO1, BTL1]**

Engineers have a tradition of contributing in practical and meaningful ways to development, but seldom within the explicit framework of human rights. This subject will explore, what it means to adopt a human rights-based approach to engineering the roles and responsibilities of engineers when designing and implementing projects, the opportunities to contribute to human rights through research and teaching.

2) What is Human Rights? [CO1, BTL1]

The basic rights and freedoms to which all human beings are entitled, often held to include the right to life and liberty, freedom of thought and expression, and equality before the law.

3) What is the world‟s first charter of Human rights? [CO1, BTL1]

539 B.C: The CYRUS CYLINDER is recognized by many as the world‟s first charter of human rights, this clay tablet contains proclamations of freedom and equality made by Cyrus the Great, the first king of ancient Persia.

4) What is Magna Carta? [CO1, BTL1]

The Magna Carta a latin word called as Great Charter, of 1215 is the most significant constitutiona document of all human history. The main theme of it was protection against the arbitrary acts by the king.

5) What is the Petition Of Right? [CO1, BTL1]

The petition of Right was declared on 1628. It is a statement of civil liberties sent by the English Parliament to Charles I. Refusal by parliament to finance the king‟s unpopular foreign policy had caused his government to exact loans and to quarter troops in subjects houses as an economy measure.

6) **Write the four principles of The petition of Right. [CO1, BTL1]**

i. No taxation without the consent of Parliament
ii. No imprisonment without cause
iii. No quartering of soldiers on subjects
iv. No martial law in peacetime

7) Discuss the English Bill of Rights. [CO1, BTL2]

The next source and avenue of the development of the philosophy of human rights is the English Bill of Rights, enacted on December 16, 1689, by the British Parliament. The British Parliament declared its supremacy over the crown in clear terms. The English Bill of Rights declared that the king has no overriding authority. The Bill of Rights codified the customary laws, and clarified the rights and liberties of the citizens

8) Summarize the United States Declaration of Independence. [CO1, BTL2]

The Declaration of Independence was done on 1776. By issuing the Declaration of Independence, adopted by the Continental Congress on July 4, 1776, the 13 American colonies served their political connections to Great Britain. The Declaration summarized the colonists‟ motivations for seeking independence. These

rights, as spelled out in the Declaration of Independence are life, liberty, and the pursuit of happiness

9) When the Constitution of the United States of America declared. [CO1, BTL1]

In 1787, the Constitution of the United States of America formed the fundamental laws of the US federal system of government and defining the basic rights of citizens.

10) When and where the Declaration of the Rights of Man and of the Citizen happened? [CO1, BTL1]

In 1789, The Declaration of the Rights of Man and of the Citizen was declared in France, establishing that all citizens are equal in the eyes of the law.

11) Show the Declaration of the Rights of Man And of the Citizen. [CO1, BTL2]

The Declaration of the Rights of Man and of the Citizen (French: La Declaration des droits de l‟Homme et du citoyen) is one of the most important papers of the French Revolution. This paper explains a list of rights, such as freedom of religion, freedom of speech, freedom of assembly, separation of powers.

12) When did the US Bill of Rights declared and where? [CO1, BTL1]

Bill of Rights, in the United States, the first 10 amendments to the U.S> Constitution which were adopted as a single unit of December 15, 1971. It constitute a collection of mutually reinforcing guarantees of individual rights and of limitations on federal and state governments.

13) Classify the Human Rights Characteristics. [CO1, BTL2]

- Universal – Human rights belong to all people
- Inalienable – Human rights cannot be taken away
- Interconnected – Human rights are dependent on one another
- Indivisible – Human rights cannot be treated in isolation Non-Discriminatory – Human rights should be respected without prejudice.

14) Compare between Fundamental Rights and Human Rights. [CO1, BTL2]

Fundamental rights include only those rights which are basic to a normal life. As against, the human rights are based on the right of life with dignity. Fundamental rights are guaranteed under the constitution of the country, whereas the human rights are recognised at international level.

15) What are fundamental Rights of India? [CO1, BTL1]

- Right to equality – Article 14-18
- Right to freedom – Article 19-22
- Right against exploitation – Article 23-24
- Right to freedom of religion – Article 25-28
- Cultural & educational rights – Article 29-30
- Right to constitutional Remedies – Article 32-35

16) Define Right to Equality. [CO1, BTL1]

Prohibition of discrimination on grounds of religion, race, caste, gender or place of birth.

17) Define Right to Freedom. [CO1, BTL 1]

Freedom of speech and expression, assemble, association or union or cooperatives, movement, residence, and right to practice any profession or occupation.

18) What is Right against Exploitation? [CO1, BTL 1]

Prohibits all forms of forced labour, child labour and traffic of human beings.

19) What is Right to Freedom of Religion? [CO1, BTL 1]

Freedom of conscience and free profession, practice, and propagation of religion, freedom to manage religious affairs.

20) Mention Cultural and Educational Rights. [CO1, BTL 1]

Right of any section of citizens to conserve their culture, language or script, and right of minorities to establish and administer educational institutions of their choice.

21) What is Right Constitutional Remedies? [CO1, BTL 1]

It provides a mechanism for enforcement of Fundamental Rights.

22) Illustrate the Notion of Rights. [CO1, BTL 2]

Notion of Rights is called as "A Conception of or belief about something". Historically, many notions of rights were authoritarian and hierarchical, with different people granted different rights, and some having more rights than others.

23) Mention some additional definitions of Human Rights. [CO1, BTL 1]

Laski defined as "Those conditions of social life without which he cannot seek, in general, to be himself at his best and every state is known by the right if maintains". Dr. Beniprasad defined as "rights are nothing more an nothing less than those social condition which are necessary or favourable to the development of personality"‟ T.H.Green defined as "right is a power claimed and recognized as contributory to common good".

24) Classify the Types of Rights. [CO1, BTL 2]

- Natural Right
- Moral Rights
- Legal Rights
- Civil Rights
- Political Rights
- Economic Rights
- Social Rights
- Cultural Rights
- Collective/Solidarity Rights.

25) Interpret about Natural Rights. [CO1, BTL 2]

Natural Rights are these rights which are "natural" in the sense not artificial, not man-made, as rights deriving from human nature, or from the God. They are Universe. They apply to all people and do not derive from the laws of any specific society. They are regarded as self-evident truths.

26) What are the two treatises on Government? [CO1, BTL1]

John Locke was an Englishman who similarly produced works about the purpose and structure on government. Lock argues in his Two Treatises on Government that the sole purpose of government is to protect the natural rights of citizens. According to Locke, people are endowed with three natural rights. These rights are life, liberty, and property/Happiness.

27) Define Legal Rights. [CO1, BTL1]

Holland defined as "Legal Right is the capacity residing in one man of controlling, with the assent and assistance of the state, actions of other". Salmond defined as "A right is an interest recognised and protected by a rule of right. It is an interest, respect for which is a duty and disregard of which is a wrong".

28) **Classify the different rights in Civil Rights. [CO1, BTL2]** Right to life, Right to persona liberty/freedom, Right to security, Right to privacy, Right to home, Right to own property, Right to freedom from torture, Right to freedom from inhuman treatment.

29) Classify the different rights in Political Rights. [CO1, BTL2]

Right to thought, Right to religion, Right to freedom of movement, Right to participate in the Government, Right to vote, Right to be elected in election, Right to take part in the conduct of public office, Right to choose public representative, Right to equal consideration before the law, Right to peaceful assembly and association.

30) Define Economic Rights. [CO1, BTL1]

Economic rights are the right to work, the right to adequate wages and right to reasonable hours of work. These economic conditions are very essential for the economic and political progress of man.

31) Explain the Cultural Rights. [CO1, BTL2]

The UNESCO Declaration on Cultural Diversity affirmed that culture should be regarded as: "the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, and that it encompasses, in addition to art and literatures, lifestyles, ways of living together, value systems, traditions and beliefs."

32) What is CESCR and write its features. [CO1, BTL1]

In its General Comment 21, the UN Committee on Economic, Social and Cultural Rights (CESCR) provided detailed guidance to States regarding their obligations to respect, protect and fulfil the right to participate in cultural life. The Committee also noted that the right includes the following five interrelated and essential features: Availability Accessibility Acceptability Adaptability Appropriateness

PART B

1. Illustrate the two treaties on Government on Natural Rights. [CO1, BTL2]
2. Classify the Civil Rights and Summarize the features of Civil Rights. [CO1, BTL2]
3. Classify the Political Rights and Summarize the features of Political Rights. [CO1, BTl2]
4. Explain in detail about Social Rights in the Constitutions. [CO1, BTL2]
5. What is CESCR? Summarize the essential features of CESCR. [CO1, BTL2]
6. Explain in detail about the Collective/Solidarity Rights. [CO1, BTL2]

UNIT II

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

1) Define Ma‟at in Ancient Egypt. [CO2, BTL1]

Ma‟at (pronounced may-et) is the ancient Egyptian goddess of truth, justice,harmony, and balance (a concept known as ma‟at in Egyptian) who first appearsduring the period known as the Old Kingdom. Ma‟at represented truth, order,balance and justice in the universe.

2) What is Ancient Mesopotamia? [CO2, BTL1]

Hammurabi (1792-1750 B.C) was an ancient Babylonian king. Hammurabi created the first written set of laws during 1780 BC. The code of Hammurabi consists of 282 laws, with scaled punishments, adjusting "an eye for an eye, a tooth for a tooth" as graded depending on the social status of the „slave‟ versus the „free man‟. On the stone slab, among the laws of Hammurabi, there are many articles, that attempt to establish the basic principles of protection and independence of women.

3) Which is called as world‟s first Charter and illustrate it? [CO2, BTL1]

Ans: The Cyrus Cylinder is recognized as the world‟s first charter of human rights. It was developed in 539 BC. The armies of the Persian king Cyrus the Great conquered Babylon. He freed the slavery. He declared that all people had the right to choose their own religion. He established racial equality. It was recorded in a baked-clay cylinder in the Akkadian language with cuneiform script.

4) Show the four Articles of the Universal Declaration of Human Rights. [CO2, BTL1]

- Free and equal
- No discriminations
- the right to life
- no slavery

5) What is Edicts of Ashoka? [CO2, BTL1]

The Edicts of Ashoka are a collection of 33 inscriptions on the pillars of Ashoka as well as boulders and cave walls, made by the king Ashoka of the Mauryan

dynasty during his reign. These inscriptions are dispersed throughout the areas of modern-day Pakistan and India and represent the first tangible evidence of Buddhism. The edicts describe in detail the first wide expansion of Buddhism through the sponsorship of one of the most powerful kings of Indian history. The inscriptions revolve around a few repetitive themes: Ashoka's conversion to Buddhism, the description of his efforts to spread Buddhism, his moral and religious precepts, and his social and animal welfare programme. Two edicts in Afghanistan have been found with Greek inscriptions, one of these being a bilingual edict in Greek language and Aramaic.

6) What is the Magna Carta? [CO2, BTL1]

The Magna Carta called as „Great Charter" is an English document created by the barons during King John"s rule in 1215. Magna Carta stands for freedom, that the people have certain rights that cannot be taken away by anyone, and it stands for the only real true rule of law; that no one, not even a king, is above the law. It still has major influence on our legal system today, and has ensured equality for all citizens under the law.

7) List the three clauses of the Original Magna Carta which are still exist today? [CO2, BTL1]

- ❖ The Church of England shall be free and maintain all of its rights and liberties.
- ❖ The City of London shall keep all of its old customs and liberties.
- ❖ No one shall be imprisoned or taken away without a trial

8) What are the important points relevance in Todays legal system with respect to Magna Carta? [CO2, BTL1]

There are two main points of the Magna Carta that are still relevant today. Firstly, the fact that everyone is equal under the law is very important in our legal system today. What once applied to kings still applies to our politicians. It ensures that no person can gain unlimited power in our society. It carries heavy influence in the rule that no person shall be imprisoned or judged without a fair trial.

9) When did the Geneva convention declared? [CO2, BTL1]

The first modern international rules of war, known as the Geneva Conventions, or Treaties, were made in Geneva, Switzerland in 1864.

10) Write the importance of Geneva Convention. [CO2, BTL1]

The Geneva Conventions were first drafted and ratified in Europe in 1864, modern version with four Conventions drafted in 1949 and ratified by 191 countries. It established the Red Cross in 1877. These treaties were accepted by all European countries, the US and some Asian & Latin American countries.

11) O**utline the four groups of Geneva Conventions. [CO2, BTL2]**

Geneva Conventions guarantee human rights to four groups:
Improving the conditions of the sick and wounded, members of the armed forces in the field.
Improving the conditions of shipwrecked sailors, members of armed forces at sea.
Treatment of prisoners of war (POW)
Protection of civilians in time of war.

12) When did the First Geneva Convention declared? [CO2, BTL1]

The First Geneva Convention for the Amelioration of the Condition of the Wounded and sick in Armed forces, was declared on August 12, 1949 and it was mentioned in 64 articles that protects the soldiers who are out of action due to injury or damage.

13) Who is POW? [CO2, BTL1]

POW stands for Prisoner of War. Geneva Convention III includes restrictions that apply to prisoners of war, i.e., captured soldiers from other countries armies.

14) Which date is celebrated as United Nations Day and Why? [CO2, BTL1]

The Charter of the new United Nations organization went into effect on October 24, 1945, a date that is celebrated each year as United Nations Day.

15) Write the ideals of the organization in United Nations. [CO2, BTL1]

The ideals of the organization were stated in the preamble to its proposed charter: "We the peoples of the United Nations are determined to save succeeding generations form the scourge of war, which twice in our lifetime has brought untold sorrow to mankind".

16) When did the Universal Declaration of Human Rights declared and who declared it? [CO2, BTL1]

The Universal Declaration of Human Rights was declared in 1948. Roosevelt, credited with its inspiration, referred to the Declaration as the international Magna Carta for all mankind. It was adopted by the United Nations on December 10, 1948.

17) How does the UN Promote and protect Human Rights? [CO2, BTL1]

High Commissioner for Human Rights
Human Rights Council
Human Rights Treaty Bodies
Special Procedures
UNDG-HRM
Special Advisers on the Prevention of Genocide and the Responsibility to Protect

18) What legal Instruments help the UN protect Human Rights? [CO2, BTL1]

The International Bill of Human Rights.

19) Mention the different theories of Human Rights.

The legal theory of Rights, The Anti-Utilitarian Theory of Rights, The Marxist Theory of Rights.

20) What is ICESCR? [CO2, BTL1]

International covenant Economic, Social and Cultural Rights (ICESCR) and it is developed in 1966. This theory, however, does not include religion, customs, traditions and mortality as integral components of human rights.

PART-B

1. Explain in detail about the Magna Carta. [CO2, BTL2]
2. Interpret the First Geneva Convention in detail. [CO2, BTL2]
3. Define PoW. Develop the PoW along with Case study. [CO2, BTL3]

4. Classify the Theories of United Nations and explain in detail about each of the theories. [CO2, BTL2]
5. Explain the Universal Declaration of the United Rights and its preamble. [CO2, BTL2]

UNIT III

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

1) Which led to a strong movement for the international protection of fundamental human rights? [CO3, BTL1]

A key principle of the human rights movement is its appeal to universality: the idea that all human beings should struggle in solidarity for a common set of basic conditions that has to be followed by all.

2) List out the seven references highlighted in the original conception of the UN charter. [CO3, BTL1]

The Charter of the United Nations (also known as the UN Charter) is the foundational treaty of the United Nations, an intergovernmental organization.[1] Consisting of a preamble and 19 chapters divided into 111 articles, it establishes the purposes, governing structure, and overall framework of the UN system, including its six principal organs: the Secretariat, the General Assembly, the Security Council, the Economic and Social Council, the International Court of Justice, and the Trusteeship Council.

3) What is the preamble of the UN charter?[CO3, BTL1]

Accordingly, our respective Governments, through representatives assembled in the city of San Francisco, who have exhibited their full powers found to be in good and due form, have agreed to the present Charter of the United Nations and do hereby establish an international organization to be known as the United Nations.

4) Explain Article 1(3) of the UN charter.[CO3, BTL1]

To maintain international peace and security, and to that end: to take effective collective measures for the prevention and removal of threats to the peace, and for the suppression of acts of aggression or other breaches of the peace, and to bring about by peaceful means, and in conformity with the principles of justice and international law, adjustment or settlement of international disputes or situations which might lead to a breach of the peace.

5) Generalize article 13(2) chapter IX and chapter X of UN charter. [CO3, BTL1]

The General Assembly shall initiate studies and make recommendations for the purpose of promoting international co-operation in the economic, social, cultural, educational, and health fields, and assisting in the realization of human rights and fundamental freedoms for all without distinction as to race, sex, language, or religion.

6) Explain article 55 and 56 of UN charter. [CO3, BTL1]

Article 55 With a view to the creation of conditions of stability and well-being which are necessary for peaceful and friendly relations among nations based on respect for the principle of equal rights and self-determination of peoples, the United Nations shall promote, universal respect for, and observance of, human rights and fundamental freedoms for all without distinction as to race, sex, language, or religion. Article 56 All Members pledge themselves to take joint and separate action in co-operation with the Organization for the achievement of the purposes set forth in Article 55.

7) What is article 2(7) of UN charter? . [CO3, BTL2]

Article 2 (7) states that the United Nations has no authority to intervene in matters which are within the domestic jurisdiction of any State, while this principle shall not prejudice the application of enforcement

measures under Chapter VII of the Charter.

8) List out the UN bodies primarily. [CO3, BTL2]

General Assembly. The General Assembly is the main deliberative, policymaking and representative organ of the UN. ... Security Council. Economic and Social Council. Trusteeship Council. International Court of Justice. Secretariat.

9) When was UN commission on human rights established and by whom? [CO3, BTL1]

It met for the first time in January 1947 and established a drafting committee for the Universal Declaration of Human Rights, which was adopted by the United Nations on December 10, 1948.

10) Write the functions of UN high commissioner of human rights. [CO3, BTL1]

The United Nations High Commissioner for Human Rights, accountable to the Secretary-General, is responsible for all the activities of the OHCHR, as well as for its administration, and carries out the functions specifically assigned to him or her by the UN General Assembly in its resolution 48/141 of 20 December 1993 and subsequent resolutions of policy-making bodies.

