1st Year (Part-I)-Electronics (General)

Paper IA: Introduction to Electric circuits and Basic Electronics I

I. Introduction to Electric Circuits

Short Questions

1. What is meant by linear and nonlinear elements?

2. What is meant by active and passive elements?

3. What is meant by unilateral and bilateral elements?

4. What is a dual network?

5. What is a node, a junction and a branch?

6. Sate superposition theorem.

7. State Thevenins theorem

8. State Norton's theorem

9. State maximum power transfer theorem.

10. State the steps to solve the super position theorem.

11. What is the limitation of superposition theorem?

12. State the steps to solve the Thevenin's Theorem

13. List the applications of Thevinins theorem.

14. State the steps to solve the Norton's theorem.

15. What is the maximum power in a circuit?

16. Write some applications of maximum power transfer theorem.

17. What are the limitations of maximum power transfer theorem?

18. Explain the purpose of star delta transformation.

19. What is meant by Resonance?

20. What is resonant frequency?

21. Define series resonance.

22. Write the characteristics of series resonance

23. Write the characteristics of parallel resonance.

24. What is transient state?

25. What is transient time?

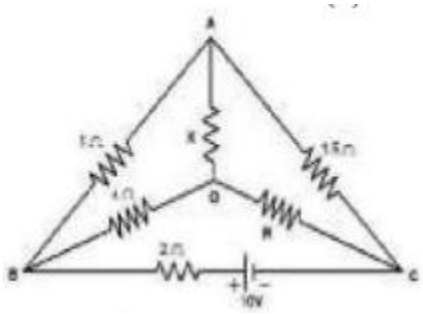
26. What is transient response?

27. Define time constant of RLC circuit.

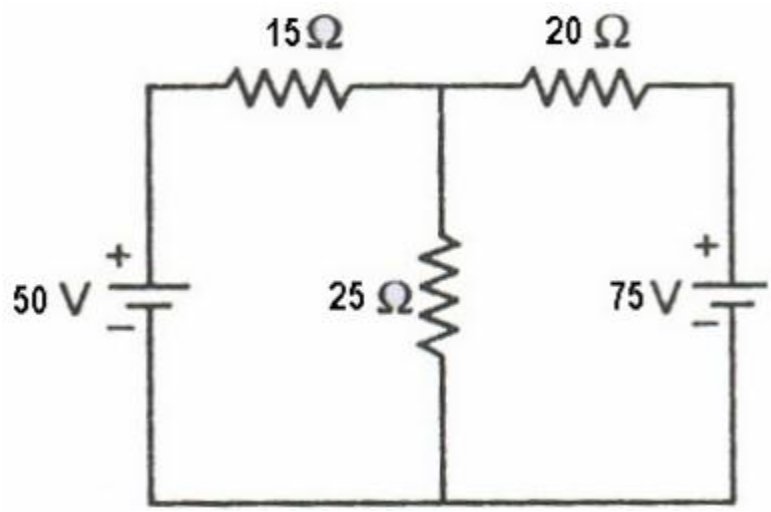
28. Define time constant of RC circuit.

Lengthy Questions

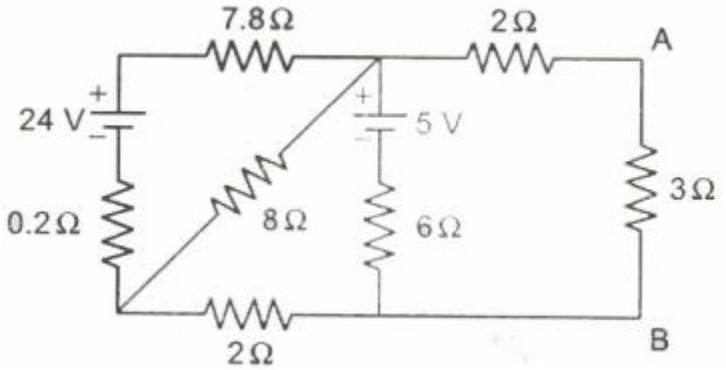
1. Find the value of R and the current flowing through it in the circuit shown when the current in the branch OA is zero.



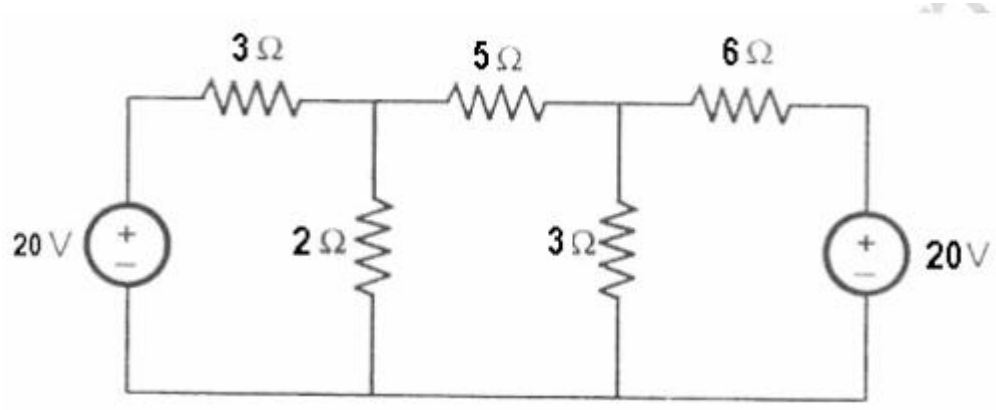
2. Find out the current I through 25 ohm resistance using Thevenin's Theorem.



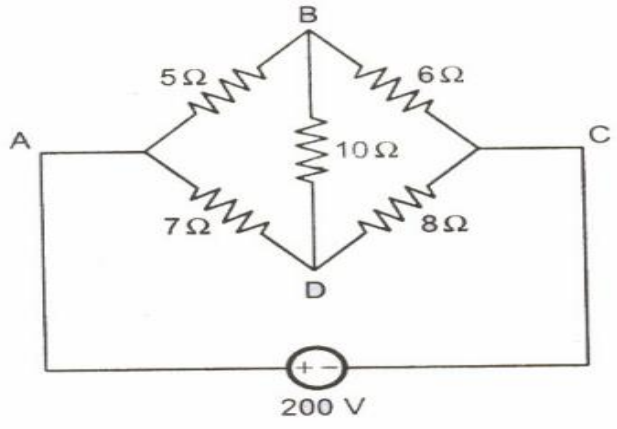
3. Find out the current I through 3 ohm resistance using Norton's Theorem.



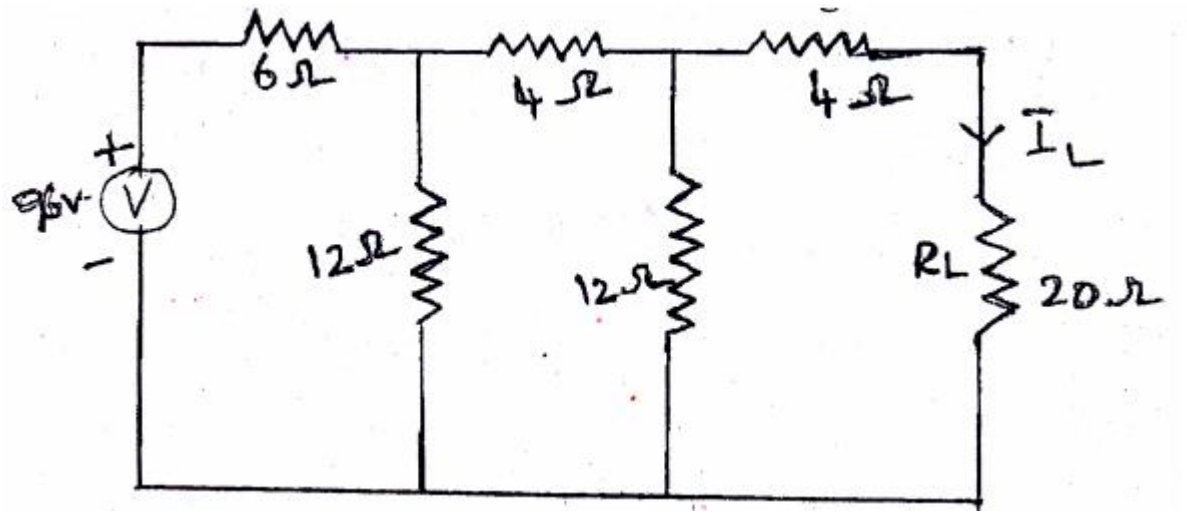
4. Find out the current I through 3 ohm resistance using KVL law.



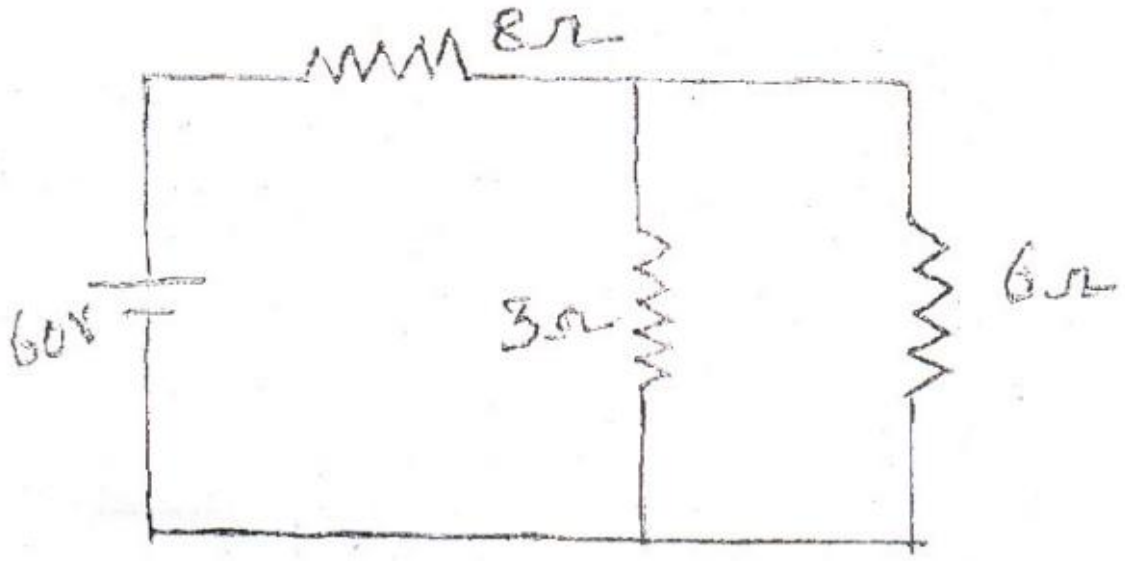
5. Find out the current I through 10 ohm resistance using Thevenin's Theorem.