11) Summarize the recommendations and reports that can be prepared by UN commission of human rights. [CO3, BTL2]

The Declaration of the Rights of Man and of the Citizen (French: La Declaration des droits de l'Homme et du citoyen) is one of the most important papers of the French Revolution. This paper explains a list of rights, such as freedom of religion, freedom of speech, freedom of assembly, separation of powers.

12) Write about the commission on the status of women.[CO3, BTL1]

The Commission on the Status of Women (CSW) is the principal global intergovernmental body exclusively dedicated to the promotion of gender equality and the empowerment of women. A functional commission of the Economic and Social Council (ECOSOC), it was established by ECOSOC resolution 11(II) of 21 June 1946.

13) Classify the Human Rights Characteristics. [CO3, BTL2]

1) Universal – Human rights belong to all people
2) Inalienable – Human rights cannot be taken away
3) Interconnected – Human rights are dependent on one another
4) Indivisible – Human rights cannot be treated in isolation Non-Discriminatory – Human rights should be respected without prejudice.

14) Categorize the member states of UN commission on status of women. [CO3, BTL1]

Forty-five Member States of the United Nations serve as members of the Commission at any one time. The Commission consists of one representative from each of the 45 Member States elected by the Economic and Social Council on the basis of equitable geographical distribution: 13 members from Africa 11 from Asia nine from Latin America and Caribbean eight from Western Europe and other States four from Eastern Europe

15) Define Right to Freedom. [CO3, BTL1]

Freedom of speech and expression, assemble, association or union or cooperatives, movement, residence, and right to practice any profession or occupation.

16) Write the functions of the commission on the status of women[CO3, BTL1]

The Commission on the Status of Women (CSW) is the world's main policymaking body dedicated exclusively to gender equality and the advancement of women. It is part of the United Nations, and works to promote women's political, economic, civil, social and educational rights.

17) Criticize the statement " Fifty years after its creation , the United Nations continues to deny itself the benefits of women's leadership". [CO3, BTL1]

On average, women's salaries are 30 to 40 per cent lower than these of men, for the same work.

PART B

1) Describe the following references that are highlighted in the original conception of UN charter. [CO3, BTL2]
2) Compare Human rights of UN charter and domestic Jurisdiction. [CO3, BTL2]
3) Describe about UN commission on human rights. [C03, BTL2]
4) Explain in detail the importance and functions of UN commission on the status of women. [CO3, BTL2]
5) Highlight the importance and functions of UN sub commission on prevention of discrimination and protection of minorities. [CO3, BTL2]
6) Generalize the roles and responsibilities of UN high commissioner for human rights. [CO3,BTL2].
7) To what extend do states comply with the views of the human rights committee. Support your answer with examples. [C03, BTL3]

UNIT IV

Human Rights in India – Constitutional Provisions / Guarantees.

1) When was Indian Constitution adopted? [CO4, BTL1]

26 January 1950: The Constitution Was Legally Enforced. Passed by the Constituent Assembly on 26 November 1949, it came into effect on 26 January 1950. The date 26 January was chosen to commemorate the declaration of Purna Swaraj (complete Independence) of 1930

2) **State Preamble of Indian Constitution. [CO4, BTL1]**

According to the preamble, the constitution of India has been pursuance of the solemn resolution of the people of India to constitute India into a 'Sovereign Democratic Republic', and to secure well-defined objects set forth in the preamble. Sovereignty denotes supreme and ultimate power.

3) **Show that Indian Constitution has recognized and given effect to human rights. [CO4, BTL1]**

The Constitution of India provides for Fundamental rights, which include freedom of religion. Clauses also provide for freedom of speech, as well as separation of executive and judiciary and freedom of movement within the country and abroad. The country also has an independent judiciary as well as bodies to look into issues of human rights

4) Generalize preamble of Indian Constitution and charter of UN [CO4, BTL1]

The idea of the Preamble, however, it is believed, was borrowed from the Preamble of the UN Charter which in turn had borrowed the idea from the US constitution. It would therefore be more correct to say that the

idea of Indian Preamble was adopted from Preamble of the US Constitution..

5) Give the article 38(1) of Indian constitution[CO4, BTL1]

The State shall strive to promote the welfare of the people by securing and protecting as effectively as it may a social order in which justice, social, economic and political, shall inform all the institutions of the national life..

6) Show that article 38(1) is strengthened by article 39 – A. [CO4, BTL1]

Article 38 and 39 embody the principle of distributive justice which connotes the removal of economic inequalities rectifying the injustice resulting from transactions between unequals in society.

7) Analyze, fundamental rights contained in which part of the Indian constitution are enforceable in courts of law. [CO4, BTL2]

The Fundamental Rights are defined as the basic human rights of all citizens. These rights, defined in Part III of the Constitution, applied irrespective of race, place of birth, religion, caste, creed, or gender. They are enforceable by the courts, subject to specific restrictions.

8) Analyze, directive principles of state policy contained in which part of the Indian constitution are not enforceable by any court[CO1, BTL2]

The Directive Principles of State Policy are guidelines for the framing of laws by the government. These provisions, set out in Part IV of the Constitution, are not enforceable by the courts, but the principles on which they are based are fundamental guidelines for governance that the State is expected to apply in framing policies and passing laws.

9) Write about appointment of chairperson and other members of the National human rights commission.[CO1, BTL1]

The Chairperson and members of the NHRC are appointed by the President of India, on the recommendation of a committee consisting of:The Prime Minister (chairperson), The Home Minister,The Leader of the Opposition in the Lok Sabha (House of the People), The Leader of the Opposition in the Rajya Sabha (Council of States), The Speaker of the Lok Sabha (House of the People),The Deputy Chairman of the Rajya Sabha (Council of States).

10) Classify the preamble liberty which seeks to secure.[CO1, BTL1]

Ans: The Preamble to the Constitution of India guide the people of the nation, and to present the principles of the Constitution, and to indicate the source from which the document derives its authority, and meaning. It highlights the goals and aspirations of the Indian people.

11) Show the Declaration of the Rights of Man And of the Citizen. [CO1, BTL2]

The Declaration of the Rights of Man and of the Citizen (French: La Declaration des droits de l'Homme et du citoyen) is one of the most important papers of the French Revolution. This paper explains a list of rights, such as freedom of religion, freedom of speech, freedom of assembly, separation of powers.

12) Explain article (19) of Indian Constitution relating to protection of rights. ? [CO1, BTL1]

The heart of the Article 19 says: "Everyone has the right to freedom of opinion and expression, this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers.

13) Classify the Human Rights Characteristics. [CO1, BTL2]

1) Universal – Human rights belong to all people
2) Inalienable – Human rights cannot be taken away
3) Interconnected – Human rights are dependent on one another

4) Indivisible – Human rights cannot be treated in isolation Non-Discriminatory – Human rights should be respected without prejudice.

14) Compare between Fundamental Rights and Human Rights. [CO1, BTL2]

Fundamental rights include only those rights which are basic to a normal life. As against, the human rights are based on the right of life with dignity. Fundamental rights are guaranteed under the constitution of the country, whereas the human rights are recognised at international level.

15) What are fundamental Rights of India? [CO1, BTL1]

- ❖ Right to equality – Article 14-18
- ❖ Right to freedom – Article 19-22
- ❖ Right against exploitation – Article 23-24
- ❖ Right to freedom of religion – Article 25-28
- ❖ Cultural & educational rights – Article 29-30
- ❖ Right to constitutional Remedies – Article 32-35

16) Generalize the international conventions in which India as become part. [CO1, BTL1]

India became a signatory to the Convention in June 1979 which came into force in November 1983. India was the Chairman of the Scientific Council of the Convention in 1986 and has been a member of its Standing Committee since 1986.

17) Write any two functions and jurisdiction of the National human rigths commission. [CO1, BTL1]

a. promote and protect human rights

b. review the safeguard provided by or under any enactment for the protection of human rights.

18) What is Right to Freedom of Religion? [CO1, BTL1]

Freedom of conscience and free profession, practice, and propagation of religion, freedom to manage religious affairs.

19) Mention Cultural and Educational Rights. [CO4, BTL1]

Right of any section of citizens to conserve their culture, language or script, and right of minorities to establish and administer educational institutions of their choice.

20) What is Right Constitutional Remedies? [CO4, BTL1]

It provides a mechanism for enforcement of Fundamental Rights.

21) Illustrate the Notion of Rights. [CO4, BTL2]

Notion of Rights is called as "A Conception of or belief about something". Historically, many notions of rights were authoritarian and hierarchical, with different people granted different rights, and some having more rights than others.

22) Compare enumerated fundamental human rights and other fundamental human rights. [CO4, BTL1]

Fundamental Rights means the primary rights of the citizens which are justifiable and written in the constitution. Human Rights are the basic rights that all the human beings can enjoy, no matter where they live, what they do, and how they behave, etc.

23) Classify the Types of Rights. [CO4, BTL2]

1) Natural Rights 2) Moral Rights 3) Legal Rights 4) Civil Rights 5) Political Rights 6) Economic Rights 7) Social Rights 8) Cultural Rights 9) Collective/Solidarity Rights.

24) Interpret about Natural Rights. [CO4, BTL2]

Natural Rights are these rights which are "natural" in the sense not artificial, not man-made, as rights

deriving from human nature, or from the God. They are Universe. They apply to all people and do not derive from the laws of any specific society. They are regarded as self-evident truths.

25) Illustrate the constitution of National human rights commission.[CO4, BTL1]

The Central Government shall constitute a body to be known as the National Human Rights Commission to exercise the powers conferred upon, and to perform the functions assigned to, it under this Act.

26) Define human rights under the human rights act, 1993 section 2 (d). [CO4, BTL1]

In terms of Section 2 of the Protection of Human Rights Act, 1993 (hereafter referred to as 'the Act'), "human rights" means the rights relating to life, liberty, equality and dignity of the individual guaranteed under the Constitution or embodied in the International Covenants and enforceable by courts in India. "International Covenants" means the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social and Cultural Rights adopted by the General Assembly of the United Nations on the 16th December, 1966.

27) What are the enforceable human rights by Courts in India? [CO4, BTL2]

The Act defines human rights in Section 2(d) as "the rights relating to life, liberty, equality and dignity of the individual guaranteed by the Constitution or embodied in the International Covenants and enforceable by courts in India."

28) Classify the different rights in Political Rights. [CO4, BTL2]

Right to thought, Right to religion, Right to freedom of movement, Right to participate in the Government, Right to vote, Right to be elected in election, Right to take part in the conduct of public office, Right to choose public representative, Right to equal consideration before the law, Right to peaceful assembly and association.

29) Define Economic Rights. [CO4, BTL1]

Economic rights are the right to work, the right to adequate wages and right to reasonable hours of work. These economic conditions are very essential for the economic and political progress of man.

30) Under what condition the President of India can remove the member of National human rights commission?[CO4, BTL1]

According to the NHRC Act, The NHRC/SHRC chairman or a member can be removed from his office by the President on the ground of proved misbehaviour or incapacity. But the President has to refer the matter to the Supreme Court which has to hold an inquiry into the allegations against the NHRC/SHRC member in question

PART B

1. Describe the following objectives that are resolved to secure to all citizens through the preamble of the constitution of India [CO4, BTL2]
2. Describe the specifically enumerated Civil and political rights in Indian Constitution with article number. [CO4, BTL2]
3. Summarize the specifically enumerated economic, social and cultural rights in Indian Constitution with article number. [CO4, BTL2]
4. Explain the human rights for citizens as per Indian constitution. [CO4, BTL2]
5. Analyze the enumerated and un-enumerated human rights in Indian constitution. [CO4, BTL2]
6. Explain the India and international conventions on human rights other than international covenants on human rights[CO4, BTL2]
7. Support Nagendra Singh remark on Ancient Hindu law of human rights.[C04,BTL3]
8. Validate the expansion of article 21 of Indian constitution. [C04,BTL2]

9. Assess human rights in British India and Motilal Nehru Committee [C04,BTL2]

UNIT V

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disability persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

1. **Define Vulnerable groups. [CO5.BTL1]**

The meaning of vulnerable is highly evasive. However, in common understanding, people who are easily susceptible to physical or emotional injury, or subject to unnecessary criticism, or in a less advantageous position in any society may be defined as vulnerable people. Accordingly, vulnerable groups are those groups of people who may find it difficult to lead a comfortable life, and lack developmental opportunities due to their disadvantageous positions. Further, due to adverse socio-economical, cultural, and other practices present in each society, they find it difficult many a times to exercise their human rights fully.

2. **Mention the other definitions of Vulnerable groups. [CO5.BTL2]**

i) In the language of human rights vulnerable groups may be defined as, certain groups of population who often encounter discriminatory treatment, or need some kind of special attention for protection of the State to avoid exploitation or from a harmful environment.

ii) People who are discriminated based on sex, race, by birth in a particular community, religious or disability or any other criteria that is specific to each society may generally described as disadvantaged people.

3. According to European foundation, explain the concept of Vulnerable people? [CO5.BTL2]

According to European Foundation for the improvement of living Working Conditions, vulnerable people means : "Groups that experience a higher risk of poverty and social exclusion than the general population, ethnic minorities, migrants, disabled people, the homeless, those struggling with substance abuse, isolated elderly people and children all often face difficulties that can lead to further social exclusion, such as low levels of education and unemployment or underemployment, refugees, stateless persons, victims of war are described as vulnerable groups".

4. Define the meaning of Disadvantaged groups. [CO5.BTL1]

According to the general perspective of International Law of Human Rights, disadvantaged groups are the people who are denied free access to the guaranteed rights in their free exercise. Based on the socio, economic, cultural perspectives, the classification of these groups vary from country to country. In general, women, children, socially, economically, culturally deprived sections, disabled, minorities etc. form part of disadvantaged groups. Poverty is the main contributing factor towards degradation of the status of these people that are classified as disadvantaged groups.

5. Explain the disadvantaged people of Women and Girls? [CO5.BTL2]

Women and girls are normally in a disadvantageous position all over the World. However, compared to developed countries, they are in a more disadvantageous position in developing countries due to abject poverty, other social, cultural, and derogatory customary practices adopted in each country.

6. Explain the disadvantaged people of Children? [CO5.BTL2]

Children again are the most disadvantaged people in the World. Children of developing countries, compared to developed countries face a number of problems, such as poverty, malnutrition, and other socio, economic, cultural abuses.

7. Illustrate the United Nations Convention on the Refugees? [CO5.BTL2]

According to the as defined (in Article 1A) a refugee means: "Any person who, owing to well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence, is unable or, owing to such fear, is unwilling to return to it."

8. Define Internally Displaced Persons. [CO5.BTL1]

People who are forced to leave their home and place of residence due to adverse affects or events that take place in their habitual dwelling are described as Internally Displaced Persons. These people normally take shelter in their own country away from their habitual place of residence. They do not fall unde r the c a t egory of refugees. There is no exact definition defining Internally Displaced Persons. However, according to UN Principles of Internal Displacement, an IDP means: 'internally displaced persons are persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border.'

9. Explain Displaced Persons. [CO5.BTL2]

Disability assumes different meaning in different contexts. However, according to UN Declaration on the

Rights of Disabled Persons (1975) "any person unable to ensure by himself or herself, wholly or partly the necessities of a normal individual and or social life as a result of a deficiency either congenital or not in his /her physical or mental abilities" could be described as disabled. Accordingly, any individual may also qualify as disabled if he/she has had impairment in the past or is seen as disabled based on a personal or group standard, or norm. Such impairments may include physical, sensory, and cognitive or developmental disabilities. People who suffer from mental disorders such as, psychiatric or psychological infirmities are also described as disabled persons.

10. When the UN council declared as International aged people's day and explain it. [CO5.BTL2]

People those who are of 60 years and above in age are normally described as old age people or elderly persons. Very often, the rights of these people are violated by family members, society and in other fronts. Being elders, their rights need to be protected. In order to protect their rights, the UN adopted a number of resolutions and declared every October 1 to be celebrated as the International aged people's day. It conducted a world congress in 2002 at Madrid and plan to adopt a convention to protect the rights of the aged people. As per the official agency of social policy and development division of the UN there are 737 million aged people living in the world today.

11. When the Government of India adopted a National policy of older policy? [CO5.BTL1]

In the national scenario, the Government of India adopted a national policy of older persons in 1998. In view of the increasing number of older persons and to protect their rights, the Government of India enacted the Maintenance and Welfare of Parents and Senior Citizens Act 2007, in order to extend legal protection to the rights of the elderly persons in the country. It has also constituted a National Council for elderly persons to address various aspects concerning the rights of elderly persons.

12. Explain the disadvantaged people of HIV infected person? [CO5.BTL2]

The people those who are afflicted by this most dreaded disease are another kind of persons who are discriminated on many counts in enjoying their basic rights around the World. According to UN official agency UNAIDS there are about 34 million people living in the World affected by HIV/AIDS. The UN works and adopts different strategies through its various organs and with the nation-states to augment the rights of these people who are many times, denied human treatment by fellow citizens, family members and even at hospitals.

13. Eradicate the general framework adopted by UN council based on the reports of the various committees? [CO5.BTL2]

Equal pay for equal work;

- Independent mechanism or commission to establish and to deal with each category of people;
- Basic compulsory education;
- Special concessions to these people;
- Provisions to enable them to take part in the governance; Independent forums to express their grievances;
- Easy accessibility to medical and health care; and,
- Efforts to raise the standard of living, subsidized food supply, eradicate malnutrition, abolish any customary practices that threaten their survival, over all social security etc.

14. Mention the two important conventions of Human Rights of Women? [CO5.BTL2]

- The Convention on the Political Rights of Women, 1952
- The Declaration on the Protection of Women and Children in Emergency and Armed Conflict 1974

15. What is CEDAW? [CO5.BTL1]

The UN in 1979 adopted The Convention on the Elimination of All Forms of Discrimination against Women (popularly referred to as CEDAW Convention). This convention became a milestone in the development of women's rights and addressed to eliminate all kinds of discrimination. The convention has come into force in 1981 and 187 states have ratified the convention and became parties. Among the few who have not become parties to it are Iran, Palau, Somalia, Sudan, South Sudan, Tonga, and United States of

America. USAand Palau have signed but not ratified the convention.

16. When did the First World Conference was conducted and mention its objectives? [CO5.BTL2]

- ✓ The First World Conferecne was conducted during 19 June- 2 July ,1975 at Mexico. In this conference it set three objectives ;
- ✓ Full gender equality and the elimination of gender discrimination;
- ✓ The integration and full participation of women in development;
- ✓ An increased contribution by women towards strengthening world peace.

17. When did the International Women's Day celebrated? [CO5.BTL1]

For the first time in history, the Government of USA on February 28, 1909 after adoption of socialist declaration to highlight the issues of women, celebrated this day as women's day. After the declaration of USA, a number of countries in the Western World declared different dates to celebrate the Women's day. Finally, in the year 1977, the General Assembly of the UN declared March 8 as International Women's and Peace Day. Following the Declaration today all most all the countries celebrate March 8 as the Women's day in recognition of their services and for the promotion of their rights. In many countries, this day is declared as a holiday to celebrate the women's achievements in their country. In some countries it is declared as holiday for women employees and workers.

18. What is UNICEF? [CO5.BTL1]

United Nations Children's Emergency Fund (UNICEF)

19. What are the ten principles declared by universal declaration for the Rights of children? [CO5.BTL1]

The ten principles are as follows:

- ❖ The right to equality without any distinction on account of race, religion, or national origin. • The right to special protection for the child's physical, mental, and social development.
- ❖ The right to a name and a nationality.
- ❖ The right to adequate nutrition, housing and medical services.
- ❖ The right to special education and treatment when a child is physically or mentally handicapped.
- ❖ The right to understanding and love by parents and society.
- ❖ The right to recreational activities and free education.
- ❖ The right to be among the first to receive relief in all circumstances.
- ❖ The right to protection against all forms of neglect, cruelty and exploitation.
- ❖ The right to be brought up in a spirit of understanding, tolerance, friendship among peoples, and universal brotherhood.

20. What is ICCPR and ICESCR? [CO5.BTL1]

After the adoption of the Declaration, the United Nations in 1966 adopted two more important Covenants on Human Rights. They are International Covenant on Civil and Political Rights, (ICCPR) and International Covenant on Economic, Social and Cultural Rights (ICESCR). Both the Covenants recognizes civil, political, economic, social, and cultural rights of every person in the world including the children.

21. When did World Children's Day celebrated? [CO5.BTL1]

In order to augment the rights of children throughout the World, the General Assembly in 1954, declared November 20 every year to be celebrated as the Children's Day. On this day along with all the organs of UN and the World bodies, the UNICEF especially organizes number activities and works with the states, which have different dates throughout the year for the celebration of Children's Day. India celebrates November 14 every year as National Children's day. Among all the countries in the world, the USA has not yet designated any day in the year as children's day.

22. What is NCPCR? [CO5.BTL1]

The National Commission for Protection of Child Rights (NCPCR) was set up in March 2007 under the Commission for Protection of Child Rights Act, 2005. According to the provisions of the Act, a child is defined as a person below the age of 18 years on the lines of the United Nations Child Rights Convention

definition.

23. Define the term disability. [CO5.BTL1]

Disability is a broad term. It generally refers to any person suffering from physical, cognitive, mental, sensory, emotional, developmental problems, or some combination of any of these problems. The term Disability includes within its meaning, impairments, activity limitations, and participatory restrictions. Impairment is a problem of body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participatory restriction is a problem experienced by an individual in numerous life situations. Thus, disability is a complex phenomenon, reflecting an interaction between features of a person's body and features of the society in which he or she lives.

24. According to WHO, Define the term disability. [CO5.BTL1]

According to World Health Organization, An individual may also qualify as disabled if he/she has had an impairment in the past or is seen as disabled based on a personal or group standard or norm. Such impairments may include physical, sensory, and cognitive or developmental disabilities, Mental disorders (also known as psychiatric or psychosocial disability) and various types of chronic disease may also qualify as disabilities. Accordingly, disabilities may be of various types such as Physical Disability, Mental Disability, Sensory Disability, Visual Disability or hearing impairment etc.

25. When and what is CPRD? [CO5.BTL1]

UN Convention on the Rights of Persons with Disabilities (CPRD), 2006,

26. Mention the preamble of CPRD? [CO5.BTL2]

The Preamble of CRPD states: 'Disability is an evolving concept, and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders full and effective participation in society on an equal basis with others'

27. Mention the laws relating to Disabled? [CO5.BTL2]

Among the various legislations, the most important of them are: • The Indian Lunacy Act 1912, • The Lepers Act, 1899. • Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act 1995 • National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act 1999. • Rehabilitation Council of India Act 1992 • The Mental Health Act 1987.

28. When did World's AIDS Day declared? [CO5.BTL1]

In order to promote their rights and to create awareness among various sections of people across the world, it has declared December 1, 1988 as World AIDS Day.

29. What are the objectives of National AIDS Control Programme? [CO5.BTL1]

The Government of India even before the increase of the patients suffering from this chronic disease as a preventive care, in the year 1987 launched the National AIDS Control Programme. Accordingly the objectives of the programme are:

- Covered Surveillance
- Blood Screening
- Health Education.

30. What is NHRC? [CO6.BTL1]

"The rights of every man are diminished when the rights of one man are threatened." -John F. Kennedy "To deny people their human rights is to challenge their very humanity"-Nelson Mandela NHRC of India is an independent statutory body established on 12 October, 1993 as per provisions of Protection of Human Rights Act, 1993, later amended in 2006. NHRC has celebrated its Silver Jubilee (25 years) on October 12, 2018. Its headquarter is located in New Delhi. It is the watchdog of human rights in the country, i.e. the rights related to life, liberty, equality and dignity of the individual guaranteed by Indian Constitution or embodied in the international covenants and enforceable by courts in India. It was established in conformity with the Paris Principles, adopted for the promotion and protection of human rights in Paris (October, 1991) and endorsed by the General Assembly of the United Nations on 20 December, 1993.

31. **Mention the structure of NHRC? [CO6.BTL2]**

NHRCiscomposedofaChairmanandsevenothermembersOutoftheseven .

32. What is state Human Rights Commission? [CO6.BTL1]

The Protection of Human Rights Act of 1993 provides for the creation of State Human Rights Commission at

the state level. A State Human Rights Commission can inquire into violation of human rights related to subjects covered under state list and concurrent list in the seventh schedule of the Indian constitution.

33. What is an NGO? What role does it play in civil society? [CO6.BTL2]

Non-governmental organizations, or NGOs, were first called such in Article 71 in the Charter of the newly formed United Nations in 1945. While NGOs have no fixed or formal definition, they are generally defined as nonprofit entities independent of governmental influence (although they may receive government funding). As one can tell from the basic definition above, the difference between nonprofit organizations (NPOs) and NGOs is slim. However, the term "NGO" is not typically applied to U.S.-based nonprofit organizations. Generally, the NGO label is given to organizations operating on an international level although some countries classify their own civil society groups as NGOs. NGO activities include, but are not limited to, environmental, social, advocacy and human rights work. They can work to promote social or political change on a broad scale or very locally. NGOs play a critical part in developing society, improving communities, and promoting citizen participation.

34. What are the important Roles of NGOs based on the risk of generalization? [CO6.BTL2]

- Development and Operation of Infrastructure:
- Supporting Innovation, Demonstration and Pilot Projects:
- Facilitating Communication:
- Technical Assistance and Training:
- Research, Monitoring and Evaluation:
- Advocacy for and with the Poor:

35. What Rights do media have? [CO6.BTL1]

The United Nations' 1948 Universal Declaration of Human Rights states: "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference, and to seek, receive, and impart information and ideas through any media regardless of frontiers".

36. List the limitations of National Human Rights Commission? [CO6, BTL1]

NHRC does not have any mechanism of investigation. In majority cases, it asks the concerned central and state government to investigate the cases of the violation of human rights.

PART B

1. Explain about human rights of disadvantaged people. [CO5, BTL2]
2. Illustrate the Women human rights of Disadvantaged people. [CO5, BTL2]
3. Explain the Children human rights of Disadvantaged people. [CO5, BTL2]
4. Summarize the human rights of disadvantaged people of displaced persons. [CO5, BTL2] 5. Describe the human rights of disadvantaged people of disabled persons of Aged people. [CO5, BTL2]
5. Explain the human rights of disadvantaged people of HIV infected people. [CO5, BTL2]
6. Classify the implementation of human rights. [CO6, BTL2]
7. Summarize National Human Rights Commission(NHRC) in detail. [CO6, BTL2]
8. Explain in detail of State Human Rights Commission and its limitations. [CO6, BTL2]
9. Illustrate the Judiciary system in Human Rights. [CO6, BTL2]
10. Discuss about the Role of NGO’s and its advantages and disadvantages. [CO6, BTL2]
11. Explain the Role of Media in Human Rights. [CO6, BTL2]
12. Describe the role of Educational Institutions and its pros and cons. [CO6, BTL2]

GE6757 – TOTAL QUALITY MANAGEMENT

UNIT – I

INTRODUCTION

PART – A

1. **Define Quality.**

Quality means conformance to the specifications and standards.

(or)

Quality means productivity, competitive costs, on-time delivery and satisfaction of the customer.

(or)

Quality means getting everyone to do what they accepted to do, for the first time and every time.

(or)

Quality means the degree to which a set of inherent characteristics fulfills requirements.

(or)

Quality = Performance / Expectations

2. **Define Total Quality.**

Total Quality is a people-focused management system that aims at continual increase in customer satisfaction at continually lower real costs. It provides an umbrella under which everyone in the organization can strive and create customer satisfaction.

TQM is an enhancement to the traditional way of doing business. It is the art of managing the whole to achieve excellence. It is defined both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization.

3. **Define quality cost. Mention four categories of quality cost.**

Quality cost is sum of cost incurred in maintaining acceptable quality levels plus the cost of failure to maintain that level.

Four categories are: Cost of prevention, cost of appraisal, cost of internal failures, and cost of external failures.

4. **Define quality audit.**

Quality audit is a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements.

5. **Distinguish between defect and defective.**

Defect: Each characteristics that does not meet the specifications is called defect.

Defective: An item is said to be defective if it fails to confirm to the specifications in any of the characteristics.

For example, if a mobile phone has battery problem, speaker problem etc. then the mobile phone is defective and the battery problem, speaker problem are the defects.

6. **Explain Quality auditing.**

A quality audit is defined as "a systematic and independent examination to determine whether quality activities and related results comply with planned arrangement, whether these arrangements are implemented effectively and whether these are suitable to achieve objectives".

7. **Why is it difficult to change organizational culture?**

There are external and internal environment factors which makes it difficult to change the organizational culture. The external environment factors are social, economic, political, regulatory, financial, competition, technological, and so on. The internal environment factors are attitude, working conditions, and morale and motivation level of employees, hierarchy, communication, lead by example ability of leaders and so on.

8. Write the equation that would quantify quality.

Quality can be quantified as:

Q = P / E

Where Q = Quality

P = Performance &

E = Expectations.

9. What are the seven faces of quality?

(a) Performance
(b) Features
(c) Reliability
(d) Conformance
(e) Durability
(f) Serviceability
(g) Aesthetics.

10. List the dimensions of quality.

(a) Performance
(b) Features
(c) Conformance
(d) Reliability
(e) Durability
(f) Service
(g) Response
(h) Aesthetics
(i) Reputation
(j) Safety
(k) Uniformity
(l) Compatibility

11. List the dimensions of service quality.

(a) Tangibles
(b) Reliability
(c) Assurance
(d) Responsiveness
(e) Empathy

12. Define quality as per Ed. Deming.

Quality is a predictable degree of uniformity and dependability at low cost and suited to the market.

13. Name any two popular awards for quality.

(a) Malcom Baldrige National Quality Award (MBNQA) and
(b) Deming prize.

14. Define TQM.

Total Quality Management is the management approach of an organization, centered of quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society.

15. Mention any four principles of TQM.

(a) Led by Top management
(b) Focus on satisfying the customer
(c) Aimed at Continual improvement

(d) Effective employee involvement.

16. What are the basic concepts required for TQM?

A successful TQM programme requires the following four basic concepts:

(a) Led by Top management
(b) Focus on satisfying the customer
(c) Aimed at Continual improvement
(d) Effective employee involvement.

17. What are the five elements of TQM?

(a) Culture
(b) Management
(c) Getting involvement
(d) Management tools
(e) Result

18. What are the building blocks or pillars of TQM?

The four building blocks or pillars of TQM are:

(a) Continuous improvement
(b) People
(c) Quality in daily work
(d) Strategic quality planning

19. What are the three areas of benefits of TQM?

The three areas of TQM benefits are:

(a) Those that relate to cost saving i.e., reduce company expenditure
(b) Those that relate to free up of management time
(c) Those that relate to customer satisfaction.

20. State the seven underlying principles of TQM.

(a) Led by the top management and team working to ensure functioning as effective groups
(b) Focused on satisfying customers
(c) Designed to involve everyone and to develop human potential (Effective employee involvement)
(d) Process approach to management and Fact based management
(e) Based on an error/failure prevention strategy
(f) Aimed at continual improvement
(g) Built on cooperative, trustful relationship to have win-win situation and geared toward public responsibility.

21. Give the Objective of TQM.

(a) To develop a conceptual understanding of the basic principles and methods associated with TQM.
(b) To develop an understanding of how these principles and methods have been put into effect in a variety of organizations.
(c) To develop an understanding of the relationship between TQM Principles and the theories and models studied in traditional management.
(d) To do the right things, right the first time, every time.

22. State the Quality Improvement Strategy.

- Reduce failure costs by problem solving
- Invest in the "right" prevention activities
- Reduce appraisal costs where appropriate and in a statically sound manner.
- Continuously evaluate and redirect the prevention effort to gain further quality improvement.

23. Give the Basic Concepts of TQM.

- A committed and involved management to provide long-term top-to-bottom organizational support.
- An unwavering focuses on the customer, both internally and externally.
- Effective involvement and utilization of the entire work force.
- Continuous improvement of the business and production process.
- Treating suppliers as partners.
- Establish performance measures for the processes.

24. What are the three elements of Juran trilogy?

(a) Quality planning
(b) Quality control
(c) Quality improvement.

25. What are the four essentials of TQM as per Crosby?

Four essentials of TQM, which he calls "Absolutes" are as:

(a) Quality is defined as conformance to requirements, not as goodness.
(b) Quality is achieved by prevention not appraisal.
(c) The quality performance is standard is zero defects (a concept he invented in the 1960s) and is best known for no acceptable quality levels.
(d) Quality is measured by the price of non-conformance, not by indexes.

26. Deming's approach to quality was built upon which of two types of variation?

Deming's approach to quality was built upon Shewhart's work and aimed at understanding the causes of two types of variation namely,

(a) Uncontrolled variation which is due to assignable or special causes – for example, change in raw material, procedure or method or breakage etc. and
(b) Controlled variation, which is due to unassignable causes, which are chance, random or common causes. These are due to process itself, its design and installation.

27. Give the obstacles associated with TQM Implementation.

- Lack of management commitment.
- Inability to change organizational culture.
- Improper planning.
- Lack of continuous training and education.
- Incompatible organizational structure and isolated individuals and departments.
- Ineffective measurement techniques and lack of access to data and results.
- Paying inadequate attention to internal and external customers.
- Inadequate use of empowerment and teamwork.

28. What are the two types of customers?

There are two types of customers. i.e., Internal customers and External customers. The customers inside the company are called internal customers, whereas the customers outside the company are called external customers.

29. What is customer focusing?

Customer Focusing is a technique for identifying the customers, products/services, quality characteristics, and performance measures which are most important to your business unit.

30. List any four tools used for collecting customer complaints.

(a) Feedback form
(b) Toll-free telephone numbers
(c) Service Report cards
(d) Company website.

31. Customer retention is more power than customer satisfaction. Why?

Customer retention is more powerful than customer satisfaction, because of the following findings in customer focus related research.

(a) Over 70% of an organization's future revenue will come from existing customers.
(b) A 3% increase in customer retention has an equivalent impact upon profitability as a 12% reduction in operating costs.
(c) 90% of the unhappy customer will never purchase goods and services from you again.
(d) It costs 5 times as much to attract a new customer as it costs to keep an old one.

32. How do the business people measure customer satisfaction?

(a) Increased number of repeat orders
(b) Increase in sales volume
(c) Increase in profit
(d) Reduced number of warranty claims.

33. Define customer retention.

Customer Retention is the activity that a selling organization undertakes in order to reduce customer defections. Customer retention is more than giving the customer what they expect, it's about exceeding their expectations so that they become loyal advocates for your brand.

PART – B

1. What is quality cost? Explain the techniques used for Quality cost?
2. Explain the principles of TQM?
3. Explain Deming Philosophy?
4. Explain the barriers to TQM implementation?
5. What are the customer perceptions of quality? Explain.
6. Explain the service quality with its characteristics and expectations.
7. Indicate the dimensions of quality with examples.
8. What are the different definitions given for quality? Explain how it got evolved and what are its prime concerns?
9. What are the barriers for implementing TQM in an industry? Explain.
10. List out the barriers of TQM implementation.
11. State and explain the principles of TQM.
12. List the fourteen principles of Deming's approach.
13. Explain on Juran's ten steps to quality improvement.
14. Explain Deming's 14 points on quality.
15. Explain Juran's 'Quality trilogy" in detail.
16. Explain the fourteen steps of Deming's philosophy for improving quality, productivity and competitiveness.
17. Enumerate Deming's 14 points of management.
18. Explain Deming's philosophy for the improvement of quality, productivity and competitive position. (AU Nov/Dec 2008)
19. Compare Deming and Juran approaches.
20. Explain Juran Trilogy.
21. Briefly discuss on: Customer satisfaction.
22. How can the organizations use customer feedback to their benefits? Give examples.
23. Enumerate any eight actions that an organization shall take to handle complaints.
24. Explain the importance of customer satisfaction.