6. Find out the voltage drop through 12 ohm resistance using Thevenin's Theorem.



7. Find out the current I through 6 ohm resistance using Thevenin's Theorem.



8. Derive an expression of the transient current for series R-C circuit.

9. Explain about current decay in source free series R-C circuit.

10. Explain Series Resonance and Parallel Resonance.

II. Basic Electronics I: Semiconductors and Analog Electronic Devices

Short Questions

1. What is charged particle? Define the unit of the charge.
2. What is valance band?
3. What is covalent band?
4. What is forbidden band?
5. Explain semiconductor types?
6. Define energy level and energy band.
7. What is Fermi level?
8. What is a semiconductor?
9. What is meant by electron –hole pair?
10. What is p-type semiconductor?
11. What is doping?
12. What is hole current /electron current?
13. Define law of mass of action
14. What is drift current?
15. What is diffusion current?
16. What is forward and reverse resistance of a diode?
17. What is cut in voltage of a diode?
18. What is switching characteristics of diode?
19. What is Zener break down voltage?
20. Give the expression for transition capacitance of a diode (CT).
21. What are applications for zener diode?
22. What is pinch off voltage?
23. Define current amplification factor in CC transistor.
24. What are the values of input resistance in CB, CE & CC configuration?

25. What are the advantages of FET?

26. What do you understand by DC and AC load line?

27. How FET is known as voltage variable resistor?

28. What is thermal runaway?

29. What are handling precautions for MOSFET?

30. In which region the JFET act as a simple resistor and why?

31. Why FET is called as voltage controlled device?

32. Define the channel width of JFET.

33. Define Base spreading resistance.

34. Write the advantages of N channel MOSFET over P channel MOSFET

35. Write the characteristics of JFET

36. Define FET parameters.

Lengthy Questions

1. Explain the theory of PN junction and explain how it acts as diode?

2. Derive the diode equation of the diode.

. Explain and derive the current components and switching characteristics of diode?

4. Derive the expression for transition and diffusing capacitance.

5. Explain the Zener diode and it's breakdown mechanism?

6. Explain the transistor action.

7. Explain the operation of BJT and its types?

8. Write comparisons of CC, CE, and CB configuration?

9. Explain the breakdown in transistor.

10. Explain the transistor switching times.

11. Explain the operation of JFET.

12. Derive MOSFET and explain its enhancement?

13. Describe the operation of zener diode and explain its characteristics.

Paper IB: Basic Electronics II: Analog Electronic Circuits

I. Diode and Transistor circuits.

Short Questions

1. Draw the block diagram practical power amplifier.

2. What is the function of power amplifier?

3. What is the need of power amplifier?

4. Explain voltage amplification stage in case of power amplifier.

5. Define class C power amplifier.

6. Define class B power amplifier.

7. What is the difference between voltage amplifier and power amplifier?

8. Sketch ac load line in case of class A power amplifier.

9. Sketch ac load line in case of class B power amplifier.

10. What is a bias? What is the need for biasing?

11. What is meant by operating point Q?

12. What are all the factors that affect the stability of the operating point?

13. Define Stability factor S.

14. Why voltage divider bias is commonly used in amplifier circuits?

15. How self bias circuit is used as constant current source?

16. Why self-bias technique is not used in enhancement type.

17. Define power transistors.

18. What do you mean by class A power amplifier?

19. Explain Barkhausen criterion.

20. What is meant by feedback?

21. Give the different types of feedbacks used in amplifier circuits.

22. Define the positive feedback.

23. Define negative feedback.

24. What type of feedback is used in oscillator?

25. Define feedback factor or feedback ratio.

26. What are the advantages of class C push-pull amplifier?

27. What are the disadvantages of class C push-pull amplifier?

28. What is cross over distortion?

29. Define h parameters.

30. Mention the advantages of Push pull amplifier

31. What is PIV?

Lengthy Questions

1. Find out the expression of current gain, voltage gain of a transistor using h parameters.

2. Find out the expression of input impedance and output impedance of a transistor using h parameters.

3.Explain the working principle of class C amplifier.

4. Explain class A power amplifier and class B power amplifier.

5. Explain class C power amplifier.

6. Describe the cross over efficiency of class B push-pull amplifier. How it can be minimized?

7. Explain in detail classification of power amplifier.

8. With the neat diagram explain the class B push-pull amplifier.

9. Explain voltage shunt feedback amplifiers?

10. Explain current series feedback amplifiers?

11. Explain the classification of amplifiers?

12. Explain the principle of operation and derive the expression for Hartley oscillator.

13. Explain the principle of operation and derive the expression for crystal oscillator.

14. Explain the principle of operation and derive the expression for Phase-shift-oscillator.

15. Explain general theory of feedback.

16. Explain the Fixed bias and self-bias of a transistor.

17. Explain the load and line regulation with a zener diode.

18. Explain the working principle of half and full-wave rectifier.

19. Explain the working principle of Bridge rectifier.

20. Explain the Effect of filters on rectifier.

II. Operational Amplifier (Op-Amp) and Op-Amp circuits

Short Questions

1. Define Common Mode Rejection Ratio.

2. How can a DC equivalent circuit of an amplifier be obtained?

3. Define CMRR and common mode gain.

4. Draw the transfer characteristics of differential amplifier circuits.

5. Explain open loop voltage gain.

6. Explain input bias current.

7. Explain slew rate.

8. Why an Op-amp is called as operational amplifier?

9. Define input impedance.

10. Define output impedance.

11. Define input bias current.

12. Define offset current.

13 Define offset voltage.

14. Define slew rate.

15. Define open loop gain

16. What is the voltage follower?

17. Define virtual ground.

18. What is unity gain buffer?

Lengthy Questions

1. Draw the block diagram of operational amplifier and explain it in detail.

2. Describe the ideal characteristics of Op-amp.

3. Explain concept of virtual ground.

4. Draw the circuit symbol of op-amp. Explain what is mean by inverting input and non inverting input?

5. List the ideal characteristics of op-amp.

6. Explain the working principle of integrator and differentiator circuit using OPAMP.

7. Explain the working principle of adder and subtractor (differential)circuit using OPAMP.

8. Explain the working principle of first order low pass using OPAMP.

9. Explain the working principle of high pass active filter using OPAMP.

10. Explain the working principle comparator using OPAMP.

11. Explain the working principle Schmitt-trigger using OPAMP.

2nd Year (Part-II)-Electronics (General)

Paper IIA : Digital Electronics and Instrumentation

I.Digital Electronics

II. Instrumentation:

Short Questions

1. What is K-map?

2. " Simplification of logic expressions using K-map is simple than using Boolean laws and theorems" Comment.

3. Design half adder using NAND gates.

4. Design half substractor using NAND gates.

5. Design full adder using using AND – OR gates.

6. Design full adder using NAND-NAND gates.

7. Design full substractor using NAND-NAND gates.

8. What is multiplexer?

9. Define Synchronous counter.

10. Define Asynchronous counter.

11. Define modulus of counter.

12. Define up-down counter.

13. Draw the block diagram of MOD -3 counter.

14. Draw the circuit diagram of TTL NAND gate.

15. What is parity bit?

16.Define fan-out of a digital logic gate.

17.What is the condition for resonance of LC circuit?

18.Define Q factor of a Q meter.

19.Give the truth table of a J-K flip flop.

20.What is BCD code?

21.Using 2's compliment subtract the following binary number: 11011-01101

22.What is Mode –N-counter?

23.What is comparator?

24.Define Encoder?

25.Define sensitivity of a voltmeter?

26.What is power meter?

27. Mention advantages of Digital Voltmeter over Analog Voltmeter.

28.Define line current and phase current.

29.Define phase voltage.

30. What is Q meter

31. State levels of integration

32. Define Power dissipation of a digital logic gate

33. Define Propagation delay of a digital logic gate

34. Noise margin of a digital logic gate

35. Draw the circuit diagram of Complementary MOSFET Logic (CMOS).

36. Draw the block diagram of unregulated power supply.

37. Draw the block diagram of regulated power supply.

38. State advantages of regulated power supply over unregulated power supply.

39. What is the function of voltage regulator?

40. Draw labeled block diagram of horizontal deflection system in CRO.

41. Mention any four major components of CRT.

42. State the condition for synchronization of sweep signal with vertical input signal.

43. List any four CRO front panel controls.

44. Which two CRO controls can be used together to obtain sharp & fine display pattern.

45. List the various blocks in horizontal deflection system of CRO.

46. What are the uses of CRO?

47. Draw the basic block diagram of DVM.

48. What is noise Generator?

Lengthy Questions

1. Construct A FULL ADDER using NAND gates and verify its operation .

2. Construct A 2 BIT COMPARATOR using NAND gates and verify its operation.
3. Describe the working principle of Master Slave J-K FLIP FLOP.

4. Draw the block diagram of 3-bit up-down counter & explain its operation with truth table.

5. Explain 4 – bit asynchronous counter with block diagram, truth table & timing diagram.

6. Explain 4 – bit synchronous counter with block diagram, truth table & timing diagram.

7. Write short notes on

(I) Basic features of Diode Transistor Logic (DTL).

(ii) Transistor-Transistor Logic (TTL).

(iii) Emitter-Coupled Logic (ECL).

(iv) Shift-registers,

(v) ROM and RAM.

8. Explain the principle of working of Ramp type digital voltmeter.

9.Explain the working principal of an Integrating type digital voltmeter.

10.Describe the working principal of successive approximation DVM.

11. Explain the functioning of Function Generator.

12.Describe the working principal of pulse Generator.