UNIT – II

TQM PRINCIPLES

PART – A

1. What are quality statements?

The three elements of quality statements are:

(a) Vision statement
(b) Mission statement
(c) Quality policy statement

2. What is meant by vision statement? Write a sample one-sentence vision statement.

A vision statement is sometimes called a picture of your company in the future but it is so much more than that. Your vision statement is your inspiration, the framework for all your strategic planning. A vision statement may apply to an entire company or to a single division of that company. Whether for all or part of an organization, the vision statement answers the question, "Where do we want to go?".

3. What do you understand by quality statement?

Quality statements are the overall quality intentions and direction for the organization with respect to quality. Three elements of quality statements are:

(a) Vision statement
(b) Mission statement
(c) Quality policy statement

4. Explain the need for the quality systems in an organization.

The quality system is needed to:

(a) To know and document what we are doing
(b) To ensure continuous improvement
(c) To ensure every employee understands how to implement effectively quality in daily work
(d) To enhance the customer satisfaction

5. Define strategic planning.

Strategic planning is clarifying the overall purpose and desired results of an organization, and how those results will be achieved. Strategic planning is a disciplined effort to produce fundamental decisions and actions that shape and guide what an organizations what it does, and why it does it, with a focus on the future.

6. What are the elements of a quality systems?

(a) Management responsibility
(b) Quality management system
(c) Resource management
(d) Product or service realization
(e) Measurement, analysis and improvement.

7. Define quality planning.

It is a strategic planning process in which quality is embedded in each and every step.

8. What are the types of quality planning?

(a) Strategic quality planning
(b) Process quality planning
(c) Product quality planning

9. What is the difference between mission statement and vision statement?

The difference between a mission statement and a vision statement is that a mission statement focuses on a

company's present state while a vision statement focuses on a company's future.

10. List the four business objectives.

(a) Customer satisfaction
(b) Employee satisfaction
(c) Maximize market share
(d) Maximize profit and return on assets

11. What are the steps in strategic quality planning?

(a) Understand existing product and processes
(b) Identify potential customers
(c) Identify customer needs in their language by using QFD
(d) Translate customer needs in the form of product feature

12. What are the steps in product quality planning?

(a) Develop satisfactions for product features
(b) Optimize product design to set product goals
(c) Develop processes to meet product goals

13. What are the steps in process quality planning?

(a) Finalize process features and specifications in line with product goals
(b) Establish process stability by measuring its process performance
(c) Compute process capability by considering specifications and process performance
(d) Transfer process to operations
(e) Process ready to produce

14. What is a mission statement?

The mission statement answers the following questions: who we are, who are the customers, what we do, and how we do it.

15. What is a vision statement?

The vision statement is a declaration of how an organization should look like after five to ten years in future.

16. What is Employee involvement?

Employee involvement is creating an environment in which people have an impact on decisions and actions that affect their jobs.

17. What are the Maslow's basic needs?

Maslow's basic needs are:

(a) Physiological
(b) Safety
(c) Social
(d) Esteem &
(e) Self-actualisation needs.

18. Explain empowerment.

Employee empowerment entails identifying how much responsibility and authority an individual can effectively handle without becoming over-burdened or distressed. Empowerment includes supervisors and employees working together to establish clear goals and expectations within agreed-upon boundaries.

An empowered organization is one in which individuals have the knowledge, skill, desire, and opportunity to personally succeed in a way that leads to collective organizational success.

19. Define employee empowerment.

Empowerment refers to enlargement of an employee's job responsibility by giving him the authority of decision making about his own job without approval of his immediate supervisor.

20. What are the required condition to create empowered environment?

The four conditions required to create the empowered environment are:

(a) Free flow and exchange of information
(b) Everyone must be convinced for need for change
(c) The system needs to be modified in line with required new environment
(d) The organization must train and educate employees to upgrade their skill sets.

21. What are the important factors that influenced purchases?

(a) Performance
(b) Features
(c) Service
(d) Warranty
(e) Price
(f) Reputation.

22. Write short notes on Maslow's hierarchy of needs.

According to Maslow, there is a hierarchy of five needs. The five needs are: 1. Physiological, 2. Safety, 3. Social, 4. Esteem, and 5. Self-actualization. These needs form a hierarchy and each need becomes active only when the next lower level need is reasonably satisfied.

23. State Frederick Herzberg's Two-factor theory.

Herzberg found that people were motivated by recognition, responsibility, achievement and the work itself.

24. What do you mean by team?

Team comprises a group of people linked in a common purpose. Teams are especially appropriate for conducting tasks that are high in complexity and have many interdependent subtasks.

25. What do you mean by teamwork?

Teamwork is work performed by a team towards a common goal. Teamwork is defined as "a joint action by a group of people, in which each person subordinates his or her individual interests and opinions to the unity and efficiency of the group".

26. What are the types of teams?

(a) Process improvement team
(b) Cross-functional team
(c) Natural work team
(d) Self-directed/self-managed work teams.

27. What are the characteristics of successful teams?

(a) Sponsor
(b) Team charter
(c) Team composition
(d) Training
(e) Ground rules
(f) Clear objectives
(g) Accountability
(h) Well-defined decision procedures
(i) Resources
(j) Trust
(k) Effective problem solving

(l) Open communications
(m) Appropriate leadership
(n) Balanced participation
(o) Cohensiveness

28. What are the stages of team development?

(a) Forming
(b) Storming
(c) Norming
(d) Performing
(e) Adjourning

29. What is meant by reactive and proactive behaviour?

According to behavioural theory of motivation, people would get motivated to work for recognition and reward. They have a like for work. This behavior is known as proactive behavior.

Some people have dislike for work. Punishment only can motivate the people. This behavior is known as reactive behavior.

30. Give some common team problems.

(a) Floundering
(b) Overbearing participants
(c) Dominating participants
(d) Reluctant participants
(e) Unquestioned acceptance of opinions as facts
(f) Rush to accomplish
(g) Attribution
(h) Discounts and "plops"
(i) Wanderlust: digression and tangents
(j) Feuding team members.

31. What are the common barriers to team?

(a) Insufficient training
(b) Incompatible rewards and compensation
(c) First-line supervisor resistance
(d) Lack of planning
(e) Lack of management support
(f) Access to information systems
(g) Lack of union support.

32. Give the steps involved in training process.

Step 1: Make everyone aware of what the training is all about.
Step 2: Get acceptance.
Step 3: Adapt the program
Step 4: Adapt to what has been agreed upon.

33. Define Recognition and Reward.

Recognition is a form of employee motivation in which the organization publicly acknowledges the positive contributions an individual or team has made to the success of the organization.

Reward is something tangible to promote desirable behavior. Recognition and reward go together to form a system for letting people know they are valuable members of the organization.

34. What are the objectives of Employee Recognition and Reward?

(a) To improve performance

(b) Non-monetary recognition can be very motivating
(c) Helping to build feelings of confidence and satisfaction
(d) Increased employee retention.

35. What are the types of rewards?

There are two types of rewards. i.e., (a) Monetary rewards (b) Nonmonetary rewards.

36. What is performance appraisal?

Performance appraisal is the process of obtaining, analyzing and recording information about the relative worth of an employee. The focus of the performance appraisal is measuring and improving the actual performance of the employee and also the future potential of the employee.

37. What are the types of appraisal formats?

(a) Ranking
(b) Narrative
(c) Graphic
(d) Forced choice

38. What are the benefits of employee involvement?

Employee Involvement improves quality and increases productivity because:

(a) Employees make better decisions.
(b) Employees are more likely to implement and support decisions they had a part in making.
(c) Employees are better able to spot and pinpoint areas for improvement.
(d) Employees are better able to take immediate corrective action.
(e) Employee involvement reduces labour/management hassle by more effective communications and cooperation.
(f) Employee involvement increases morale by creating a feeling of belonging to the organization.
(g) Employees are better able to accept change because they control the work environment.
(h) Employees have an increased commitment to unit goals because they are involved.

39. What are the disadvantages of performance appraisal?

(a) Time consuming
(b) Discouragement
(c) Inconsistent Message
(d) Biases

40. State any four objectives of performance appraisal.

(a) To review the performance of the employees over a given period of time.
(b) To judge the gap between the actual and the desired performance.
(c) To help the management in exercising organizational control.
(d) To identify training needs.

41. What are the basic ways for a continuous process improvement?

(a) Reduce resources
(b) Reduce errors
(c) Meet or exceed expectations of downstream customers.
(d) Make the process safer.
(e) Make the process more satisfying to the person doing it.

42. What are the phases of a Continuous Process Improvement?

(a) Identify the opportunity
(b) Analyze the process
(c) Develop the optimal solutions
(d) Implement
(e) Study the results

(f) Standardize the solution
(g) Plan for the future.

43. What are the steps in the PDSA cycle?

The basic Plan-Do-Study-Act is an effective improvement technique.

- Plan carefully what is to be done
- Carry out the plan
- Study the results
- Act on the results by identifying what worked as planned and what didn't.

44. Define 5S.

5S Philosophy focuses on effective work place organization and standardized work procedures. 5S simplifies your work environment, reduces waste and non-value activity while improving quality efficiency and safety.

1. **Sort – (Seiri):** The first S focuses on eliminating unnecessary items from the workplace.
2. **Set In Order: (Seiton)** is the second of the 5S and focuses on efficient and effective storage methods.
3. **Shine: (Seiso)** Once you have eliminated the clutter and junk that has been clogging your work areas and identified and located the necessary items, the next step is to thoroughly clean the work area.
4. **Standardize: (Seiketsu)** Once the first three 5S have been implemented, you should concentrate on standardizing best practice in your work area.
5. **Sustain: (Shitsuke)** This is by far the most difficult S to implement and achieve. Once fully implemented, the 5S process can increase morale, create positive impressions on customers, and increase efficiency of organization.

45. What is a Kaizen?

Kaizen is a Japanese word for the philosophy that defines management's role in continuously encouraging and implementing small improvements involving everyone. It is the process of continuous improvement in small increments that make the process more efficient, effective, under control and adaptable.

46. What are the three key elements to a partnering relationship?

(a) Long-term commitment
(b) Trust
(c) Shared vision

47. What are the three types of sourcing?

(a) Sole sourcing
(b) Multiple sourcing
(c) Single sourcing

48. What are the four phases of inspection?

(a) 100% inspection
(b) Sampling
(c) Audit
(d) Identity check

49. What are the objectives of Performance measures?

(a) Establish baseline measures and reveal trends.
(b) Determine which processes need to be improved.
(c) Indicate process gains and losses.

(d) Compare goals with actual performance.
(e) Provide information for individual and team evaluation.
(f) Provide information to make informed decisions.
(g) Determine the overall performance of the organization.

50. What are the characteristics used to measure the performance of a particular process?

(a) Quantity
(b) Cost
(c) Time
(d) Accuracy
(e) Function
(f) Service
(g) Aesthetics

51. Give the six basic techniques for presenting performance measures?

(a) Time series graph
(b) Control chart
(c) Capability index
(d) Taguchi's Loss Function
(e) Cost of poor quality
(f) Malcolm Baldrige National Quality Award

52. How will you improve the performance appraisal system?

(a) Use rating scales that have few rating categories.
(b) Require work team or group evaluations that are atleast equal in emphasis to individual-focused evaluations.
(c) Require more frequent performance reviews where such reviews will have a dominant emphasis on future planning.
(d) Promotion decisions should be made by an independent administrative process that draws on current-job information and potential for the new job.
(e) Include indexes of external customer satisfaction in the appraisal process.
(f) Use peer and subordinate feedback as an index of internal customer satisfaction.
(g) Include evaluation for process improvement in addition to results.

53. What are the criteria to evaluate the performance measures?

(a) Simple
(b) Few in number
(c) Developed by users
(d) Relevance to customer
(e) Improvement
(f) Cost
(g) Visible
(h) Timely
(i) Aligned

54. What are the typical measurements frequently asked by managers and teams?

(a) Human Resource
(b) Customers
(c) Production
(d) Research and Development

(e) Suppliers
(f) Marketing/Sales
(g) Administration

55. Give the usage of an effective recognition and reward system.

(a) Serves as a continual reminder that the organization regards quality and productivity as important.
(b) Offers the organization a visible technique to thank high achievers for outstanding performance.
(c) Provides employees a specific goal to work toward. It motivates them to improve the process.
(d) Boosts morale in the work environment by creating a healthy sense of competition among individuals and teams seeking recognition.

PART – B

1. What are the duties of quality council? Explain in detail.
2. What should a leader know and understand in order to be effective?
3. Enumerate the duties of quality council.
4. Discuss about strategic planning and list out the characteristic behaviors of successful leaders.
5. What are the seven steps to strategic planning? (
6. Describe briefly any eight criteria that need to be considered while developing performance measures in organizations.
7. Explain about the strategic planning.
8. Explain the types of problems expected in a product and the improvement strategies which are applied on the product.
9. Briefly discuss on: Employee involvement.
10. Explain the following with their advantages and limitations: Performance appraisal.
11. What are the important factors that influence purchases?
12. Describe briefly any eight concepts to achieve a motivated workforce in an organization.
13. Discuss about Maslow's need hierarchy theory and Herzberg's two factor theory for motivation.
14. What are the characteristics of successful teams?
15. Briefly explain employee motivation and empowerment.
16. Explain continuous process improvement.
17. Explain the following with their advantages and limitations: Kaizen.
18. What are the major benefits of 5S implementation? Explain how are they achieved?
19. What are the principles of customer/supplier relations?
20. Explain the following: (i) 5S (ii) Kaizen (iii) Supplier rating and relationship development.
21. Explain the key elements of partnering.
22. Explain the conditions for selection and evaluation of suppliers.

UNIT – III

TQM TOOLS AND TECHNIQUES – I

PART – A

1. Define Statistics?

Statistics is defined as the science that deals with the collection, tabulation, analysis, interpretation, and presentation of quantitative data.

2. What is a measure of central tendency?

A measure of central tendency of a distribution is a numerical value that describes the central position of the data or how the data tend to build up in the center. There are three measures in common in use in quality viz, the average, the median and the mode.

3. What is Measures of dispersion?

Measures of dispersion describe how the data are spread out or scattered on each side of the central value. The measures of dispersion used are range and standard deviation.

4. What is a normal curve?

The normal curve is a symmetrical, unimodal, bell-shaped distribution with the mean, median and mode having the same value.

5. What is the use of the control chart?

The control chart is used to keep a continuing record of a particular quality characteristic. It is a picture of process over time.

6. Give the objectives of the attribute charts?

- Determine the average quality level.
- Improve the product quality.
- Evaluate the quality performance of operating and management personnel.
- Determine acceptance criteria of a product before shipment to the customer.

7. Define Six Sigma Problem Solving Method.

Define - improvement opportunity with an emphasis on increasing customer satisfaction. Measure - determine process capability (Cp/ Cpk) & dpmo (defects per million opportunities).Analyze - identify the vital few process input variables that affect key product output variables ("Finding the knobs").Improve - Make changes to process settings, redesign processes, etc. to reduce the number of defects of key output variables. Control - Implement process control plans, install real-time process monitoring tools, and standardize processes to maintain levels.

8. What are the new seven management tools?

(a) Affinity Diagram
(b) Interrelationship Digraph
(c) Tree Diagram
(d) Matrix Diagram
(e) Prioritization Matrices
(f) Process Decision Program Chart
(g) Activity Network diagram.

9. Give the seven tools of quality?

- Pareto Diagram
- Process Flow Diagram
- Cause-and-Effect Diagram
- Check Sheets

•Histogram
•Control Charts
•Scatter Diagrams

10. Give the usage of C&E diagrams?

•Analyze actual conditions for the purpose of product or service quality improvement, more efficient use of resources, and reduced costs.
•Eliminate conditions causing nonconformities and customer complaints.
•Standardize existing and proposed operations.
•Educate and train personnel in decision-making and corrective-action activities.

11. Define Six Sigma?

Six-Sigma is a business process that allows organizations to drastically improve their bottom line by designing and monitoring every day business activities in ways that minimize waste and resources while increasing customer satisfaction. It is achieved through continuous process measurement, analysis & improvement.

12. What are the various histogram shapes?

* Symmetrical * Skewed right * Skewed left * Peaked * Flat * Bimodal * Plateau distribution * Comb distribution * Double peaked distribution.

13. Differentiate Population & Sample?

Population represents the mathematical world and Sample represents the real world. A population frequency distribution is represented by a smooth curve whereas a sample frequency distribution is represented by a histogram.

14. Give the sources of variation?

Equipment
Material Environment Operator

15. Define Run chart?

A run chart is a very simple technique for analyzing the process in the development stage or, for that matter, when other charting techniques are not applicable.

16. Define Control chart?

Control chart is a means of visualizing the variations that occur in the central tendency and the dispersion of a set of observations. It is a graphical record of the quality of a particular characteristic.

17. What are the various patterns of scatter diagrams?

• Positive correlation
• Negative correlation
• No correlation
• Negative correlation may exist
• Correlation by stratification
• Curvilinear relationship

18. What is the procedure for constructing the tree diagram?

Choose an action oriented objective statement from the interrelationship diagram, affinity diagram, brainstorming, team mission statement, and so forth.
Using brainstorming, choose the major headings. Generate the next level by analyzing the major headings.

19. Give at least five standard formats of matrix diagram?

L- shaped
T-shaped
Y-shaped
C-shaped
X-shaped

20. What are the benefits of an activity network diagram?

A realistic timetable determined by the users.

Team members understand the role in the overall plan. Bottlenecks can be discovered and corrective action taken. Members focus on the critical tasks.