13.Explain the sweep Generator with proper block diagram.

14.SHORT NOTES:

a) Q METER.
b) ELECTRONICS COUNTER.
c) SINE AND SQUARE WAVE GENERATOR.

15. Explain the need of regulated power supply.

16. Explain with the help of a block diagram three terminal IC voltage regulator.

17. Draw the functional block diagram of three terminal voltage regulator & explain in brief.

18. Define line regulation & load regulation. Elaborate the difference between series & shunt type voltage regulation.

19. Explain the working of shunt regulator. What are its advantages over a series voltage regulator?

20.Write Short notes on

(i) Construction of a power supply with rectifier,
(ii) Construction of a power supply with zener
(iii) Short circuit protection of regulated power supply.

21. What is synchronization? State the condition for synchronization.

22. State the basic working principle of CRO.

23. Draw the labeled block diagram of CRO. Explain the function of delay line block.

24. Draw the labeled block diagram of CRO. Explain the function of vertical amplifier.

25. Draw the block diagram of general purpose CRO & label it. State the function of each block.

26. With a neat circuit diagram, explain the working of various CRT controls of CRO.

27. Draw the block diagram of vertical deflection system of CRO and explain the function of INPUT-SELECTOR.

28. Explain the function of SYNC selector used in CRO.

29. Describe the working of vertical amplifier in CRO.

30. Explain synchronization of sweep in CRO.

31. Explain vertical deflection system of CRO.

32. Explain the function of CRO probe.

33. With the help of circuit diagram explain working of triggered sweep generator.

34. Explain various modes of trigger in CRO. What is the use of trigger level control on CRO front panel?

35. Draw a circuit connection for CRT and describe the control knobs associated with it.

36. Draw the block diagram of CRO & explain the function of CRO probe.

37.Explain the working principle of dual beam CRO.

38. Explain the Q meter.

39. Explain the power factor meter.

Paper IIB: Electromagnetism and Electronic Communication

I. Electromagnetism and transmission lines

Short Questions

1. What is group velocity?

2. What is patch loading?

3. What do you understand by loading of transmission lines?

4. Define Characteristic impedance?

5. What is frequency distortion?

6. Calculate the load reflection coefficient of open and short circuited lines?

7. Calculate the characteristic impedance for the following line parameters

R = 10.4 ohms /km L = 0.00367 H/km

C = 0.00835μf /km G = 10.8x10-6 mhos /km

8. Define phase distortion?

9. Write the equation for the input impedance of a TL?

10. Define propagation constant?

11. Define wavelength?

12. Give the input impedance of a open and short circuit line?

13. Define reflection factor?

14. Define reflection loss?

15. What is meant by reflection co – efficient?

16. State the properties of infinite line?

17. Write the condition for a distortion less line?

18. When does reflection take place on a TL?

19. What is transfer impedance? State its expression?

20. What is difference between lumped and distributed parameters?

21. Draw the equivalent circuit of a TL?

22.. Find the VSWR and reflection co – efficient of a perfectly matched line with no reflection from load?

23.. Give the analytical expression for input impedance of dissipation less line?

24.. Derive the relationship between standing wave ratio and reflection co – efficient?

25.. Define standing wave ratio?

26.. Why do standing waves exist on TL?

27. State Ampere's Law.

28. Define Lorentz force.

29. Define mutual and self inductance.

30.State Coulomb's Law,

31.Define electric field due to a continuous charge distribution.

32.Define electric potential due to a continuous charge distribution.

33. What is lines of force?

34. Define flux of electric field

35. What is capacitor?

36. Define polarization density.

37. What is polarization charge density?

38. State Faraday's law of electromagnetic induction,

Lengthy Questions

1. Find out the transmission line equations in terms of voltage and current of Transmission line?

2. Explain about waveform distortion and distortion less line condition?

3. Explain about reflection loss?

4. Derive the equation of attenuation constant and phase constant of TL in terms of R,

L, C, G?

5. Explain about physical significance of TL?

6. Derive the expression for input impedance of lossless line?

7. Explain about voltage and current waveform of dissipation less line?

8. Derive the expression for the input impedance of the dissipation less line and the

expression for the input impedance of a TL line.

9. Derive the expression for the line impedance in terms of reflection coefficient or standing-wave ratio.

10. Derive the expression for the characteristic impedance using a short circuited and open circuited line.

11. Discuss about Coulomb's Law,

12. Discuss about the electric potential due to a continuous charge distribution.

13. Short notes on

(i) Gauss's law (integral and differential forms).

(ii) Divergence and Curl of electric field.

(iii) Poisson's equation.

(iv) Electric dipole.

(v) Laplace's equation.

(vi) Energy of a capacitor.

(vii) Energy density in an electric field.

(viii) Electric polarizability of atoms.

14. Establish the relation D = eE + P.

15. Explain the Biot – Savart Law,

16. Write short notes on (i) motional EMF, (ii) mutual and self inductance.

II. Wave guides, modulation, noise and radiowave propagation

Short Questions

1.What is modulation?

2.Define modulation index of an AM signal

3.A transmitter radiates 9 kW without modulation and 10.125 kW after modulation. Determine depth of modulation.

4.Define the transmission efficiency of AM signal.

5.Draw the phasor diagram of AM signal.

6.Advantages of SSB.

7.Disadvantages of DSB-FC.

8.What are the advantages of superhetrodyne receiver?

9.Distinguish between low level and high level modulator.

10.Give the parameters of receiver.

11.Define sensitivity and selectivity.

12.Define fidelity.

13.What is meant by image frequency?

14.Need for modulation.

15.Application of AM.

16.What is meant by diagonal clipping and negative peak clipping?

17.Define envelope.

18.Distinguish between linear and non linear modulator.

19.What are the limitations of AM

20.Draw the envelope of AM

21.Differentiate phase modulation and frequency modulation.

22.When a signal m(t) = 3 cos (2p x 103t) modulates a carrier c(t) = 5 cos (p x 106t), find the modulation index and transmission bandwidth if the modulationisAM.

23.What do you mean by narrowband and wideband FM?

24. Give the frequency spectrum of narrowband FM?

25. Define frequency deviation in FM?

26.State Carson's rule of FM bandwidth?

27. Differentiate between narrow band and wideband FM.?

28.What are the advantages of FM.?

29 Define PM.

30. what is meant by indirect FM generation?

31. Draw the phasor diagram of narrow band FM.

32. Write the expression for the spectrum of a single tone FM signal.

33. Define modulation index of FM and PM.

34. Differentiate between phase and frequency modulation.

35. A carrier of frequency 100 MHz is frequency modulated by a signal x(t)=20sin

36. (200¶x103 t). What is the bandwidth of the FM signal if the frequency sensitivity of the modulator is 25 KHz per volt?

37. What is the bandwidth required for an FM wave in which the modulating frequency signal is 2 KHz and the maximum frequency deviation is 12 KHz?

38. Determine and draw the instantaneous frequency of a wave having a total phase angle given by ø(t)= 2000t +sin10t.

39. Define group velocity?

40. What are the characteristics of TEM waves?

41. What is the cut off frequency of TEM wave?

42. Give the expression that relates phase velocity (Vp), Group velocity (Vg) and free space velocity?

43. What are TE waves or H waves?

44. What are TM waves or E waves?

45. What are guided waves?

46. What is dominant mode? Give examples?

47. Write down the expression for cut off wavelength and cut off frequency?

48. Write down the expression for velocity of propagation?

49. Define attenuation factor?

50. Define wave impedance?

51. Distinguish between TE and TM waves?

52. Write down the relation between guide wavelengths and cut off wavelength?

53. Give the expression for the guide wavelength when the wave transmitted in between two parallel plates?

54. Find the frequency of minimum attenuation foe TM waves?

55. Give relation between the attenuation factor for TE and TM waves?

56. Draw a neat sketch showing the variation in the value of attenuation with frequency for TE, TM, and TEM mode between two parallel plates?

57. Draw a neat sketch showing the variation in the value of wave impedance with frequency for TE, TM, and TEM mode between two parallel plates?

58. Define Thermal Noise.

59.Define shot noise

60. What is noise bandwidth?

61. Define Noise figure.

62. What is Noise temperature?

63. What is critical frequency?

64. Define virtual height,

65. What is maximum usable frequency?

66. Define skip distance.

67. State Sampling Theorem.

68. What are the dominant mode and degenerate modes in rectangular wave – guides?

69. A rectangular wave – guides has the following values l=2.54 cm, b= 1.27 cm waveguide thickness = .0127. Calculate the cut off frequency?

70. Define wave impedance?

71. Why TEM mode is not possible for rectangular wave – guides?

72. Define characteristic impedance?

73. Define attenuation factor?

74. Draw a neat sketch showing the variation in the value of attenuation with frequency for TE, TM, and TEM mode for rectangular wave guide?

75. Draw a neat sketch showing the variation in the value of wave impedance with frequency for TE, TM, and TEM mode for rectangular wave guide?

76. Write down the expression for cut off wavelength and cut off frequency for rectangular wave guide?

77. Write down the expression for cut off wavelength and cut off frequency for TE 10 mode?

78. Write down the expression for guide wavelength and velocity of propagation for rectangular wave guide?

79. Write down the expression for attenuation constant for TE 10 mode?

80. Write down the expression for attenuation constant for TM 11 mode?

81. What is dominant mode? Name the dominant mode in TE and TM waves?

Lengthy Questions

1. What is the principle of Amplitude modulation? Derive expression for the AM wave and draw its spectrum.
2. Describe the frequency analysis of Angle modulated waves. Explain their Bandwidth requirements.
3. A modulating signal of $2\cos 5000t$ is amplitude modulated over a carrier signal of $5\cos 20000t$. Derive expressions for the modulation index, LSB and VSB frequencies, Bandwidth and the ratio of Side Band Power in the Total Power of AM wave.
4. Explain the principle of Angle Modulation. Derive and explain phase deviation, Modulation index, frequency deviation and percent modulation.
5. Write short notes on :

(i) AM voltage distribution.

(ii) AM power distribution.