PART – B

1. Explain the QC or SPC tools?
2. Explain the Seven Management Tools?
3. Plot the control chart for variables and attributes
4. Explain the concept of Six Sigma with an example.
5. Discuss the properties of normal curve.
6. Explain cause and effect diagram with an example.
7. How is pareto analysis done? Explain with an example.
8. How is a cause and effect diagram constructed? Discuss in detail with a case study.
9. Explain the tool which measures the statistics of data scattered on each side of central value?
10. Discuss the seven tools of quality and new management tools for improving product and service quality.
11. Discuss about the analysis techniques for the quality cost.
12. Discuss the management techniques for establishing quality costs.
13. Explain in detail: process capability.
14. Discuss the need, construction and applications of control charts for variables.
15. Discuss process capability and explain the relationship of process capability to tolerance.
16. Explain the different types of control charts available for problem solving. Enumerate the different types patterns commonly noticed in control charts.
17. Explain affinity diagram and tree diagram.
18. Explain briefly matrix data analysis and check sheet.
19. Explain the tree diagram and arrow diagram.
20. Discuss the applications on new seven management tools with examples.
21. With a specific application, compare the affinity diagram and relationship diagram in terms of getting highly creative solutions for managerial problems.
22. Explain the concept of six-sigma. Also compare process capability with six-sigma concept.
23. Explain the stages of six sigma in process improvement.
24. Explain in detail: Six sigma
25. Explain Benchmarking.
26. Write short notes on : Benchmarking process.
27. What are the steps that contain the core technique of benchmarking?
28. Explain about the following: Benchmarking process.
29. Identify and explain the three main types of benchmarking. In what circumstance would each type be more appropriate?
30. Describe the different benchmarking metrices that can be used in educational institutions.
31. What are the stages of FMEA?
32. Write short notes on: FMEA.
33. Explain the step by step procedure to perform design FMEA with computer mouse as an example.
34. List the four stages of FMEA and indicate the activities carried out under each stage.
35. Discuss the objectives, Process, outcome and benefits of FMEA.
36. How failures of a product can be classified? Write the stages of FMEA.

UNIT – IV

TQM TOOLS AND TECHNIQUES – II

PART – A

1. Define Benchmarking?

Benchmarking is a systematic method by which organizations can measure
themselves against the best industry practices. The essence of benchmarking is the process of borrowing ideas and adapting them to gain competitive advantage. It is a tool for continuous improvement.

2. Enumerate the steps to benchmark?
a) Decide what to benchmark
b) Understand current performance
c) Plan
d) Study others
e) Learn from the data
f) Use the findings
3. What are the types of benchmarking?
i. Internal
ii.Competitive
iii.Process
4. What is a QFD?
Quality Function Deployment is a planning tool used to fulfill customer expectations. It is a disciplined approach to product design, engineering, and production and provides in-depth evaluation of a product.
5. What are the benefits of QFD?
i. Customer driven
ii. Reduces implementation time
iii. Promotes teamwork
iv. Provides documentation
6. What are the steps required to construct an affinity diagram?
i. Phrase the objective
ii. Record all responses
iii. Group the responses
iv. Organize groups in an affinity diagram
7. What are the parts of house of quality?
i. Customer requirements
ii. Prioritized customer requirements
iii. Technical descriptors
iv. Prioritized technical descriptors
v. Relationship between requirements and descriptors
vi. Interrelationship between technical descriptors
8. How will you build a house of quality?
a) List customer requirements
b) List technical descriptors
c) Develop a relationship matrix between WHATs and HOWs
d) Develop an interrelationship matrix between HOWs
e) Competitive assessments
f) Develop prioritized customer requirements
g) Develop prioritized technical descriptors
9 .Define FMEA?
Failure Mode Effect Analysis is an analytical technique that combines the technology and experience of people in identifying foreseeable failure modes of a product or process and planning for its elimination.
10. What are the stages of FMEA?
1. Specifying possibilities
a. Functions
b. Possible failure modes
c. Root causes
d. Effects
e. Detection/Prevention
2. Quantifying risk
a. Probability of cause
b. Severity of effect
c. Effectiveness of control to prevent cause

d. Risk priority number
3. Correcting high risk causes
a. Prioritizing work
b. Detailed action
c. Assigning action responsibility
d. Check points on completion
4. Revaluation of risk
a. Recalculation of risk priority number

11. What are the goals of TPM?

The overall goals of Total Productive Maintenance, which is an extension of TQM are

i. Maintaining and improving equipment capacity
ii. Maintaining equipment for life
iii. Using support from all areas of the operation
iv. Encouraging input from all employees
v. Using teams for continuous improvement

12. Give the seven basic steps to get an organization started toward TPM?

a) Management learns the new philosophy
b) Management promotes the new philosophy
c) Training is funded and developed for everyone in the organization d) Areas of needed improvement are identified
e) Performance goals are formulated
f) An implementation plan is developed
g) Autonomous work groups are established

13. What are the major loss areas?

i. Planned downtime
ii. Unplanned downtime
iii. Idling and minor stoppages
iv. Slow-downs
v. Process nonconformities
vi. Scrap

14. What are the generic steps for the development and execution of action plans in benchmarking? (AU Nov/Dec 2015)

" Specify tasks.
" Sequence tasks.
" Determine resource needs. " Establish task schedule.
" Assign responsibility for each task. " Describe expected results.
" Specify methods for monitoring results.

15. What are the phases of QFD process?

I. Product planning
ii. Part development
iii. Process planning
iv. Production planning

16. What are the several types of FMEA?

Design FMEA
Process FMEA Equipment FMEA Maintenance FMEA
Concept FMEA
Service FMEA
System FMEA
Environment FMEA etc.

17. Define TPM?

Total = All encompassing by maintenance and production individuals Working together.
Productive = Production of goods and services that meet or exceed customer's Expectations.

Maintenance = Keeping equipment and plant in as good as or better than the original Condition at all times.

PART – B

1. Explain clearly the 5 step Benchmarking process.
2. Explain with example what is meant by HOQ.
3. What is meant by Overall Equipment Effectiveness? Enumerate the steps outlined for Total Productive maintenance.
4. Enumerate different stages of FMEA with an example.
5. Explain clearly Taguchi's loss function.

UNIT – V
QUALITY SYSTEMS
PART – A

1. Give the ISO 9000 Series of Standards?

• ISO 9000, "Quality Management and Quality Assurance Standards Guidelines for Selection and Use".
• ISO 9001, "Quality Systems — Model for Quality Assurance in Design, Development, Production, Installation & Servicing".
• ISO 9002, "Quality Systems — "Model for Quality Assurance in Production, Installation & Servicing".
• ISO 9003, "Quality Systems — "Model for Quality Assurance in Final Inspection and Test".
• ISO 9004-1, "Quality Management and Quality System Elements — Guidelines".

2. What is the need for ISO 9000?

ISO 9000 is needed to unify the quality terms and definitions used by
Industrialized nations and use terms to demonstrate a supplier's capability of controlling its processes.

3. Give some other quality systems?

i. QS-9000
ii. TE-9000
iii. AS9000

4. Give the objectives of the internal audit?

a) Determine the actual performance conforms to the documented quality systems.
b) Initiate corrective action activities in response to deficiencies.
c) Follow up on noncompliance items of previous audits.
d) Provide continued improvement in the system through feedback to management.
e) Cause the auditee to think about the process, thereby creating possible improvements.

5. What are the requirements of ISO 14001?

i. General requirements
ii. Environmental policy
iii. Planning
iv. Implementation and operation
vi. Checking and corrective action
vii. vi. Management review

6. What are the benefits of ISO 14000?

a. Global
•Facilitate trade and remove trade barriers
•Improve environmental performance of planet earth
•Build consensus that there is a need for environment management and a common terminology for EMS.
b. Organizational
• Assuring customers of a commitment to environmental management
• Meeting customer requirements
• Maintaining a good public / community relations image
• Satisfying investor criteria and improving access to capital
• Obtaining insurance at reasonable cost
•Increasing market share that results from a competitive advantage •Reducing incidents that result in liability
•Improving defense posture in litigation
•Conserving input materials and energy
•Facilitating the attainment of permits and authorization

•Improving industry/government relations

7. What are the four elements for the checking & corrective action of ISO 14001?

a) Monitoring and measuring
b) Nonconformance and corrective and preventative action c) Records
d) EMS audit

8. What are the seven elements for the implementation & operations of ISO 14001?

a) Structure and responsibility
b) Training, awareness and competency
c) Communication
d) EMS documentation
e) Documentation control
f) Operational control
g) Emergency preparedness and response

9. What are the four elements for the planning of ISO 14001?

a) Environmental aspects
b) Legal and other requirements
c) Objectives and targets
d) Environmental Management Programs

10. Give the types of Organizational Evaluation Standards?

• Environmental Management System
• Environmental Auditing
• Environmental Performance Evaluation

11. Give the types of Product Evaluation Standards?

• Environmental Aspects in Product Standards
• Environmental Labeling
• Life-Cycle Assessment

12. Define Quality Audits?

Quality Audits examine the elements of a quality management system in order to evaluate how well these elements comply with quality system requirements.

13. Analyze TQM?

Total = Made up of the whole.
Quality = Degree of excellence a product or service provides. Management = Act, art or manner of handling, controlling, directing etc.

14. What are the benefits of ISO?

(a) Fewer on-site audit by customers. Increased market share.
(b) Improved quality, both internally and externally.
(C) Improve product and service quality levels from suppliers. Greater awareness of quality by employees.
(d) A documented formal systems. Reduced operating costs.
(e) Give the ISO 9001 requirements Scope
(f) Normative Reference Terms and Definitions
(g) Quality Management System Management Responsibility Resource Management Product Realization
(h) Measurement, Analysis & Improvement

15. What are the methods of actual audit?

i. Examination of documents ii. Observation of activities iii. Interviews

PART – B

1. What is ISO-9000 ? Enumerate major elements of ISO 9001:2000 & Principles of Quality Management.
2. Explain the significance of ISO 9001: 2000 QMS Requirements.
3. What is meant by Internal Auditing and how is it used in QMS?
4. What is EMS system as per ISO?

5. Explain clearly EMS system as per ISO 14001.

OCS752 Introduction to C Programming

UNIT I INTRODUCTION

Structure of C program – Basics: Data Types – Constants –Variables - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision-making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process – Exercise Programs: Check whether the required amount can be withdrawn based on the available amount – Menu-driven program to find the area of different shapes – Find the sum of even numbers

Text Book: Reema Thareja (Chapters 2, 3)

UNIT II ARRAYS

Introduction to Arrays – One dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Traversal, Insertion, Deletion, Searching - Two dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Read – Print – Sum – Transpose – Exercise Programs: Print the number of positive and negative values present in the array – Sort the numbers using bubble sort - Find whether the given is matrix is diagonal or not.

Text Book: Reema Thareja (Chapters 5)

UNIT III STRINGS

Introduction to Strings - Reading and writing a string - String operations (without using built-in string functions): Length – Compare – Concatenate – Copy – Reverse – Substring – Insertion – Indexing – Deletion – Replacement – Array of strings – Introduction to Pointers – Pointer operators – Pointer arithmetic - Exercise programs: To find the frequency of a character in a string - To find the number of vowels, consonants and white spaces in a given text - Sorting the names.

Text Book: Reema Thareja (Chapters 6 & 7)

UNIT IV FUNCTIONS

Introduction to Functions – Types: User-defined and built-in functions - Function prototype - Function definition - Function call - Parameter passing: Pass by value - Pass by reference - Built-in functions (string

functions) – Recursive functions – Exercise programs: Calculate the total amount of power consumed by „n" devices (passing an array to a function) – Menu-driven program to count the numbers which are divisible by 3, 5 and by both (passing an array to a function) – Replace the punctuations from a given sentence by the space character (passing an array to a function)

Text Book: Reema Thareja (Chapters 4)

UNIT V STRUCTURES

Introduction to structures – Declaration – Initialization – Accessing the members – Nested Structures – Array of Structures – Structures and functions – Passing an entire structure – Exercise programs: Compute the age of a person using structure and functions (passing a structure to a function) – Compute the number of days an employee came late to the office by considering his arrival time for 30 days (Use array of structures and functions)

Text Book: Reema Thareja (Chapters 8)

Text Books:

1. Reema Thareja, Programming in C, Oxford University Press, Second Edition, 2016

References:

1. Kernighan, B.W and Ritchie, D.M, The C Programming language, Second Edition, Pearson Education, 2006
2. Paul Deitel and Harvey Deitel, C How to Program, Seventh edition, Pearson Publication
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OCS752 Introduction to C Programming

UNIT I INTRODUCTION

Structure of C program – Basics: Data Types – Constants –Variables - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision-making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process – Exercise Programs: Check whether the required amount can be withdrawn based on the available amount – Menu-driven program to find the area of different shapes – Find the sum of even numbers

Text Book: Reema Thareja (Chapters 2, 3)

UNIT II ARRAYS

Introduction to Arrays – One dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Traversal, Insertion, Deletion, Searching - Two dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Read – Print – Sum – Transpose – Exercise Programs: Print the number of positive and negative values present in the array – Sort the numbers using bubble sort - Find whether the given is matrix is diagonal or not.

Text Book: Reema Thareja (Chapters 5)

UNIT III STRINGS

Introduction to Strings - Reading and writing a string - String operations (without using built-in string functions): Length – Compare – Concatenate – Copy – Reverse – Substring – Insertion – Indexing – Deletion – Replacement – Array of strings – Introduction to Pointers – Pointer operators – Pointer arithmetic - Exercise programs: To find the frequency of a character in a string - To find the number of vowels, consonants and white spaces in a given text - Sorting the names.

Text Book: Reema Thareja (Chapters 6 & 7)

UNIT IV FUNCTIONS

Introduction to Functions – Types: User-defined and built-in functions - Function prototype - Function definition - Function call - Parameter passing: Pass by value - Pass by reference - Built-in functions (string

functions) – Recursive functions – Exercise programs: Calculate the total amount of power consumed by „n" devices (passing an array to a function) – Menu-driven program to count the numbers which are divisible by 3, 5 and by both (passing an array to a function) – Replace the punctuations from a given sentence by the space character (passing an array to a function)

Text Book: Reema Thareja (Chapters 4)

UNIT V STRUCTURES

Introduction to structures – Declaration – Initialization – Accessing the members – Nested Structures – Array of Structures – Structures and functions – Passing an entire structure – Exercise programs: Compute the age of a person using structure and functions (passing a structure to a function) – Compute the number of days an employee came late to the office by considering his arrival time for 30 days (Use array of structures and functions)

Text Book: Reema Thareja (Chapters 8)

Text Books:

1. Reema Thareja, Programming in C, Oxford University Press, Second Edition, 2016

References:

5. Kernighan, B.W and Ritchie, D.M, The C Programming language, Second Edition, Pearson Education, 2006
6. Paul Deitel and Harvey Deitel, C How to Program, Seventh edition, Pearson Publication
7. Juneja, B. L and Anita Seth, Programming in C, CENGAGE Learning India pvt. Ltd., 2011
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SUBJECT : OCS752 – INTRODUCTION TO C

PROGRAMMINGSEM / YEAR : V SEMESTER / III

YEAR EEE

UNIT -I INTRODUCTION

Structure of C program – Basics. Data Types – Constants –Variables - Keywords – Operators: Precedence and Associativity - Expressions - Input/output statements, Assignment statements – Decision-making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process – Exercise Programs: Check whether the required amount can be withdrawn based on the available amount – Menu-driven program to find the area of different shapes – Find the sum of even numbers

PART – A

Q. No.	Questions
1	Define Constants in C
2	List the different data types available in C
3	What are Keywords?
4	What do you mean by variables in „C“?
5	What is the use of sizeof() operator in C?
6	Define Looping in C
7	Why header files are included in „C“ programming?
8	Outline delimiters in „C“
9	What is type casting?
10	What is the difference between ++a and a++?
11	Difference between Local and Global variable in C
12	What is the difference between scanf() and gets() function?
13	What is the difference between „=“ and „==“ operator?
14	What are the types of I/O statements available in „C“?
15	What are Operators? Mention their types in C
16	Mention the various decisions making statement available in C
17	What do you meant by conditional or ternary operator?
18	What is the difference between if and while statement?
19	What are the types of looping statements available in C?
20	Distinguish between while..do and do..while statement in C

PART – B

1	Describe the structure of C program with example?(13)
2	What is data type? Explain different types of data types in detail with example(13)
3	Describe the various types of operators in „C‟ language along with its priority(13)
4	What is loop? Explain its types in detail with example(13)
5	i) Discuss nested loop structure with suitable example(6) ii) Summarize the input and output function in „C‟(7)
6	Discuss in detail about „C‟ declarations and variables(13)
7	Illustrate in detail about the constants, expressions and statements in „C‟(13)
8	Apply the various decision making statements in a „C‟ program (13)
9	Identify the following terms and explain it: i. Keywords (3) ii. Identifiers (3) iii. C character set (3) iv. Constant and Volatile variables(4)
10	Build a C program for numbers from 1 to n(13) i. To find the sum (6)
	ii. To find prime numbers(7)
11	Explain the following: i. break statement with example program (5) ii. continue statement with example program(4) iii. goto statement with example program(4)
12	How switch case will work? Explain it with an example(13)
13	Evaluate a C program to find whether a given number is palindrome or not(13)
14	i. Create a C Program to perform swapping of two numbers(6) ii. Create a C program to find the sum of even numbers(7)
	PART – C
1	Construct a C program with a following operator in a C language? a. Bitwise Operators (5) b. Logical operator(5) c. Increment and decrement operator(5)
2	Create a C program to perform various calculator arithmetic operations using switch statement(15)
3	Write a Menu driven program in C to find the area of different shapes(15)
4	Assess a C program to check whether given amount can be withdrawn from the given bank account or not?(15)

UNIT – I

Introduction2 MARKS

1. Define Constants in C

Constants in C are the fixed values that are used in a program, and its value remains the sameduring the entire execution of the program.

- Constants are also called literals.
- Constants can be any of the data types.
- It is considered best practice to define constants using only upper-case names.

2. List the different data types available in C

Data types specify how we enter data into our programs and what type of data we enter. C language has some predefined set of data types to handle various kinds of data that we can use in our program. These data types have different storage capacities. C language supports 2 different type of data types:

1. **Primary data types:**
   These are fundamental data types in C namely integer(int), floating point(float), character(char) and void.

2. **Derived data types:**
   Derived data types are nothing but primary data types but a little twisted or grouped together like array, structure, union and pointers.

3. What are Keywords?

Keywords are certain reserved words that have standard and pre-defined meaning in „C". There are 32 keywords and it can be used only for their intended purpose. For example, auto, if, else, for,switch and return are keywords.