6. An audio frequency signal 10 sin 2*3.14* 500*t* is used to amplitude modulate a carrier of 50 sin 5*3.14*10^5 t. Calculate

(i) Modulation index.

(ii) Side band frequencies.

(iii) BW required.

(iv) Total power delivered to the load of 600 W.

6. Compare FM and AM.

7. The phase deviation constant in a phase modulation system is K = 0.01 rad/v. Calculate the maximum phase deviation when a modulating signal of 10 V is applied?

8. In angle modulation, explain frequency deviation, percent modulation, phase deviation and modulation index with suitable example.

9. Derive the expression for a Amplitude Modulated wave and draw its spectrum.

10. Obtain a relationship between carrier and side band powers in an AM DSBFC wave and explain how power distribution takes place in AM DSB FC system.

11. Define modulation index for FM and PM and obtain the relation between modulation index and modulating signal for FM and PM.

12. Compare the advantages and disadvantages of angle modulation with amplitude modulation.

13. Distinguish between FM and PM by giving its mathematical analysis.

14. Derive the relationship between the voltage amplitudes of the side band frequencies and the carrier and draw the frequency spectrum.

15. Discuss the characteristics of TE and TM waves and also derive the cut off

frequency and phase velocity from the propagation constant?

16. Derive the expression for the field strength for TE waves between parallel plates

propagating in Z direction?

17. Derive the expression for attenuation of TM waves in between parallel plates?

18. Derive the expression for attenuation of TE waves in between parallel

Plates?

19. Derive the expression for the field strength for TM waves between

Parallel plates propagating in Z direction?

20. Obtain the expression for the field components of an electromagnetic wave propagating between a pair of perfectly conducting planes?

21**.** Derive the expression for wave impedance of TE, TM and TEM wave between a pair of perfectly conducting planes?

22. Derive the field configuration, cut off frequency and velocity of propagation for TM waves in rectangular wave – guides?

23**.** Determine the solution of electric and magnetic fields of TE waves guided along rectangular wave – guides? `

24. Explain the wave impedance of a rectangular wave – guide and derive the expression for the wave impedance of TE,TM, and TEM mode?

25. Discuss the characteristics of TE and TM waves and also derive the cut off frequency and phase velocity from the propagation constant?

26. Explain about dominant mode in rectangular wave guide?

27. Determine the solution of electric and magnetic fields of TM waves guided along rectangular wave – guides?

28. Explain about characteristic impedance in rectangular wave guide?

29. Explain about degenerate mode in rectangular wave guide?

30. Explain the Sampling theorem (PAM)

31. Explain the Sampling theorem (PWM),

32. Write short notes on

(i) Characteristics of electromagnetic wave.

(ii) Propagation of radio waves at different frequencies.

(iii) Structure of atmosphere.

(iv) Ground wave.

(v) Sky-wave.

33.Calculate the noise in linear systems.

34.Find out SNR ratio in two-port networks.

35. Discuss about the Noise temperature.

37. Discuss about the equivalent noise resistance.

3rd Year (Part-III)-Electronics (General)

Paper IVA : Introducation to the 8085 Microprocessor and Computer Programming

I: Introduction to the 8085 Microprocessor

II: Computer Programming

Short Questions

1. Name the various flag bits available in 8085 microprocessor?

2. Give the significance of SIM and RIM instructions available in 8085?

3. How do the address and data lines are demultiplexed in 8085?

4. List various instructions that can be used to clear accumulator in 8085?

5. When the Ready signal of 8085 is sampled by the processor?

6. List out the the similarities b/w the CALL_RET and PUSH_POP instructions?

7. What is the need of ALE signal in 8085?

8. What are the addressing modes of 8085?

9. List the interrupt signals of 8085?

10. Why multiplexing is done in 8085?

11. List the limitations of 8085?

12. What is DMA?

13. Define machine cycle and instruction cycle?

14. Why address bus is unidirectional?

15. List few instructions to clear accumulator?

16. What is the function of NOP instruction?

17. What is Array?.

18. What is Function?.

19. Define loop.

20. What is structure?

Lengthy Questions

1. . Draw the block diagram of 8085 mp and explain?

2. Write an assembly language program to add two 2-digits BCD Number?

3.. Explain the instruction set of 8085?

4.Write notes on status flag?

5. Explain the architecture of Intel 8085 with the help of a block diagram?

6. Explain the similarities diff b/w subtract and compare instructions in 8085?

7.. Describe the sequence of event that may occur during the different T state in the opcode fetch machine cycle of 8085?

8. Write an assembly language program to convert on array of ASCII code to corresponding binary (hex) value. The ASCII array is stored starting from 4200H.The first element of the number of elements in the array.

9.. With neat block diagram explain the architecture of 8085?

10. List out the maskable and non maskable interrupts available in 8085?

11. a. How do the instructions of 8085 is classified based on their function and word length? Give an example?

12. Write an ALP to Add two 8bit numbers?

13. With the help of neat diagram explain the architecture of 8085 microprocessor in detail. Discuss its flag register.

14. Write an assembly language program with comment lines. An 8-bit number is stored in memory location C100H. Count number of ones (i.e. 1) in this byte and store this count in memory location C200H.

15. Write an assembly language program with comment lines. An array of bytes is stored starting from memory location C301H. Length of this array is stored in memory location. C300H. Count how many bytes are greater than 70H. Store this count in memory location C400H.

16.Explain the following instructions with suitable example of each (i) LXI (ii) MOV (iii) SHLD (iv) LDAX (v) CMP.

17. Why the lower order address bus is multiplexed with data bus? How they will be de-multiplexed? With the help of figure explain demultiplexing of address/data bus.

18. Draw and explain the timing diagram of memory write cycle with example.

19. Draw and explain the timing diagram of opcode fetch cycle.

20. Write an 8085 assembly language program using minimum number of instructions to add the 16 bit no. in BC, DE and HL. Store the 16 bit result in DE pair.

21.Define addressing modes. With suitable examples explain 8085 addressing modes in detail. 8

22. Explain the 8085 microprocessor interrupt system in detail.

23. With suitable examples explain how I/O devices are connected using memory mapped I/O and peripheral I/O.

24. Compare memory mapped I/O and peripheral mapped I/O.

25.Explain the stack memory of 8085 microprocessor with the help of instructions and neat diagrams in detail.

26. Write short note on vectored interrupts of 8085 microprocessor.

27. Draw the microprocessor bus timing for the instruction STA 4500H and explain it.

28.What is the need of interrupt in microprocessor? Explain restart instruction with the help of timing and circuit diagram.

29.Explain the timing diagram of MVI A,50H instruction of 8085 microprocessor in detail.

30. Explain timing diagram of OUT instruction of 8085 microprocessor in detail.

31. Write short notes on

(I) Idea of a typical PC configuration
(ii) Role of motherboard
(iii)CPU
(iv) RAM
(v) Hard-disk
(vi) DVD drive
(vii) Parallel, serial and USB ports
(viii) Keyboard and mouse.

32. Write short notes on

(i) Declaration of variables.
(ii) Data types, operators, loop.

(iii) Arrays and Functions.
(iv) File handling.

1st YEAR ELECTRONICS-HONOURS QUESTION BANK (B.Sc)

PAPER IA

MATHEMATICAL METHODS

Each question carries 2 mark .

1.What is Rodrigue's formula for Legendre's polynomial ?

2.prove that $(AB)^{-1} = B^{-1} A^{-1}$

3.Write down Bessel's differential equation of order n.

4.Define unitary matrix

5.Define linear homogeneous differential equation and linear inhomogeneous differential equation.

6.Prove that the matrix A= $\begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}$ is a Hermitian matrix

7.If the product of two square matrices is a small matrix and one of them is a singular matrix then prove that the other one is null matrix .

8.Find the upper and lower bonds (limits) for Legendre polynomial of order n.

9. i)If $\vec{A}$ has a constant magnitude show that $\vec{A}$ and $d\vec{A}/dt$ are perpendicular provided $|d\vec{A}/dt| \neq 0$.the surface $x^2dx = 4$.

ii) Find a unit normal to 4 at the point (2,-2,3)straight line joining the above points

10. If A =$(ax^2+6y)i - 14yz\, j + 20xt^2k$ evaluate $\int \vec{A}.d\vec{r}$ from(0,0,0,)to (1,1,1,)along the straight line joining the above points.

11. Is the matrix A=$\begin{bmatrix} 1 & 0 \\ a & 1 \end{bmatrix}$ hermitian ?verify

12. If A and B are two matrices. Show that (A+B) (A-B) = A^2-B^2.If and only If A and B commute.

13. A function n(t) satisfy the following differential equation $\frac{dn}{dt}$ = - $(n - n0)/\tau$, wher n0 and τ are constants .Find the solution for n(t) .

14)What is meant by solenoidal vector?

15)For a position vector $\vec{r}$=ix+jy+kz,prove that $\vec{\nabla} \times \vec{r} = 0$

16)State Stokes'theorem.

17)Write down the solution of $\frac{d^2x}{dt^2}$ +ω^2x=0.

18)What is Rodrigue'sformula for Legendr's polynomial?

19)Find the Laplace transfrom of $\mathcal{F}(t) = e^{at}$ sin ωt.

20)What are Dirichlet's conditions of fourier's expension of a function f(x) ?

<u>Each question carries 5 mark .</u>

1.Prove that $\overrightarrow{\nabla} \times \left(\frac{xi+yj}{x+y}\right) = \frac{x-y}{(x+y)^2}$k

2.If $\vec{V} = \overrightarrow{W} \times \vec{r}$, prove that

W= ½ $(\vec{\nabla} \times \vec{V})$Where W is a constant vector .

3.Obtain the Fourier's series for the function f (x)

Where f(x) =1+2x/π , - $\pi \leq x \leq 0$

= 1-2x/π , 0 ≤ x ≤ π

Hence show that $1/1^2+1/3^2+1/5^2$ +……..=$\pi^2/8$.

4.The displacement y of a viscously damped string is given by the equation

$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ - 2k $\frac{\partial y}{\partial t}$ where c and k are constants.

Find the general solution of the equation by the method separation of the variable.

5.Determine the eigenvalues and eigenvectors of the following matrix

$$A=\begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$$

6.If v=w× r. prove that w =$\frac{1}{2}$ curl v,where w is a constant vector

7.Prove that the vector $\vec{A}$=3y^{4}z^2 I +4x^{3}z^2 j -3x^{2}y^2 k is solenoidal.

8.State Gauss's divergence theorem. Verify the theorem for $\vec{A}$=4xi -2y^2 j+ z^2 k taken over a region bounded by $x^2 + y^2$ =4, z = 0 and z= 3

9.Find the eigen values and normalized cigen vectors of the following matrix .

$$A=\begin{matrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 1 \end{matrix}$$

10.Write down the Fourier transform of a function f(x) in K-space . Obtain the Fourier transform of the following function in k-space .

f(x)= $\delta(x)$,where $\delta(x)$ is a delta function .

11.Find the power series solutions of the following differential equation $\frac{\mathrm{d}^2 y}{\mathrm{dt}^2}$ + ω^2y=0 , where ω is a constant.

12. Prove Gauss's divergence theorem If $\overrightarrow{A =}$ A$_1$i+A$_2$j +A$_3$k is Vector function of position and n= n1 i+ n2 j +n3 k a unit normal the surface S enclosing a volume V, then show that

$\iiint_V (\frac{\partial A1}{\partial x} + \frac{\partial A2}{\partial y} + \frac{\partial A3}{\partial z})$dx dy dz.=$\iint_S (A1\cos\alpha + A2\cos\beta + A3\cos\gamma)$ ds

Where cosα, cosβ and cos γ are the direction cosines of $\vec{n}$.

13.Define cylindrical coordinates. Prove that a cylindrical coordinate system is orthogonal .Represent a vector $\bar{A}$ in cylindricalcoordinate.

14.Write down Legendre differential equation and obtain its power series solutions.

15(a) A matrix is given by

$$A = \begin{matrix} 2+3i & 1-i & 5i & -3 \\ 1+i & 6-i & 1+3i & -1-2i \\ 5-6i & 3 & 0 & 4 \end{matrix}$$

Obtain the complex conjugate and transpose of the matrix A.

(b) Obtain the conditions that the matrix

$$U = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

Is unitary ,where a, b,c and d are complex scalars .

(c) Find the eigen values of the matrix

$$A = \begin{bmatrix} q & p & p \\ p & q & p \\ p & p & q \end{bmatrix}$$

16.Explain Newton-Rapson method for finding real roots of transcendental equations.

17) Apply the Newton-Rapson method to obtain the real root of equation 3x- cosx -1 = 0.Assume the approximate value of the root to be 0.61.

18) Define Laplace transform of a function .Evaluate Laplace transform of the function F(t) =cosh Kt.

19) Prove that div $(\vec{A} \times \vec{B})$=$\vec{B}$. (curl$\vec{A}$)-$\vec{A}$.(curl$\vec{B}$) .

20) Using Gauss divergence theorem, evaluate $\iint (x^3 dydz + y^3 dz$dx + Z^3 dx dy)where S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$

21)) Determine the normalized eigenvectors of the following matrix :

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{pmatrix}$$

22) Solve Legendre's differential equation (1-x2) $\frac{d^2y}{dx^2}$ -2x $\frac{dy}{dx}$ + n (n+1) y = 0.

23) Prove that p_2 (x) = $\frac{1}{2}$ ($3x^2$-1).

24) solve by the method of separation of variables 3 $\frac{\delta u}{\delta x}$ + 2 $\frac{\delta u}{\delta y}$ = 0 , Where u (x.0) = $4/e^x$.

25) Find the general solution of Laplace's eqution

$\frac{\partial^2 \emptyset}{\partial x^2} + \frac{\partial^2 \emptyset}{\partial \gamma^2} + \frac{\partial^2 \emptyset}{\partial z^2} = 0$

26) Obtain the Foreier's series for the Function f (x) where

f(x) = $-\pi - \pi > x < 0$

= x $0> x > \pi$

Hence show that $\frac{1}{12} + \frac{1}{32} + \frac{1}{52} + \ldots = \frac{\pi^2}{8}$.

27) Determine the eigenvalues of the following matrix :

A= $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{pmatrix}$

28) prove that $\vec{A} \times(\vec{B} \times \vec{C}) + \vec{B} \times(\vec{C} \times \vec{A}) + \vec{C} \times(\vec{A} \times \vec{B}) = 0$.

29) Determine the unit vector perpendicular to the plane of $\vec{A}=2\hat{\imath}-6\hat{\jmath}-3\hat{k}$ and $\vec{B}= 4\hat{\imath}+3\hat{\jmath}-\hat{k}$.

30) Define a diagonal matrix . Show that the multiplication of diagonal matrices is commutative .

31) Define a Hermetian matrix . Is the matrix A=$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ Hermetian ? Verify .

32) A differential equation is given by

$d^2g/dr^2 - L(L+1)g/r^2 = 0$.

Where L is a constant .Obtain the solutions of the differential equation .

33) If $\emptyset(x,y,z) = 3x^2y - y^3z^2$, find the value of $\nabla\emptyset$ at a point (1,-2,-1).Prove that $\nabla \times(\nabla\emptyset) = 0$ where $\emptyset$ is a differentiable scalar function .

34) Compute upto four decimal places the real root of the equation

$X^2 + 4 \sin x = 0$ by Newton Raphson Method .Assume the approximate value of the root to be 1.9.

35)Compute the value of the definite integral

$\int_4^{5.2} \ln x \, dx$ by using simpson's rule .

PAPER IB

I) CLASSICAL MECHANICS:

Each question carries 2 mark .

1) Write th principle of virtual work .
2) Define holonomic and non holonomic systems .
3) Distinguish conservative and non conservative forces .
4) What do you mean by centre of mass ?
5) Define holonomic and non holonomic systems .
6) What do you mean by generaised force .
7) What is the work done by a conservative force $\vec{F}$ upon a particle being taken from point 1 to point 2 along a path and back to point 1 by another path .
8) What do you mean by rigid body ?
9) What do you mean by cyclic coordinates ?
10) Define potential energy .

Each question carries 5 marks .

1. Obtain the velocity and acceleration of a particle in plane polar coordinates.Prove that the force given by $\vec{F} = x^2yz\,\hat{\mathbf{i}} - xyz^2\,\mathbf{k}$ is non-conservative . 3+2

2. A particle of mass m and charge q is moving in a constant electric field, show that the sum of the kinetic energy and potential energy is a constant. 5

3. Show that the total energy of a harmonic oscillator at any instant of time is constant and proportional to the square of the amplitude and the square of the frequency of the oscillator. 5

4. Obtain the lagrangian and lagrange's equations of motion of a spherical pendulum of fixed length *l.* 5

5. A particle of mass m moves in xy plane so that its position vector is $\vec{r} = (a\cos wt)\,\boldsymbol{i} + (b \sin wt)\,\mathbf{j}$ where a ,b ,w are positive constants and a >b.

a. Prove that the particle moves in an ellipse. 1
b. Find the force acting on the particle. 2
c. Show that the force acting on the particle is conservative. 2

6) Prove that the force $\vec{F}= k_o x\ \hat{\mathbf{i}}$ acting on a simple harmonic oscillator is conservative. 5

7) What do you mean by generalized coordinates? Write down the expression for generalized force associated with a generalized coordinate . 2+3

8) A double pendulum vibrates in a vertical plane
a) Obtain Lagrangian of the system
b) Set the Lagrangian equations for the motion .3+2

7) What is the force on a charge particle moving in electromagnetic field . If the Lagrangian of the particle is $L=mu^2/2 -q\phi+(q\vec{A}.\vec{v})/c$ where ø and A are respectively the scalar and vector potential and v is the velocity of the particle .Obtain the momentum of the charged particle. 3+2

8) Which quantity is conserved , if a coordinate is cyclic in the Lagrangian ?Justiy your answer. 1+4

9) Derive the Tangential and normal components of velocity and acceleration of a particle in Cartesian coordinate system. 2½+2½

10) What do you mean by path and time integral of force . 2½+2½

11) What do you mean by conservative force ? Give an example of a Conservative force . 5

12) Prove that in a conservative field the total energy of a particle remains constant .5

13)Prove that $F= -\nabla V$, in a conservative field.What is the significance of the negative sign ? 3+2

14) What is Torque ?Derive a relation between Torque and angular momentum . 3+2

15)Prove the following equation , where L is the Lagrangian of a system .

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{\mathbf{r}}_i}\right) - \frac{\partial L}{\partial \mathbf{r}_i} = 0$$

5

16) What do you mean by Conservation of linear and angular momentum ?.

2½+2½

17) What is energy ? What do you mean by conservation of energy ?2+3

18)What is Central force ?Prove that Central force is conservative .3+2

19) Define holonomic and non holonomic systems .Write the principle of virtual work ?

3+2

20) What is meant by centre of mass ? Explain in detail .

5

21) What do you mean by the term degress of freedom and generalized coordinates ? 2+3

22) Two constant forces $\vec{P}$= 6i – j +3k and $\vec{Q}$=3i -2j +k act simultaneously on a particle . Calculate the work done in displacing the particle from the point (1,-2,3) to point (5,4,-2). 5

23) A particle of unit mass moves according to the equation $\vec{r}$= $(2+3t^2)$i +$5t^2$j +tk .Calculate the force acting on it. 5

24) If $\vec{r}$ is the position vector of a particle of mass m relative to the point O and F be the external force on the particle ,obtain the Torque on the particle about O. 5

25) A particle is moving in two dimensional potential given by v= v_0(x^2+y^2) .Obtain the equation of motion and predict the trajectory of the particle . 5

26) Establish Conservation theorems for the total linear momentum and angular momentum for a system of N particles . 5

27)Obtain equations of motion of particle in plane polar coordinates . 5

28) Explain D Alembert's principle . What do you mean by a Lagrangian of a system ?

3+2

29) Derive Lagrange's equation of motion for a Conservative system starting from D Alembert's principle . 5

30)Write down the Lagrangian of a harmonic oscillator in one dimension and obtain Lagrange's equation of motion for the oscillator .2+3

II. Quantum Mechanics :

Each question carries 2 mark .