4. What do you mean by variables in „C"?

- A variable is a data name used for storing a data value.
- Can be assigned different values at different times during program execution.
- Can be chosen by programmer in a meaningful way so as to reflect its functionin theprogram.
- Some examples are: Sum, percent_1 and class_total

5. What is the use of sizeof() operator in C?

· The sizeof ( ) operator gives the bytes occupied by a variable.

· Number of bytes occupied varies from variable to variable depending upon its data types.

Example:

int x,y;
printf(“%d”,sizeof(x)
);**Output:**
2

6. Define Looping in C

Many tasks done with the help of a computer are repetitive in nature. Such tasks can be donewith loop control statements.

7. Why header files are included in „C‟ programming?

· This section is used to include the function definitions used in the program.
· Each header file has „h‟ extension and include using ‟# include‟ directive at the beginning ofa program.

8. Outline delimiters in „C‟

A delimiter is one or more characters that separate text strings. When a program stores sequential or tabular data, it delimits each item of data with a predefined character. The delimiters in C are as follows:

	Delimiters	Use
:	Colon	Useful for label
;	Semicolon	Terminates Statement
( )	Parenthesis	Used in expression and functions
[ ]	Square Bracket	Used for array declaration
{ }	Curly Brace	Scope of statement
#	Hash	Preprocessor directive
,	Comma	Variable Separator

9. What is type casting?

Type casting is the process of converting the value of an expression to a particular data type.

Example:

int x, y;
c = (float) x/y; where x and y are defined as integers. Then the result of x/y is converted intofloat.

10. What is the difference between ++a and a++?

The ++a means do the increment before the operation (pre increment), whereas a++ means dothe increment after the operation (post increment).

Example:

```
a=5;
x=a++; /* assign x=5*/
y=a; /*now y assigns
y=6*/x=++a; /*assigns
x=7*/
```

11. Difference between Local and Global variable in C

Local Variable is defined as a type of variable declared within programming block or subroutines. It can only be used inside the subroutine or code block in which it is declared. The local variable exists until the block of the function is under execution. After that, it will bedestroyed automatically.

A **Global Variable** in the program is a variable defined outside the subroutine or function. It has a global scope means it holds its value throughout the lifetime of the program. Hence, it can be accessed throughout the program by any function defined within the program, unless it is shadowed.

Here, are some fundamental differences between Local and Global variables.

Parameter	Local	Global
Scope	It is declared inside a function.	It is declared outside the function.
Value	If it is not initialized, a garbage value is stored	If it is not initialized zero is stored as default.
Lifetime	It is created when the function starts execution and lost when the functions terminate.	It is created before the program's global execution starts and lost when the program terminates.
Data sharing	Data sharing is not possible asdata of the local variable can be accessed by only one function.	Data sharing is possible as multiple functions can access the same global variable.
Parameters	Parameters passing is requiredfor local variables to access the value in other function	Parameters passing is not necessary fora global variable as it is visible throughout the program

Modification of variable value	When the value of the local variable is modified in one function, the changes are not visible in another function.	When the value of the global variable is modified in one function changes arevisible in the rest of the program.
Accessed by	Local variables can be accessed with the help of statements, inside a functionin which they are declared.	You can access global variables by any statement in the program.
Memory storage	It is stored on the stack unless specified.	It is stored on a fixed location decidedby the compiler.

12. What is the difference between scanf() and gets() function?

In scanf() when there is a blank was typed, the scanf() assumes that it is an end.
The gets() assumes the enter key as end. That is gets() gets a new line (\n) terminated string ofcharacters from the keyboard and replaces the „\n" with „\0".

13. What is the difference between „=" and „==" operator?

The = is an assignment operator, whereas == is a relational operator.

Example:

while (i=5) is an infinite loop because it is a non-zero value and while (i==5) is true only wheni=5.

14. What are the types of I/O statements available in „C"?

There are two types of I/O statements available in „C".
· Formatted I/O Statements
· Unformatted I/O Statements

15. What are Operators? Mention their types in C

An operator is a symbol that specifies an operation to be performed on operands. The types aretabulated as follows:

S. No.	Operators Types	Symbolic Representation
1	Arithmetic operators	= , - , * , / and %
2	Relational operators	> , < , == , >=, <= and !=
3	Logical operators	&& , || and !
4	Increment and Decrement	++ and –
5	Assignment operators	= , + = , - = , * = , / = , ^ = , ; = , & =

6	Bitwise operators	& , | , ^ , >> , << , and ~
7	Comma operator	,
8	Conditional operator	? :

16. Mention the various decisions making statement available in C

Decision making is about deciding the order of execution of statements based on certain conditions or repeat a group of statements until certain specified conditions are met. C language handles decision-making by supporting the following statements,

- **if** statement
- **switch** statement
- conditional operator statement (**? :** operator)
- **goto** statement

17. What do you meant by conditional or ternary operator?

Ternary operators is a conditional operator with symbols ? and :. It reflects the structure ofsimple if ... else condition.
Syntax: variable = exp1 ? exp2 : exp3
If the exp1 is true variable takes value of exp2. If the exp2 is false, variable takes the value ofexp3.

18. What is the difference between if and while statement?

The difference is tabulated as below.

if	while
(i) It is a conditional statement	(i) It is a loop control statement
(ii) If the condition is true, it executes some statements.	(ii) Executes the statements within the while block if the condition is true.
(iii) If the condition is false then it stops the execution the statements.	(iii) If the condition is false the control is transferred to the next statement of the loop.

19. What are the types of looping statements available in C?

Looping statement is the statement that executes one or more statements repeatedly several number of times. In C programming language there are three types of loops: **while, for and do-while**.

20. Distinguish between while..do and do..while statement in C

In the while loop the condition is first executed. If the condition is true then it executes the body of the loop. When the condition is false it comes of the loop. In the do…while loop first the statement is executed and then the condition is checked. The do…while loop will execute at least one time even though the condition is false at the very first time. The difference is tabulated as below.

(i) Executes the statements within the while block if only the condition is true.	(i) Executes the statements within the while block at least once.
(ii) The condition is checked at the starting of the loop	(ii) The condition is checked at the end of the loop

UNIT II ARRAYS	
Introduction to Arrays – One dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Traversal, Insertion, Deletion, Searching - Two dimensional arrays: Declaration – Initialization - Accessing elements – Operations: Read – Print – Sum – Transpose – Exercise Programs: Print the number of positive and negative values present in the array – Sort the numbers using bubble sort - Findwhether the given is matrix is diagonal or not.	
PART – A	
Q. No.	**Questions**
1	Define Array
2	List out the classifications of an array
3	What is an array variable? How does it differ from an ordinary variable?
4	Define bubble sort
5	Give the syntax of an array in C
6	Predict the real time examples of an array
7	Identify the conditions that must be satisfied by all the elements of any given array
8	What is meant by sorting?
9	List the manners you will access the elements in an array
10	Outline the characteristics of an array
11	Write the procedure to find whether the element is present in the array elements or not

12	Write short note on array initialization in C
13	Define searching. Write a C program that search for an element in an array
14	How an array of 10 integers declared and used in C?
15	How to declare and initialize 2-D array? Discuss with an example
16	State the rules to be followed in declaring an array
17	Assess a C program to read and display the 2D array elements
18	Why do we need to give size of an array in the array declaration?
19	Create a C program to read and display the elements using 1-D array
20	Create a C program to print the array elements in reverse order
PART – B	
1	Define one dimensional array. Give the syntax and Explain with an example(13)
2	Describe in detail how to access values in an array with example(13)
3	Describe the following operations using array example i. Insertion(6) ii. Deletion(7)
4	Define array? Write a C program to search an element from the array(13)
5	Discuss about the process of array initialization and declaration(13)
6	Illustrate briefly about the two dimensional array with example(13)
7	Discuss basic operations of two dimensional array i. Sum and print the elements in array(6) ii. Transpose the elements in array(7)
8	Build a C program to find sum of given n integers using array(13)
9	Explain in detail about type of sorting the array elements. (13)
10	Build a C program to sort n given numbers using bubble sort and also find the number of exchangesand passes(13)
11	Write a C program to multiply two matrices(13)
12	Write a C program to read in an array of „N‟ integers and print its elements in reverse order(13)
13	Is it possible to pass array elements into function arguments? Justify your answer with suitable example(13)
14	Create a C program to determine whether the given matrix is symmetric or not(13)
PART – C	
1	Discuss how you can evaluate Mean, Median and Mode for an array of numbers. Write a C program to evaluate Mean, Median and Mode for an array of n numbers(15)

2	Write a C program to Print the number of positive and negative values present in the array(15)
3	Write a C program to find whether the given matrix is diagonal matrix or not. Justify with an example(15)
4	Create a C program to i. Reorder a one dimensional array of numbers in descending order(7) ii. Find whether the given is matrix is diagonal or not(8)

1. Define Array

In C language, arrays are referred to as structured data types. An array is defined as **finite ordered collection of homogenous** data, stored in contiguous memory locations. Here the words,

finite means data range must be defined.

ordered means data must be stored in continuous memory addresses.

homogenous means data must be of similar data type.

2. List out the classifications of an array

Arrays are classified based on their dimensions. The major classes of array are as follows:1.One-Dimensional Array

2. Two-Dimensional Array

3. Multi-Dimensional Array

3. What is an array variable? How does it differ from an ordinary variable?

Array:- An array is a set or a group of variables with same data type like integer, character, float, double etc. It can be of any size. It's initialization is as follows:

int a[n];

where **n** belongs to size given by the user and **a** is the name of the array of integer data type.

Variables:- Variables are simply names used to refer to some location in memory – a location that holds a value. In simple, variables are referred as a placeholder for a value. It's initialization is as follows:

int a;

where **a** is the name of the variable with integer data type.

4. Define bubble sort

Bubble sort is a sorting algorithm that works by repeatedly stepping through lists that need to be sorted, comparing each pair of adjacent items and swapping them if they are in the wrong order. This passing procedure is repeated until no swaps are required, indicating that the list is sorted. Bubble sort gets its name because smaller elements bubble toward the top of the list. Bubble sort is also referred to as sinking sort or comparison sort.

5. Give the syntax of an array in C

The Syntax is as follows:

datatype arrayName [size];

An array type can be any valid C data types, and array size must be an integer constant greater thanzero.

E.g. int

a[10];

Where,

int is the **data type** of the array.

a is the **array name.**

10 is the **size** of the array.

6. Predict the real time examples of array

Example where arrays are used,

- to store list of Employee or Student names,
- to store marks of students,
- to store list of numbers or characters etc.

Array can be used to represent not only simple list of data but also table of data in two or three dimensions.

7. Identify the conditions that must be satisfied by all the elements of any given array

The entire elements of any given array have common characteristics. Then can be characters, integers, floating-point numbers, structures, and so on. They must all, however, be of the same type and the same storage class.

8. What is meant by sorting?

Sorting refers to ordering data in an increasing or decreasing fashion according to some linear relationship among the data items.

9. List the manners you will access the elements in an array

Once arrays are declared, the elements in an array can be accessed with the array name, and the index number inside brackets [ ]. If an array is declared as: typeName varName[size], then the element with index n is referred to as varName[n].

Examples:

int x, list[5]; // declaration

list[3] = 6; // assign value 6 to array item with

index 3list[x] = list[x+1]; // increment by 1

It would not be appropriate, however, to use an array index that is outside the bounds of the validarray indices:

list[5] = 10; // bad statement, since your valid indices are 0 - 4.

10. Outline the characteristics of an array

The generic characteristics of an array are,

i. Array contains **similar data elements**

ii. Array **stores fixed number of data** elements

iii. The elements in the array can be **accessed by the index** of the array iv.The elements are **stored in contiguous memory location** in an array

11. Write the procedure to find whether the element is present in the array elements ornot

The steps to be followed to find whether an element is present in the array or not are as follows:

I. Read the array size and store that value into the variable n.

II. Read the entered elements and store those elements into an array a[] using scanf statement and the for loop. scanf("%d",&a[i]) indicates scanf statement reads theentered element and assigned that element to a[i].

III. Read the key which we want to search in an array.

IV. Compare the key with each element of the array as a[i]==key and print element found, if the key matches with any element of the array otherwise print element not found.

12. Write short note on array initialization in C

An array can be initialized at either following states:

- **Compiling time initialization (static initialization)**

The compile-time initialization means the array of the elements are initialized at the time the program is written or array declaration.

Syntax: data_type array_name [array_size]=(list of elements of an array);

Example: int n[5]={0, 1, 2, 3, 4};

- **Dynamic Initialization**

Run time initialization means the array can be initialized at runtime. That means array elements are initialized after the compilation of the program.

13. Define searching. Write a C program that search for an element in an array

Searching in C Language has to check for an element or retrieve an element from any data structurewhere the data is stored. Based on the type of search operation, there are generally two algorithms defined in C:

- Linear Search or Sequential Search- search for an element in an array
- Binary Search

Code for linear search is as follows:

```
#include
<stdio.h>
#include
<conio.h> int
main()
{
int a[10000],i,n,key;
printf("Enter size of the array :
");scanf("%d", &n);
printf("Enter elements in array :
");for(i=0; i<n; i++)
{
scanf("%d",&a[i]);
}
printf("Enter the key :
");scanf("%d", &key);

for(i=0; i<n; i++)
```

```
{
if(a[i]==key)
{
printf("element found ");
return 0;
}
}
printf("element  not  found");
}
```

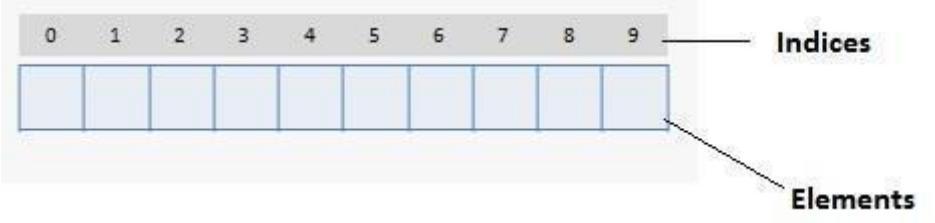
14. How an array of 10 integers declared and used in C?

The usual way of declaring an array is to **simply line up the type name, followed by a variable name, followed by a size in brackets**, as in this line of code

```
int Numbers[10];
```

This statement allocates a contiguous block of memory for ten integers and initializes all the values to

0. This is how it is laid out in memory:



Array indexes start from zero and end with (array size – 1). So for the above array, you can use the first element with a[0], second element with a[1], third element with a[2] and fourth element with a[3]and so on.

We can use the indexes to set or get specific values from the array. Here are a few examples:

```
a[0] = 10;
a[1] = 20;
a[2] = a[1] / a[0]; // a[2] will be set to
20/10 = 2a[3] = a[1] - 2;       // a[3] will
be set to 20-2 = 18
```

15. How to declare and initialize 2-D array? Discuss with an example

A 2D array is like a matrix and has a row and a column of elements (Although in memory theseare stored in contiguous memory locations)**.**

A **2D array** needs to be declared so that the compiler gets to know what type of data is being storedin the array. Similar to 1D array, a 2D array can also be declared as an int, char, float, double, etc.

The syntax is as follows:

datatype array_name[number of rows] [number of columns]int num[10][5]; //Declaration of 2D array

The „int" specifies that the data stored in the array will be of integer type.„num" is the variable name under which all the data is stored.

[10] refers to the number of rows of the array and

[5] refers to the number of columns of the array.

16. State the rules to be followed in declaring an array

Rules for declaring one dimensional array are listed below.

- An array variable must be declared before being used in a program.
- The declaration must have a data type(int, float, char, double, etc.), variable name, andsubscript.
- The subscript represents the size of the array. If the size is declared as 10, programmers canstore 10 elements.
- An array index always starts from 0. For example, if an array variable is declared as s[10],then it ranges from 0 to 9.
- Each array element stored in a separate memory location.

17. Assess a C program to read and display the 2D array elements

The program to read and display the elements of 2D array is given below.

```
#include <stdio.h>
int main()
{    int a[3][3]; // 3x3 array declaration
```

```
int i, j;
printf("Enter values in the 3x3 array:\n");
for (i = 0; i < 3; i++) // outer loop for
rows
{
for (j = 0; j < 3; j++) // inner loop for columns
{
scanf("%d", &a[i][j]); // read array values
}
}
for (i = 0; i < 3; i++) // outer loop for rows
{
for (j = 0; j < 3; j++) // inner loop for columns
{
printf("%d", a[i][j]); // print array values
}
printf("\n");
}
}
```

18. Why do we need to give size of an array in the array declaration?

The C compiler automatically guesses the size of the array from the size of the initializer list as its size is skipped in declaration.

But, we cannot skip both the size and the initializer list, and write as int a[]. Arrays in C are of a fixed size, and so their size must be known when we create the array. Therefore, if we skip both of them, C cannot create the array, and this will lead to a compile-time error.

19. Create a C program to read and display the elements using 1-D array **The C program to read and display the elements of 1-D array is given below.#include<stdio.h>**

```
int main()
{
int arr[5];
int i;
```

```
printf("\n Enter the array elements : ");


for(i = 0; i<5; i++)
{
scanf("%d", &arr[i]);
}
printf("\n The array elements are : ");
for(i = 0; i<5; i++)
{
printf(" %d ", arr[i]);
}
        return 0; }
```

20. Create a C program to print the array elements in reverse order

Reversing is the process of storing the last element into first. For example, if 'A' is an array of integers with three elements such that,

A[0] = 1, A[1] = 2, A[2] = 3

Then after reversing, the array will

beA[0] = 3, A[1] = 2, A[0] = 1

C program to reverse an array using an additional array is as follows:

```
#include
<stdio.h>int
main()
{
int n, c, d, a[100], b[100];
printf("Enter the number of elements in
array\n");scanf("%d", &n);
printf("Enter array
elements\n");for (c = 0; c < n ;
c++) scanf("%d", &a[c]);
// Copying elements into array b starting from the end of array a
for (c = n - 1, d = 0; c >= 0; c--, d++)
b[d] = a[c];
```

```
// Copying reversed array into the original, we are modifying the original array.
for (c = 0; c < n; c++)
a[c] = b[c];
printf("The array after
reversal:\n");
for (c = 0; c < n; c++)
printf("%d\n", a[c]);
return 0;
        }
```

SUBJECT : OCS752 – INTRODUCTION TO C PROGRAMMINGSEM / YEAR : VII SEMESTER/ FINAL YEAR (EEE)

UNIT -III STRINGS	
Introduction to Strings - Reading and writing a string - String operations (without using built-in string functions): Length – Compare – Concatenate – Copy – Reverse – Substring – Insertion – Indexing – Deletion– Replacement – Array of strings – Introduction to Pointers – Pointer operators – Pointer arithmetic - Exercise programs: To find the frequency of a character in a string - To find the number of vowels, consonants and white spaces in a given text - Sorting the names.	
PART – A	
Q. No.	**Questions**
1	Define strings.
2	Give the declaration for the string “COMPUTER” in C.
3	What is meant by array of strings?
4	List out the any four functions that are performed on strings.
5	What is a pointer?
6	List the advantages of using pointers.
7	Outline the operators exclusively used with pointers.
8	Summarize types of pointer in short.
9	What does the conversion specification %6s mean?
10	Infer null string and null character.
11	List the most common string manipulation operations in C.
12	Derive the steps to insert a new character into an existing string.
13	Write a C program to copy the value of one string to another.
14	What is the difference between a C character and a C string?
15	Differentiate between P and *P.
16	Analyze how pointer is initialized.
17	Assess a C program that calculates length of given string.

18	What is the output of the following
	program?#include <stdio.h>
	int main()
	{
	int i, j;
	int *p; /* a pointer to an
	integer */p = &i;
	*
	p
	=
	5;
	j
	=
	i;
	printf("%d %d %d\n", i, j,
	*p);return 0;
	}

19	Create a C program to get the string from the keyboard and print the same.
20	Create a C program to illustrate the concept of pointer.
	PART – B
1	Describe the string handling functions in C. Write a C program to concatenate two strings without using built in functions. (13)
2	What is pointer? Illustrate the role of pointers with an example. (13)
3	Describe how pointers are used for handling strings. (13)
4	Derive the types of pointers and explain modes of accessing a pointer. (13)
5	Discuss in detail about the ways of reading and writing a string with suitable examples. (13)
6	Illustrate in detail about array of strings with your own example. (13)
7	Discuss in detail about handling arrays with pointer. (13)
8	Write a C program that reflects the functionality of built-in string functions given below. i. strcpy() (6) ii. strcmp() (7)

9	Build a C program to count the number of lines, words and characters in a given text. (13)
10	Build a C program using pointer to find the bigger of two given numbers. (13)
11	Assess a C program to count the occurrence of a particular character in the given string. (13)
12	Write a C program to find the sum of two values using pointer. (13)
13	Write a C program to find number of vowels, consonants, digits and whitespace in a string. (13)
14	Create a C program i. To find whether the given string is palindrome or not. (7) ii. To find out the length of given string. (6)
PART – C	
1	Create a C program to find whether the given string is palindrome or not without using string functions. (15)
2	Create a C program to sort the names that are read from array of strings. (15)
3	Assess in detail about pointer arithmetic operations. (15)
4	Build a C program that replaces an existing character in a string with new one. (15)

UNIT – III

Strings 2 MARK

1. Define strings.

Strings are defined as a one-dimensional array of characters terminated by a **null** character '\0'.

2. Give the declaration for the string "COMPUTER" in C.

The general syntax for declaring a variable as a string in C is as follows,char string_variable_name [array_size];

The classic declaration of strings can also be initialized as follow:

```
char string_name[string_length] =
                    "string";(or)
char string_name[string_length] ={„s“,“t“,“r“,“i“,“n“,“g“,“\0“};
```

The size of an array must be defined while declaring a C String variable because it is used to calculate how many characters are going to be stored inside the string variable in C.

char str1=”COMPUTER”; (or) char str1={„C“,“O“,“M“,“P“,“U“,“T“,“E“,“R“,“\0“};

3. What is meant by array of strings?

A string is a 1-D array of characters, so an array of strings is a 2-D array of characters.

An array of string is declared as,

```
char names[20][30];
```

Here, the first index will specify how many strings are needed and the second index specifies the length of every individual string. So here, we allocate space for 20 names where each name can be maximum 30 characters long.

4. List out the basic functions that are performed on strings.

The very basic function that can be performed on strings are as follows:

1. Insert
2. Delete
3. Index
4. Replace

5. What is a pointer?

The pointer in C is a variable that stores address of another variable. A pointer can also be used to refer to another pointer function. A pointer can be incremented/decremented, i.e., to point to the next/ previous memory location. The purpose of pointer is to save memory space and achieve faster execution time.

6. List the advantages of using pointers.

The advantages are listed below.

- Pointers are useful for accessing memory locations.
- Pointers provide an efficient way for accessing the elements of an array structure.
- Pointers are used for dynamic memory allocation as well as de-allocation.
- Pointers are used to form complex data structures such as linked list, graph, tree, etc.

7. Outline the operators exclusively used with pointers.

The operators that are exclusively used with pointers are provided as follows:

Operator	Meaning
*	Serves for 2 purposes as given below 1. Declaration of a pointer 2. Returns the value of the referenced variable
&	Serves for only 1 purpose

- Returns the address of a variable

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8. Summarize types of pointer in short.

Following are the different types of pointers in c.

- **Null Pointer**

We can create a null pointer by assigning null value during the pointer declaration. This method is useful when you do not have any address assigned to the pointer. A null pointer always contains value 0.

- **Void Pointer**

In C programming, a void pointer is also called as a generic pointer. It does not have any standard data type. A void pointer is created by using the keyword void. It can be used to store an address ofany variable.

- **Wild pointer**

A pointer is said to be a wild pointer if it is not being initialized to anything. These types of C pointers are not efficient because they may point to some unknown memory location which may cause problems in our program and it may lead to crashing of the program.

9. What does the conversion specification %6s mean?

The format specifier %6s outputs a String in a field width of 6—that is, printf() function displays the value with at least 6 character positions. If the value to be output is less than 4 character positions wide, the value is right justified in the field by default. If the value is greater than 4 character positions wide, the field width expands to accommodate the appropriate number of characters. To left justify the value, use a negative integer to specify the field width.

10. Infer null string andnull character.Null Characters('\0'):

„\0" is defined to be a null character. It is a character with all bits set to zero. This has nothingto dowith pointers. „\0' is (like all character literals) an integer constant with the value zero.

Null String:

A string with no values or an empty string with null terminated character „\o" is known as null string.

11. List the most common string manipulation operations in C.

The most commonly accessed string functions defined in "string.h" library are as follows.

No.	Function	Description
1)	strlen(string_name)	Returns the length of string name.
2)	strcpy(destination, source)	Copies the contents of source string to destination string.
3)	strcat(first_string, second_string)	Concatenates or joins first string with second string. The result of the string is stored in first string.
4)	strcmp(first_string, second_string)	Compares the first string with second string. If both strings are same, it returns 0.
5)	strrev(string)	Returns reverse string.
6)	strlwr(string)	Returns string characters in lowercase.
7)	strupr(string)	Returns string characters in uppercase.

12. Derive the steps to insert a new character into an existing string.

1. Get the string str and character ch
2. Use the strncat() function to append the character ch at the end of str. strncat() is a predefinedfunction used for string handling. string.h is the header file required for string functions.

Syntax:

char *strncat(char *dest, const char *src,

size_t n)This method accepts the following

parameters:

dest: the string where we want to append.

src: the string from which „n" characters are going to append.

n: represents the maximum number of character to be appended. size_t is an unsigned

integraltype.

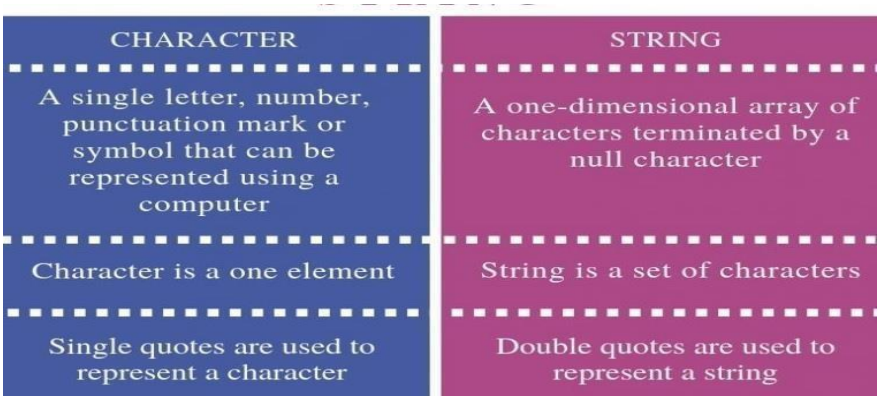
Print or return the appended string str.

. Write a C program to copy the value of one string to another.The C program to copy string using library function strcpy() is:#include <stdio.h>

```
#include
<string.h>int main
() {
//string initialization
char string1[15]="Hello";
char string2[15]="
World!";
printf("\n Copied string
is:%s\n",strcpy(string3,string1));return 0;
}
```

14. What is the difference between a C character and a C string?

The difference is captured below.



15. Differentiate between P and *P.

The difference is tabulated as below, where P is an ordinary variable and *P is a pointer variable.

VARIABLE (P)	POINTER (*P)
A value stored in a named storage/memory storage/memoryaddress	A variable that points to the address of another variable

16. Analyze how pointer is initialized.

To get the address of a variable, we use the ampersand (&) operator, placed before the name of avariable whose address we need. Pointer initialization is done with the following syntax.

Syntax:

pointer = &variable;

17. Assess a C program that calculates length of given string.

The C program to compute the length of the string using library function strlen() is:

```
#include <stdio.h>
#include
<string.h>int main
() {
//string initialization
char string1[15]="Hello";
printf("\n Length of the string
is:%d\n",strlen(string1));return 0;
}
```

18. What is the output of the following program?

```
#include
<stdio.h>int
main()
{
int i, j;
int *p;  /* a pointer to an integer */
p = &i;
*p=5
; j=i;
printf("%d %d %d\n", i, j,
*p);return 0;
}
```

The output is: 5 5 5

9. Create a C program to get the string from the keyboard and print the same.

When writing interactive programs which ask the user for input, C provides the scanf(), gets(), and fgets() functions to find a line of text entered from the user.

When we use scanf() to read, we use the "%s" format specifier without using the "&" to access the variable address because an array name acts as a pointer. The standard printf function is used for printing or displaying Strings in C on an output device.

For example:

```
#include
<stdio.h>int
main()
{
char
name[10];int
age;
printf("Enter your first name and age:
\n");scanf("%s %d", name, &age);
printf("You entered: %s %d",name,age);
}
```

Output:

```
Enter your first name and
age:John_Smith 48
```

. Create a C program to illustrate the concept of

pointer.A simple program for pointer illustration is given below: #include <stdio.h>

```
int main()
{
        int a=10;    //variable declaration
        int *p;      //pointer variable declaration
        p=&a;        //store address of variable a in pointer p
        printf("Address stored in a variable p is:%x\n",p);  //accessing the
        addressprintf("Value stored in a variable p is:%d\n",*p); //accessing
        the value return 0;
}
```

Output:

Address stored in a variable p

is:60ff08Value stored in a variable p

is:10

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UNIT - IV FUNCTIONS	
Introduction to Functions – Types: User-defined and built-in functions - Function prototype - Function definition - Function call - Parameter passing: Pass by value - Pass by reference - Built-in functions (string functions) – Recursive functions – Exercise programs: Calculate the total amount of power consumed by „n‟ devices (passing an array to a function) – Menu-driven program to count the numbers which are divisible by 3, 5 and by both (passing an array to a function) – Replace the punctuations from a given sentence by the space character (passing an array to a function)	
PART – A	
Q. No.	**Questions**
1	Define function in C.
2	List the types of function.
3	What are pre-defined functions? Give examples.
4	Justify the need of function.
5	Write the syntax of user defined function.
6	What are static functions? Mention its usage.
7	Infer the different ways of passing parameters to the functions.
8	Outline the terminologies involved in function of C.
9	Define recursion.
10	Differentiate between the arguments and the parameters.
11	Write short note on different aspects of function.
12	Does a built-in header file contain a built-in function definition?
13	Can a program be compiled without main () function?
14	Distinguish between function declaration and function definition.
15	Elaborate the role of return statement in function.

16	Is there any built-in function in C that can be used for sorting data?
17	Build a C program to perform integer addition using call by value.
18	Derive the significance of using call by reference.
19	Formulate a recursive solution to calculate factorial of a number.
20	Write a C program to reflect tail recursion.
	PART – B
1	i) What is a user defined function? Why it is used? (8) ii) Write short note on recursion. (5)
2	List the function prototypes and explain it with examples. (13)
3	Build a C program to replace punctuations with spaces by passing the string which is a character arrayas an argument to the function. (13)
4	Recall the types of functions supported by C. Explain with appropriate examples. (13)
5	Summarize user defined function in C with an example. Differentiate between actual arguments andformal argument. (13)
6	Outline the predefined functions of string with example. (13)
7	Illustrate a program to find the factorial of a number using recursion. (13)
8	Identify the ways of passing parameters to functions with suitable examples. (13)
9	Build a C function to reverse a given string and use it to check whether the given string is a palindromeor not. (13)
10	Construct a C program to sort the array of elements in ascending order using functions. (13)
11	Distinguish in detail between Linear and Tree recursion. (13)
12	Inspect a program to find the biggest of the given three values which can be realized in finding the best of three test scores and the best of three assignment scores using a function. (13)
13	Summarize the different aspects of function. (13)
14	Justify the scope of variables being utilized as an argument to the function aligned with its storage
	classes. (13)
	PART – C
1	Create a C program to calculate the total amount of power consumed by “n” devices using passing an array to a function. (15)
2	Create a Menu-driven program to count the numbers which are divisible by 3, 5 and by both using passing an array to a function. (15)

3	Assess a C program to compare two strings S1 and S2 and return the result 0, 1, -1 if (s1=s2), (s1>s2) and (s1<s2) respectively. Also write the main program. (15)
4	Assess a C program to read a matrix of order m x n and print the sum of all elements using functions. (15)

UNIT – IV

Function

s2

MARKS

1. Define function in C

A function is a group of statements that together perform a task. Every C program has at least one function, which is main().There is no limit on number of functions. A C program can have any number of functions and the same can be called at any number of times.

2. List the types of function

The types of function are listed below.

1) Predefined or standard library functions

Standard library functions are also known as built-in or predefined functions.

2) User Defined functions

The functions that we create in a program are known as user defined functions or in other words we can say that a function created by user is known as user defined function.

3. What are pre-defined functions? Give examples

Standard library functions are also known as pre-defined functions. Functions such as puts(), gets(), printf(), scanf() etc. are standard library functions. These functions are already defined in header files (files with .h extensions are called header files such as stdio.h), so we just call them whenever there is a need to use them.

4. Justify the need of function

Functions are used because of following reasons:

a) To improve the readability of code.

b) Improves the reusability of the code, same function can be used in any program rather than

writing the same code from scratch.

c) Debugging of the code would be easier if you use functions, as errors are easy to be traced.

d) Reduces the size of the code, duplicate set of statements are replaced by function calls

5. Write the syntax of user defined function

Syntax of a function is as follows:

```
return_type function_name (argument list)
{
   Set of statements – Block of code
}
```

a) return_type: Return type can be of any data type such as int, double, char, void, short etc.

b) function_name: It can be anything; however it is advised to have a meaningful name for the functions so that it would be easy to understand the purpose of function just by seeing its name.

c) argument list: Argument list contains variables names along with their data types. These arguments are kind of inputs for the function. For example – A function which is used to add two integer variables will be having two integer arguments.

Block of code: Set of C statements, which will be executed whenever a call will be made to the function.

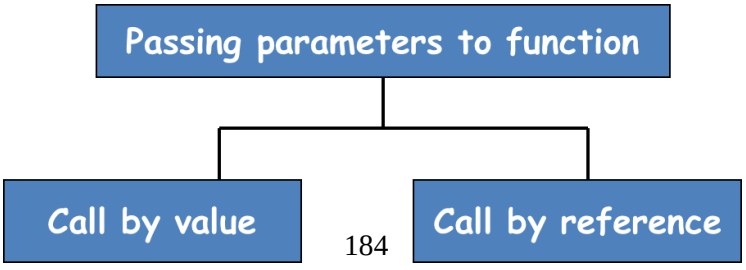
6. What are static functions? Mention its usage

In C, functions are global by default. The "static" keyword before a function name makes it static. Unlike global functions in C, access to static functions is restricted to the file where they are declared. Therefore, when we want to restrict access to functions, we make them static. Another reason for making functions static can be reuse of the same function name in other files.

7. Infer the different ways of passing parameters to the functions

There are two ways in which arguments or parameters can be passed to the called function.

- Call by value in which values of the variables are passed by the calling function to the called function.
- Call by reference in which address of the variables are passed by the calling function to the called function.



8. Outline the terminologies involved in function of C

The basic terminologies associated with function are as follows:

- Function declaration is a declaration statement that identifies a function with its name, a list of arguments that it accepts and the type of data it returns.
- Function definition consists of a function header that identifies the function, followed by the body of the function containing the executable code for that function.
- The function call statement invokes the function.

9. Define recursion

Recursion is the process which comes into existence when a function calls a copy of itself to work on a smaller problem. Any function which calls itself is called recursive function, and such function calls are called recursive calls.

10. Differentiate between the arguments and the parameters

The difference is tabulated below.

Argument	Parameter
When a function is called, the values that are passed during the call are called as arguments.	The values which are defined at the time of the function prototype or definition ofthe function are called as parameters.
These are used in function call statement to send value from the calling function to the receiving function.	These are used in function header of the called function to receive the value from the arguments.
During the time of call each argument is always assigned to the parameter in the function definition.	Parameters are local variables which are assigned value of the arguments when thefunction is called.
They are also called Actual Parameters	They are also called Formal Parameters

Example:
int num = 20;
Call(num) // num is argument
	Example:
	int Call(int rnum)
	{
	printf("the num is %d", rnum);
	} // rnum is parameter

11. Derive the classes of functions based upon the specification with argument and return type

A function may or may not accept any argument. It may or may not return any value. Based on these facts, there are four different aspects of function calls.