1) State Heisenberg's uncertainty principle ?
2) Why $\Psi=Ax^2$ is not an well accepted wave function?
3) Mention two experiments that demonstrate particle linke nature of electromagnetic radiation ?
4) Explain the equation relating entropy and probability ?
5) What do you mean by expectation value ?
6) What is Compton wavelength ?
7) What is barrier penetration ?
8) "Free electron cannot absorb photon ".Explain .
9) Calculate the wavelength of photon having energy 1.12 eV.
10) What is the ground state energy of a linear harmonic oscillator ?Write down the ground state wave function of the oscillator .
11) How can you examine the orthogonality of hydrogenic state Ψ_{100} and Ψ_{200}.
12) What is the condition that a set of function is linear independent ?
13) How do you express energy E of a particle in coordinate and momentum representation ?
14) Time dependant Schrödinger equation is given by $H\Psi = i\hbar\delta\Psi/\delta t$where all the terms have their usual meaning .Write down the conjugate wave equation .
15) Write operator representations of two operators associated with dynamical variables .
16) What is group velocity ?
17) What is Zero point energy in harmonic Oscillator?
18) What is Tunneling ?
19) What do you mean by Orthonormal wave function ?
20) Give two examples one showing the particle nature of light and the other showing the wave nature of electron.

Each question carries 10 marks .

1) What is Compton effect ?Derive the expression for Compton shift and also kinetic energy of recoiled photon .Which aspect of the nature of radiation is revealed by Compton scattering : wave or corpuscular ? 2+7+1

2) What is Compton effect .Derive the relationship between scattering angle of the photon and the angle at which the electron recoils in Compton effect .Which aspect of the nature of radiation is revealed by Compton scattering : wave or corpuscular ?2+7+1

3) What is blackbody radiation ? Give an example of a blackbody .What is Wien's displacementlaw ? The maximum in the energy distribution curve of radiation emitted by sun occurs at the wavelength of 4820 Å .Assuming the sun to be black body ,calculate the surface temperature of the sun . 3+1+3+3

4) Discuss the theory of Compton scattering of high energy photons by free electrons .Which aspect of the nature of radiation is revealed by Compton scattering : wave or corpuscular ? 9+1

5) Derive plank radiation law .Show that the law reduces to Rayleigh Jeans law in the limit when the wavelength becomes large .7+3

6) Derive plank radiation law .Show that the law approximately equals the Wein's approximation at high frequencies .7+3

7) What do you mean by blackbody? What is Stefan- Boltzmann law ? Deduce Stefan-Boltzmann law from Plank's law of radiation . 3+2+5

8) What is wave particle duality ? What is wave packet ?Prove that $\mathbf{V}_g=\mathbf{V}_p- \lambda\, d\mathbf{V}_p/d\lambda$ where the symbols have their usual meaning .Name two phenomenon one showing wave nature of electron and the other showing the particle nature of light . 2+2+4+2

9) What is Rayleigh Jeans law ? What is ultraviolet catastrophe ?How Plank solved the problem of ultraviolet catastrophe ? 3+2+5

10) What is a wave function ? What are the properties of an well accepted wave function ?What is a normalized wave function ?If $\Psi = A exp -\frac{\sigma^2 x^2}{2}$.If Ψ is normalised , then find the value of the normalizing constant .What do you mean by orthonormal wave function ?
2+2+2+2+2

11) What do you mean by wave function ? Why $\Psi = Ax^2$ is not an well accepted wave function ?What are the properties of an well accepted wave function ?What is Born interpretation ?
2+ 2+3+3

12) What do you mean by group velocity and phase velocity ?Prove that for relativistic particle $v_p v_g = c^2$,and for non relativistic particle $v_g = v_p/2$, symbols have their usual meaning.
4+3+3

13) What is the importance of Schrödinger equation ? Why Schrödinger equation is not valid for relativistic particles . Derive the time independent Schrödinger equation from time dependant one. 2+2+6

14) Write down and explain the failures of electromagnetic theory . 10

15) Wht do you mean by stationary state ?What do you mean by eigen value and eigen vector ? If Ψ_1 and Ψ_2 are eigen functions of differential operator H with Eigen values E1 and E2 then show that $\Psi = \Psi_1 + \Psi_2$ is also an eigen function of the same operator .what is the eigenvalue now . 2+3+3+2

16) Show that 4cos 2x is an eigenfunction for the operator $\partial^2/\partial x^2$. Obtain the eigen values .What is the energy eigen value for wavefunction $e^{-4x}$for the said operator .If Lx is the x component of angular momentum operator ,then show in spherical polar coordinates Lx can be represented $Lx = i\hbar (\sin\phi \partial/\partial\theta + \cot\theta \cos\phi \partial/\partial\phi)$. 2+2+2+4

17) A particle of mass m and Energy E is acted upon by rectangular potential barrier described by

$V = 0$ for $x < 0$
$= V_0$ for $0 \leq x \leq a$
$= 0$ for $x > a$.

Set the Schrödinger equations in the above three regions .What are the boundary conditions the wave functions of the three regions should satisfy ?Assuming the incident and transmitted wave functions to be $\Psi_{in} = Ae^{ikx}$ and $\Psi_t = Ce^{ikx}$, find the incident and transmitted probability current densities .Show that the transmission coefficient for barrier penetration $T = |C|^2/|A|^2$. 2+2+6

18) a)Obtain the expectation values $\langle x\rangle, \langle x^2\rangle, \langle p_x\rangle, \langle p_x^2\rangle$ for a Gaussian wave packet given by $\Psi(x)=(1/6\sqrt{\pi})^{1/2} \exp(-x^2/2\Omega^2) \exp(iK_0x)$ where all the terms have their usual meaning .
b)Show that the uncertainty product $\Delta x \Delta P$ is minimum for the above gaussian packet.
2+2+2+2+2

19) What are the properties of linear operator ? What is Hermetian operator ? What are the properties of Hermetian operator .Prove that the Eigen values of a Hermetian operator is real. Prove that the Eigen functions of Hermetian operator are orthogonal if they correspond to distinct Eigenvalues .2+2+2+2+2

20) a)Work out the commutator $[x,p^2]$.Show that $[Lx,Ly]=i\hbar Lz$.Lx,Ly,Lz are components of angular momentum of a particle. 3+3
b)The wave function of a particle moving along x- axis is given by $\Psi(x)=Ax$ for $0<x<L$.Find the expectation value in position x. 4

21) Prove that if α and β are two linear operators , then $\alpha+\beta$ and $\alpha\beta$ are also linear operators .Prove that the operators x, Px do not commute . Find the value of commutator $[L^2,L_x]$.
4+2+4

22) What is Probability current density . Prove that $\frac{\partial \rho(r,t)}{\delta t} + \frac{i\hbar}{2m}\nabla.(\Psi\nabla\Psi^* - \Psi^*\nabla\Psi) = 0$ where $\rho(r,t)$ is the probability of finding the particle in τ and Ψ is the wavefunction of the particle.
3+7

23) Find the probability density and probability current density for the case $\Psi = A exp - \frac{\sigma^2 x^2}{2}$ exp(ikx).Derive the expression of probability current density for a free particle .2+3+5

24) What is an observable ?What do you mean by expectation value of an observable .Find the expectation value of energy for an energy eigenstate $\Psi_n(r,t) = \Psi_n(r) \exp(-iE_nt/\hbar)$.

2+3+5

25) Write in brief all the postulates of quantum mechanics .Show that the operators x, d/dx do not commute . 7+3

26) Prove that the Hamiltonian operator is Hermetian .Prove that the product of two Hermetian operators is Hermetian if and only if they commute . 5+5

27) What is Hermetian conjugate of an operator ? What is anti-Hermetian operator . Show that Hermetian adjoint of α † is α. 3+3+4

28) Derive Schrödinger equation in one dimension.Derive time independent Schrödinger equation from time dependant one . 5+5

29) Show that the energy levels of one dimensional potential box are discrete .Plot the energy levels for the above case .Plot the instantaneous wave functions for the energy state of a particle in a one dimensional box.

6+2+2

30) What do you mean by tunneling in quantum mechanics .Consider a step potential given by

V=0 for x<0

$V=V_0$ for x >0

Show that the sum of the reflection coefficient and transmission coefficient is one for the case when E >V_0.Also explain in detail what will happen for E<V_0. E is the energy of the particle.2+4+4

31) Prove that the ground state energy of a Quantum Harmonic oscillator is ½$\hbar\omega$.How is quantum harmonic oscillator different from classical harmonic oscillator ? Obtain the ground state energy of 1 dimensional linear harmonic oscillator which has angular frequency 5×10^{14} per sec.5+2+3

32) State and prove de-Broglie hypothesis ? Calculate the de-Broglie wavelength of electrons of energy 10^4eV. 5+5

33) What is Wein's displacement law ? Prove the law using Plank's law of blackbody radiation .The maximum in the energy distribution curve of radiation emitted by sun occurs at wavelength of 4820Å .Assuming the sun to be a black body , Calculate the surface temperature of sun.3+4+3

34) What do you mean by binding energy ? Show the binding energy of hydrogen atom is 13.6 eV.Calculate the wavelength of light emitted due to transition between n=1 and n=2 orbits of the hydrogen atom. 2+4+4

35) The wave function of a free particle is described by

$\Psi(x,t) = A \cos \pi x/a \, e^{-iEt/\hbar}$ for $-a/2 < x < a/2$.

= 0 for $x \leq -a/2$ or $x \geq a/2$.

Where A is a constant and E is the total energy of the particle .Show that the energy of the particle has the value $E= \pi^2\hbar^2/2ma^2$.Find the expectation values of the position and momentum of the particle .Estimate the value of A. 3+3+4

36) a)Set up Schrödinger equation for quantum harmonic oscillator .Prove that for quantum harmonic oscillator the energy eigen value is given by $E_n = \hbar\omega\left(n+\frac{1}{2}\right) = (2n+1)\frac{\hbar}{2}\omega.$ n is an integer and ω is the angular frequency of oscillation. 2+4

b) What is zero point energy in quantum harmonic oscillator . Plot the energy levels of the quantum harmonic oscillator and explain the diagram . 1+1

c) Explain the significance of zeropoint energy of a simple harmonic oscillator in the light of the uncertainty principle . 2

37) What is photon ?Prove that photon has 0 rest mass ?Why free electron cant absorb photon ?Write down the equation of Einstein's Photoelectric effect and explain in simple words . 2+2+2+4

38) a)If '0' is an operator and <0> is its expectation value , show that

$d\langle 0\rangle/dt = -\langle 0,H\rangle/h + \partial \langle 0 \rangle/\partial t$

H is the Hamiltonian of the system .

b)The Hamiltonian operator of a particle moving in one-dimensional is given by $H=p^2/2m+V(X)$.

Where P and X are operators corresponding to momentum and coordinate .Show that $d\langle X\rangle/dt = \langle P\rangle/m$. 5+5

39) What is Quantum tunneling ?What do you mean by barrier penetration . Obtain the transmission coefficient of electrons tunneling through a rectangular potential barrier of height V_0 and width 2a. 2+2+6

40) Show that the probability current density for a free particle is equal to the product of its speed and probability density . 10

PAPER IIA

I: ELECTROSTATICS :

Each question carries 2 marks .

1) What is skin depth ?How does it varies with frequency ?
2) State Bio-Savart's law .
3) Define magnetic vector potential.
4) State Coulomb's law .
5) A wire is carrying a steady current I. How is the current density affected if (i) Its length is doubled (ii) Length is doubled but area is halved
6) How is the inconsistency in Ampere's law overcome .
7) What is electric field and electric potential?
8) Write down Laplace's equation and Poisson's equation .
9) State Ampere's circuital law .
10) State Gauss's law .
11) State Faraday's law of electromagnetic induction .
12) What is mutual inductance and what is self inductance ?
13) Define displacement current and write down its physical significance .
14) What do you mean by polarized and unpolarized electromagnetic waves ?
15) Define magnetic vector potential .
16) What is Lorentz force ?
17) What is dipole and dipole moment for electrostatic field .
18) The force between two charges is 120N.If the distance between the charges is doubled, What will be the force ?
19) The electric field intensity at a point situated 4 meters from a point charge is 200N/C. If the distance is reduced to 2 meters ,find the value of field intensity .
20) A capacitor stores 0.24 Coloumbs at 10 volts .What will be the value of its capacitance ?

Each question carries 10 marks .

1)

a. State Gauss's law . 2

b. Deduce Poisson's equation .Write down the Poisson's equation in Cartesian , Cylindrical and spherical Coordinate systems . 2 ½ +1 ½

c. Determine the electric field intensity due to an infinite plane sheet of uniform charge ρ C/m^2using Gauss's law. 4

2)

a) State Ampere's Circuital law . When can one use Ampere's circuital law to determine the magnetic field ? 2+1

b) An infinitely long coaxial cable consisting of an inner conductor of radius 'a' carries current I and outer conductor of inner radius 'b' and thickness 't' carries return current –I. Determine the magnetic field intensity everywhere along the radial distance from the axis of the cable assuming the current is uniformly distributed in both conductors . 7

3)

a) State Gauss's law .Determine the electric field due to an infinite line charge of uniform density ρ_L(C/m^2). 5

b) State Ampere's circuital law . Find the magnetic field due to the current in a straight wire of infinite length .5

4)

a) State Biot – Savart's law and use it to find the magnetic field due to a long straight wire carrying a current I. 2+4

b)Obtain an expression for the energy density in static magnetic field.4

5)

a) Show that the ratio of the electric field and magnetic fields of an uniform plane electromagnetic wave is constant depending upon the medium .Also verify that this ratio is equal to 377 Ω if the medium is in free space . 5+2

b)Determine the depth of penetration at 1MHZ for copper wire conductivity $58*10^4$ mho/ m and permeability $1.26*1^{-4}$ H/m. 3

6)

a)State Faraday's law of electromagnetic induction and Lenz's law . 1 ½ +1 ½

b) "Forces in the magnetic field are much larger than forces in the electric field ". Is this statement true or false .Justify your answer . 2

c) Derive the expressions for the magnetic field due to two long straight parallel wires carrying equal and oppositely directed current I. 5

7)

a) State and prove Poynting theorem .Give the physical interpretation of each term involved in the mathematical expression of Poynting theorem . 3+2

b) Find the Poynting vector on the surface of a long straight conducting wire of radius α and conductivity σ that carries a direct current I . Verify Poynting theorem . 3+2

8)

a) Explain the concept of displacement current and write its importance . 5

b) Find the values of E and H for the Poynting vector ,where they are represented the flow of energy into the wire . 5

II. LINEAR CIRCUITS

Each question carries 2 marks .

1) What do you mean by self resonance of a coil ?If the coil is to serve as an inductor what should be the frequency of operation ?
2) What do you mean by electric network and electric circuit ?
3) What are the different properties of an ideal transformer ?Draw the T equivalent circuit of a linear transformer ?
4) State Millman'stheorem .
5) State maximum power transfer theorem .
6) State Kirchhoff's voltage and current law?
7) Distinguish between transformer emf and motional emf ?
8) How can a practical voltage source, having an ideal voltage V_S and internal series resistance R_s be replaced by a current source?

9) State that the Kirchoffs voltage law follows the principle of conservation of energy ?
10) How the following sources (i) a voltage-dependant voltage source (ii) a voltage –dependant current source (iii) a current dependant current source (iv) a current dependant voltage source are specified in PSpice ?
11) Classify the network elements
12) Define resonance frequency and bandwidth for a series RLC circuit.
13) State Reciprocity theorem .
14) State Bisection theorem.
15) What do you mean by Q factor in a series RLC circuit ?
16) Define Magnification in resonance.
17) What is the time constant of a RL and RC circuit ?
18) Is transient response possible for a circuit which is purely resistive ? Explain with reason .
19) What are the causes of transient response of a circuit?
20) What do you mean by tank circuit ?Why is it called so?
21) State Thevenin's theorem .
22) What is transient state?
23) Draw the circuit of an integrator? Why is it named so ?
24) Draw the frequency response of an ideal low pass filter .
25) Draw the circuit and frequency response of a high pass filter ?
26) Draw the circuit of a differentiator ?Why is it named so ?
27) What is meant by over damped and under damped system?
28) Distinguish between steady state and transient response of an electric circuit.
29) What is the Laplace transform ?Why is it used ?
30) State Norton's theorem .
31) Prove that the load resistance of a circuit must be equal to its source resistance to transfer maximum power to the load .
32) What are the lower and upper cut off frequencies in a resonant circuit ? Write down the relation between bandwidth , resonant frequency and q factor of a resonant circuit ?
33) How does the impedance of a series resonant circuit varies with frequency ?
34) How does the impedance of a parallel resonant circuit varies with frequency ?
35) Draw a wheatstone bridge and write down the balancing condition of the bridge .
36) What is the advantage of Anderson bridge over Maxwell's bridge and Hay's bridge ?
37) Draw the circuit of a scheringbridge ? Write down one application of a schering bridge.
38) What is mutual inductance ?
39) What do you mean by self inductance of a coil ?What is 1 Henry ?
40) What do you mean by step up and step down transformer ?
41) What are the Factors that affectInductance?What is back emf ?
42) What do you mean by PSPICE statement V_s 60 DC 12.What would happen if DC of the statement is omitted .

43) Does the transformer draw any current when secondary terminal is open? Explain why ?

44) What is the purpose of usinf core in a transformer .

45) Explain the terms ..
   a) Linear network .
   b) Dual network.

PROBLEMS :

Each question carries 10 marks .

1) Obtain the current through 8 Ω resistor using thevenin's theorem for the circuit in figure.1

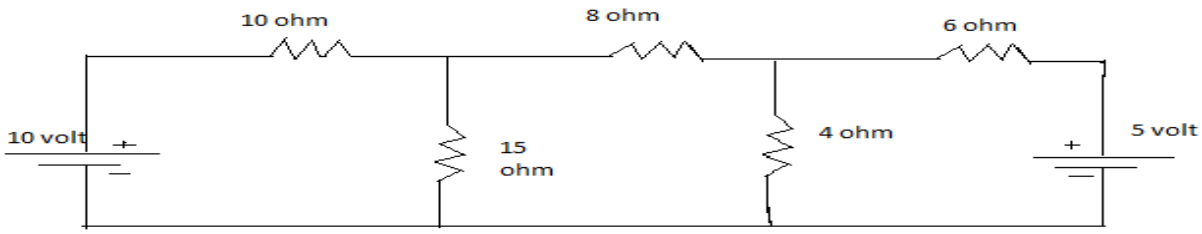


Figure 1

2) Find the thevenin equivalent current through 10 ohm resistor (across A B) in figure 2.

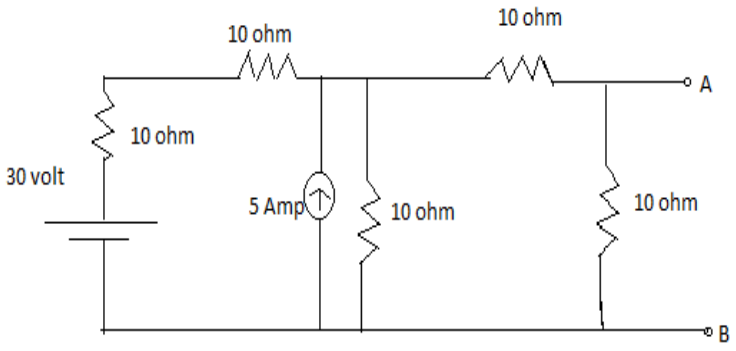


Figure 2

3) Find the constant current equivalent of a circuit using Norton's theorem.