1. Function without arguments and without return value
2. Function without arguments and with return value
3. Function with arguments and without return value
4. Function with arguments and with return value

12. <u>Does a built-in header file contain a built-in function definition?</u>

No, the header file only declares function. The definition is in library which is linked by the linker.

13. <u>Can a program be compiled without main () function?</u>

We can write c program without using main() function. To do so, we need to use #define preprocessor directive. Logically it‟s seems impossible to write a C program without using a main() function. Since every program must have a main() function because:-

- It‟s an entry point of every C/C++ program.
- All Predefined and User-defined Functions are called directly or indirectly through the main.

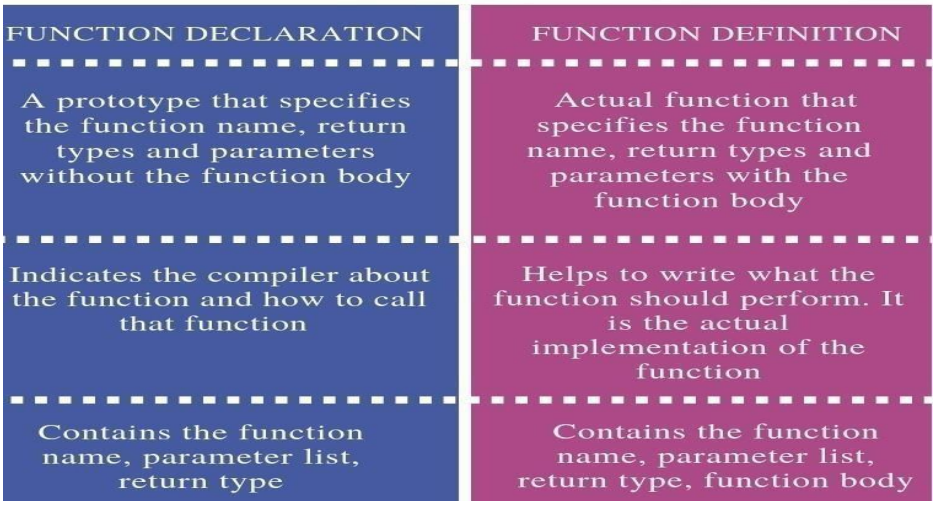
Therefore we will use preprocessor (a program which processes the source code before compilation) directive #define with arguments to give an impression that the program runs without main. But in reality it runs with a hidden main function.

A simple program to print "hello" without main() function.

```
#include<stdio.h>
#define start main
void start() {
printf("Hello");
}
```

14. Distinguish between function declaration and function definition

The difference is addressed as below.



15. Elaborate the role of return statement in function

The return statement is used to terminate the execution of a function and return control to the calling function. When the return statement is encountered, the program execution resumes in the calling function at the point immediately following the function call. For functions that has no return statement, the control automatically returns to the calling function after the last statement of the called function is executed.

16. Is there any built-in function in C that can be used for sorting data?

Standard C library provides qsort() function that can be used for sorting an array. It requires a pointer to the array, the number of elements in the array, the size of each element and a comparator function.

17. Build a C program to perform integer addition using call by value

The C program to perform integer addition using call by values is as follows:

```
#include <stdio.h>
#include <stdlib.h>
int main(){
        int num1, num2, result;

        /*Accept the numbers from the user*/
        printf("\nEnter the two number: ");
        scanf("%d %d", &num1, &num2);
```

```
        /* Pass the value of num1 and num2 as parameter to function add.
           The value returned is stored in the variable result
         */
        result = add(num1, num2);
        printf("\nAddition of %d and %d is %d", num1, num2, result);

        return 1;
}

/*Defining the function add()*/
int add(int no1, int no2)
{
        int res;
        res = no1 + no2;
        return res;
}
```

Output:

```
Enter the two number: 5 96
Addition of 5 and 96 is 101
```

18. Derive the significance of using call by reference

Call by reference technique uses in/out-mode (Caller tells callee value of variable, which may be updated by callee) semantics. Changes made to formal parameter do get transmitted back to the caller through parameter passing. Any changes to the formal parameter are reflected in the actual parameter in the calling environment as formal parameter receives a reference (or pointer) to the actual data. This method is also called as call by reference. This method is efficient in both time and space.

19. Formulate a recursive solution to calculate factorial of a number

The formula to compute factorial is given below.

- *Base case* is when n=1, because if n = 1, the result is known to be 1
- *Recursive case* of the factorial function will call itself but with a smaller value of n, thiscase can be given as

  factorial(n) = n * factorial (n-1)

20. Write a C program to reflect tail recursion.

If a function is calling itself and that recursive call is the last statement in a function then it is called tail recursion. After that call there is nothing, it is not performing anything, so, it is called tail recursion.

The following is an example of Tail

Recursion.#include <stdio.h>

```
void fun(int n)
{
   if (n > 0)
   {
      printf("%d", n);
      fun(n-1);
   }
}
int main ()
{
   fun(3); return 0;
}
```

Output: 321

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SEM / YEAR : VII SEMESTER/ FINAL YEAR (EEE)

UNIT V STRUCTURES	
Introduction to structures – Declaration – Initialization – Accessing the members – Nested Structures – Array of Structures – Structures and functions – Passing an entire structure – Exercise programs: Compute the age of a person using structure and functions (passing a structure to a function) – Compute the number of days an employee came late to the office by considering his arrival time for 30 days (Use array of structures and functions)	
PART – A	
Q. No.	**Questions**
1	What is meant by structure?
2	Create a structure for match in C that contains an integer quantity called „won", an integer quantitycalled „lost", a floating point quantity called „percentage", an array of 20 characters to hold the „name".
3	Analyze the reason for declaring a structure.
4	Write a brief note on typedef.
5	Justify the usage of sizeof() in structure.
6	Predict the possible ways of passing structure to a function.
7	Infer the relationship between a member and a structure.
8	Demonstrate structure tag and its purpose.
9	Consider the declarationstruct { char name; int num; } student; Estimate the size of the above structure.
10	Outline the role of Dot(.) operator.
11	Identify the advantages of structure data type.

12	Write short on nested structures.
13	Differentiate between structures and arrays.
14	Inspect how a structure differs from union?
15	Derive the need for self-referential structure.
16	Analyze how the elements of a structure can be accessed.
17	Judge whether you can assign one structure variable to another, provided they are of same type.
18	Can we pass the address of a structure variable to a function?
19	Formulate a suitable declaration for time using structure.
20	Write a C Program to read and display the details of a student using structure.
PART – B	
1	Discuss the method of passing structure to a function with suitable function. (13)
2	What is Structure? How is it different from an array? How they are defined and initialized? Explain with examples. (13)
3	Define and declare a structure to store date, which including day, month and year. Identify the scopefor nesting the same in student. (13)
4	Design a C structure for book and access the members of the structure through developing a Cprogram. (13)
5	Illustrate the way to handle array of structures with an example. (13)
6	Discuss how to copy and compare structure variables? Illustrate with example. (13)
7	Summarize the following: i. Dot(.) operator (6) ii. sizeof() operator (7)
8	Construct a C program to read and display student details using structure. (13)
9	Build a C program to illustrate the concept of structure within structure. (13)
10	Identify the structure as a function argument with an example program. (13)
11	Explain the following: i. Nested structures (6) ii. Array of structures (7)
12	Distinguish between structures and unions with an example. (13)
13	Assess in detail about the self-referential structures. (13)
14	Create a C program that defines a structure employee containing the details such as empno,

	empname, department name and salary. The structure has to store 20 employees in an organization. Use the appropriate method to define the above details and define a function that will display the contents? (13)
PART – C	
1	Create a C program to compute the age of a person using structure and functions using passing astructure to a function. (15)
2	Assess the relationship in detail between a structure and accessing a member structure. (15)
3	Bring out the meaning of array of structures. Write a C program to read the following information of60 students: student name, student roll number and marks of 5 subjects. Print the roll numbers and names of the students who have secured more than 60 percent. (15)
4	Create a C program to compute the number of days an employee came late to the office by considering his arrival time for 30 days Using array of structures and functions. (15)

UNIT 5

2 MARKS

1. What is meant by structure?

A structure is a user defined data type in C. A structure creates a data type that can be used to group items of possibly different types into a single type.

A structure is declared using the keyword struct followed by a structure name. All the variables of the structures are declared within the structure. A structure type is defined by using the given syntax.

struct struct-name

```
{       data_type var-name;
        data_type var-name;

                ...
};
```

2. Create a structure for match in C that contains an integer quantity called „won", an integer quantity called „lost", a floating point quantity called „percentage", an array of 20 charactersto hold the „name".

The structure for the above description is as follows:

```
struct match
{
   char name[20];
   int won;
   int lost;
  float percentage
};
```

3. Analyze the reason for declaring a structure.

The structure definition does not allocate any memory. It just gives a template that conveys to the C compiler how the structure is laid out in memory and gives details of the member names. Memory is allocated for the structure when we declare a variable of the structure. A structure variable can either be declared with structure declaration or as a separate declaration like basic types.

4. Write a brief note on typedef.

When we precede a struct name with typedef keyword, then the struct becomes a new type. It is used to make the construct shorter with more meaningful names for types already defined by C or for types that we have declared. With a typedef declaration, becomes a synonym for the type.

For example, writing

```
typedef struct student
{
        int r_no;
        char name[20];
        char course[20];
        float fees;
};
```

To declare a variable of structure student you will just write, student stud1;

5. Justify the usage of sizeof() in structure.

The sizeof for a struct is not always equal to the sum of sizeof of each individual member. This is because of the padding added by the compiler to avoid alignment issues. Padding is only added when a structure member is followed by a member with a larger size or at the end of the structure.

```
// C program to illustrate size of struct
```

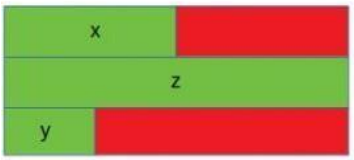
// size of int varies upon compilers- For 32-bit CPU: 4 bytes & For 16-bit CPU-2 bytes

```
#include <stdio.h>
int main()
```

```
{
    struct A {
        // sizeof(int) = 4
        int x;
        // Padding of 4 bytes
        // sizeof(double) = 8
        double z;
        // sizeof(short int) = 2
        short int y;
        // Padding of 6 bytes
    };
    printf("Size of struct: %ld", sizeof(struct A));
    return 0;
}.
```

Output:

Size of struct: 24



The red portion represents the padding added for data alignment and the green portion represents the struct members. In this case, x (int) is followed by z (double), which is larger in size as compared to x. Hence padding is added after x. Also, padding is needed at the end for data alignment.

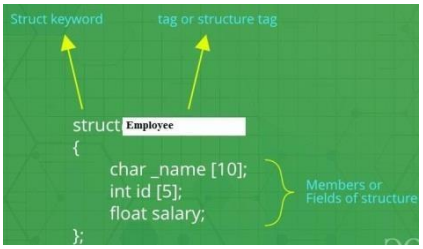
6. Predict the possible ways of passing structure to a function.

There are three ways in which structures can be passed to the called function.

- Passing structure to a function by value
- Passing structure to a function by address(reference)
- No need to pass a structure – Declare structure variable as global

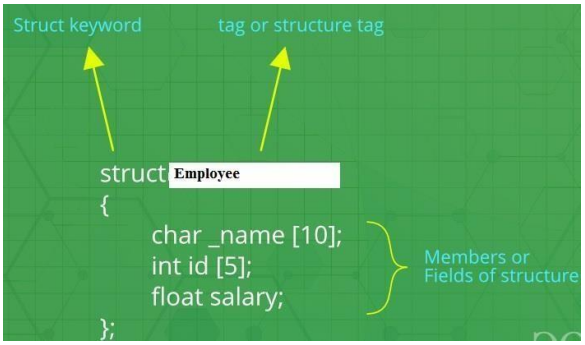
7. Infer the relationship between a member and a structure.

C Structure is a collection of different data types which are grouped together and each element in a C structure is called member. Refer below figure.



8. Demonstrate structure tag and its purpose.

The „struct" keyword is used to create a structure. The structure tag defines the name for it as illustrated in below figure.



9. Consider the declarationstruct

{

char name;int num;

} student;

Estimate the size of the above structure.

The size of the above structure including the padding is as follows: (**size of int varies upon compilers- For 32-bit CPU: 4 bytes & For 16-bit CPU-2 bytes**)

For 32-bit CPU: Size of structure is 8 bytes.

For 16-bit CPU: Size of structure is 4 bytes.

10. Outline the role of Dot(.) operator.

Each member of a structure can be used just like a normal variable, but its name will be a bit longer. A structure member variable is generally accessed using a „." (dot operator).

The syntax of accessing a structure a member of a structure is:

struct_var.member_name

11. Identify the advantages of structure data type.

Here are the benefits for using structure:

- Structures gather more than one piece of data about the same subject together in the same place.
- It is helpful when you want to gather the data of similar data types and parameters like first name, last name, etc.
- It is very easy to maintain as we can represent the whole record by using a single name.
- In structure, we can pass complete set of records to any function using a single parameter.
- We can use an array of structure to store more records with similar types.

12. Write short on nested structures.

A structure can be placed within another structure. That is, a structure may contain another structure as its member. Such a structure that contains another structure as its member is called a nested structure. For Example,

```
struct DOB
  {
        int  day;
        int month;
        int year;
  };
  struct student
  {     int roll_no;
        char name[100];
        float fees;
        struct DOB date;
  };
```

13. Differentiate between structure and array.

Array	Structure
Array refers to a collection consisting of elements of homogeneous data type.	Structure refers to a collection consisting of elements of heterogeneous data type.
Array uses subscripts or "[ ]" (square bracket) for element access	Structure uses "." (Dot operator) for element access
Array is pointer as it points to the first element of the collection.	Structure is not a pointer
Instantiation of Array objects is not possible.	Instantiation of Structure objects is possible.
Array size is fixed and is basically the number of elements multiplied by the size of an element.	Structure size is not fixed as each element of Structure can be of different type andsize.
Bit filed is not possible in an Array.	Bit filed is possible in an Structure.
Array declaration is done simply using [] and not any keyword.	Structure declaration is done with the help of "struct" keyword.
Arrays is a non-primitive data type	Structure is a user-defined data type.
Array traversal and searching is easy and fast.	Structure traversal and searching is complex and slow.
data_type array_name[size];	struct sruct_name{ data_type1 ele1; data_type2 ele2; };
Array elements are stored in continuous memory locations.	Structure elements may or may not be stored in a continuous memory location.
Array elements are accessed by their index number using subscripts.	Structure elements are accessed by their names using dot operator.

14. Inspect how a structure differs from union?

The difference is tabulated below.

Structure	Union
We can use a struct keyword to define a structure.	We can use a union keyword to define a union.
Every member within structure is assigned a unique memory location.	In union, a memory location is shared by all the data members.

Changing the value of one data member will not affect other data members in structure.	Changing the value of one data member will change the value of other data members in union.
It enables you to initialize several members at once.	It enables you to initialize only the first member of union.
The total size of the structure is the sum of the size of every data member.	The total size of the union is the size of the largest data member.
It is mainly used for storing various data types.	It is mainly used for storing one of the many data types that are available.
It occupies space for each and every member written in inner parameters.	It occupies space for a member having the highest size written in inner parameters.
We can retrieve any member at a time.	We can access one member at a time in the union.
It supports flexible array.	It does not support a flexible array.

15. Derive the need for self-referential structure.

Self-referential structures are those structures that contain a reference to data of its same type. That is, a self-referential structure in addition to other data contains a pointer to a data that is of the sametype as that of the structure. For example, consider the structure node given below.

```
struct node
{
        int val;
        struct node *next;
};
```

Here the structure node will contain two types of data- an integer val and next that is a pointer to a node.

16. Analyze how the elements of a structure can be accessed.

Structure members are accessed using dot (.) operator. For Example,

```
#include<stdio.h>
struct Point
{
int x, y;
};
int main()
```

```
{
struct Point p1 = {0, 1};
// Accessing members of point p1



p1.x = 20;
printf ("x = %d, y = %d", p1.x, p1.y);
return 0;
}
```

Output:

```
x = 20, y = 1
```

17. Judge whether you can assign one structure variable to another, provided they are of sametype.

We can assign a structure to another structure of the same type. For ex, if we have two structure variables stu1 and stud2 of type struct student given as

```
struct student stud1 = {01, "Rahul", "BCA", 45000};
struct student stud2;
```

Then to assign one structure variable to another we will write,

```
stud2 = stud1;
```

18. Can we pass the address of a structure variable to a function?

C allows creating a pointer to a structure. Like in other cases, a pointer to a structure is never itself a structure, but merely a variable that holds the address of a structure. The syntax to declare a pointer to a structure can be given as,

```
struct struct_name
{
        data_type member_name1;
        data_type member_name2;
        .....
}*ptr;
```

OR

```
struct struct_name *ptr;
```

For our student structure we can declare a pointer variable by writing

```
struct student *ptr_stud, stud;
```

19. Formulate a suitable declaration for time using structure.

The structure definition for time is given below.

```
struct time
{
   int
   hour; int
   minute;

  int second;
};
```

20. Write a C Program to read and display the details of a student using structure. The following is the program for displaying student details using structures.

```
#include<stdio.h>
int main()
{   struct DOB
    {
        int day;int month;
        int year;
    };
    struct student
    {       int roll_no;char
            name[100];float fees;
            struct DOB date;
    };
    struct student stud1;
    printf("\n Enter the roll number :
    ");scanf("%d", &stud1.roll_no);printf("\n
    Enter the name : "); scanf("%s",
    stud1.name); printf("\n Enter the fees :
    "); scanf("%f", &stud1.fees);
    printf("\nEnter the DOB : ");
    scanf("%d %d %d", &stud1.date.day, &stud1.date.month, &stud1.date.year);printf("\n
    ********STUDENT"S DETAILS *******");printf("\n ROLL No. = %d",
    stud1.roll_no);printf("\n NAME. = %s",
```

```
    stud1.name); printf("\n FEES. = %f",
    stud1.fees);
    printf("\n DOB = %d - %d - %d", stud1.date.day, stud1.date.month, stud1.date.year);
}
```