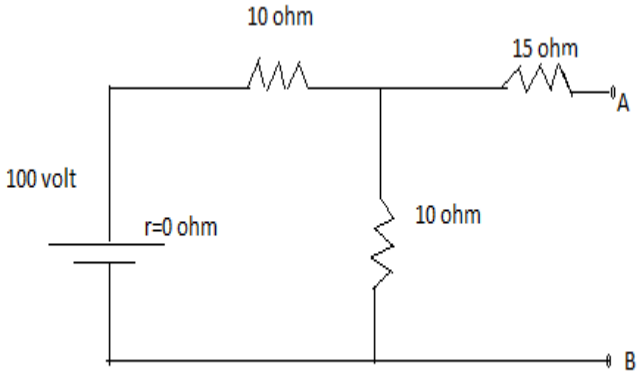


Figure 3

4) Obtain the Thevenin equivalent circuit at terminals AB of the active network shown in figure 4.

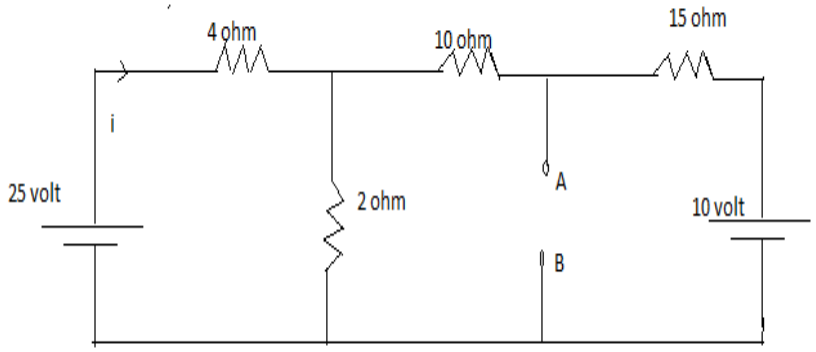


Figure 4

5) Find the current I in figure 5 using Nortons theorem .

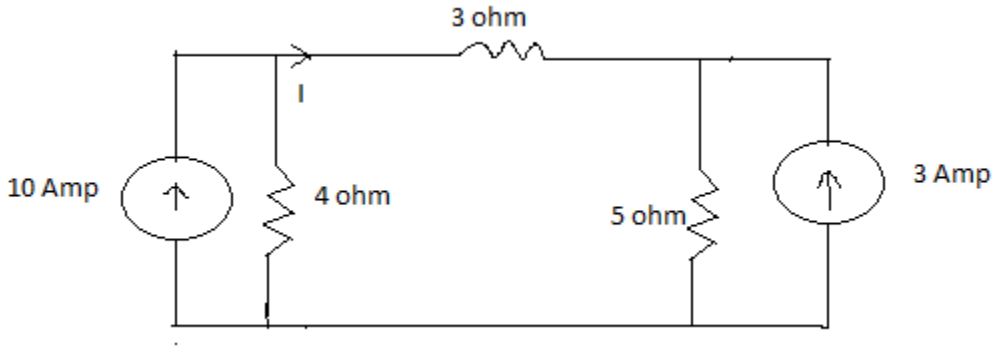


Figure 5

6) Write spice input file for the circuit shown below in figure 6 .

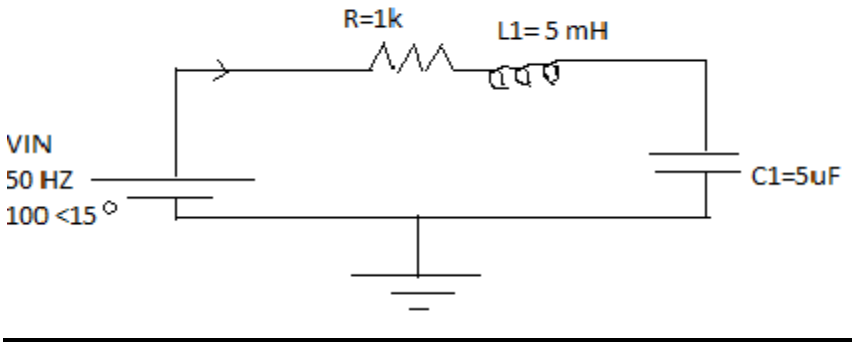


Figure 6

7)

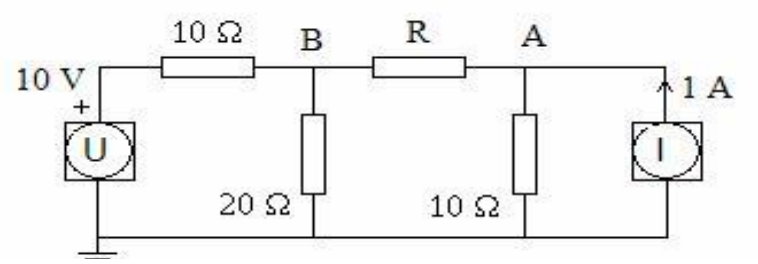


Figure 7

If R=10 Ω then find the current through resistor R using superposition theorem .

8)

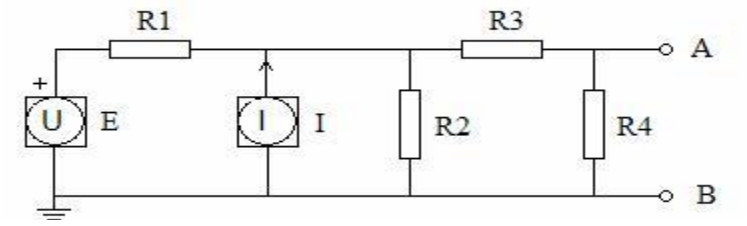


Figure 8

Obtain the Thevenin equivalent circuit at terminals AB of the network shown in figure 8.

9) Find the Norton's equivalent circuit across A-B terminals for the circuit shown in figure 9.

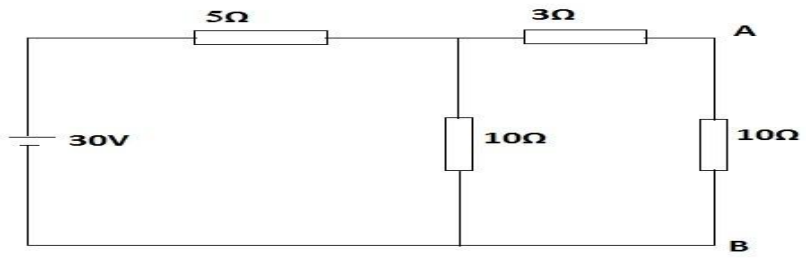


Figure 9

10)Find the current flowing through the circuit of Fig-10 when V=50<0°V and M=j5Ω.

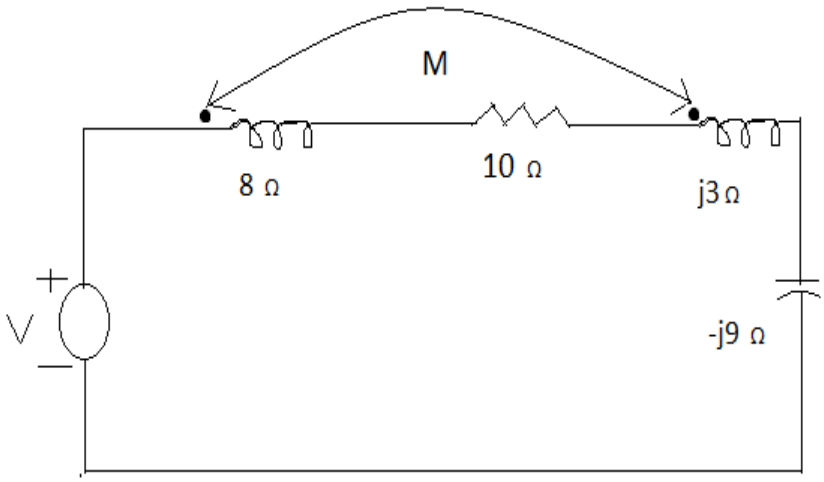


Figure 10

10) Write a program in PSPICE to find by simulation the voltage Vo(t) for the circuit shown in figure below .

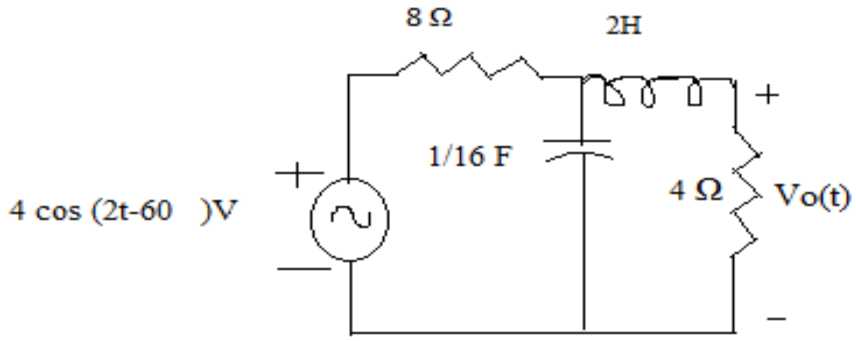


Figure 11

11) Find the expression of decaying charge in a C-R circuit having E as the dc source of energy .Show it graphically . Find the expression of current in a series L-C-R circuit with an a.c source of emf in resonance condition .What is the impedance of the circuit at resonance . 4+2+2+2

12) The circuit of figure given below is initially in the steady state .The switch k is closed at time t=0.

a) Find Vc(t).

b) Determine the final value of Vc(t) and verify it from the final value theorem of Laplace transform.

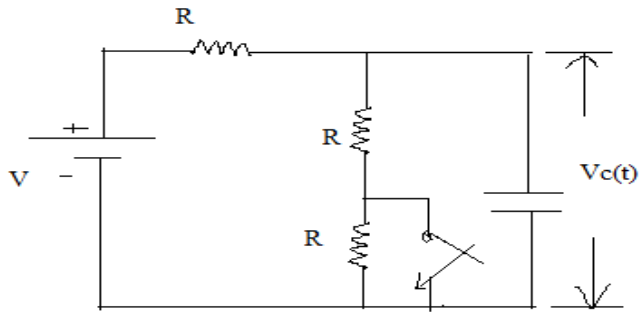


Figure 12

5+5

13) a)Draw a parallel LCR circuit and derive the condition for resonance of the Q-factor of a parallel resonant circuit . 4

b)Show that a C-R circuit acts as a low pass filter across a capacitor and a highpass filter across a resistor .Define the term 3dB frequency and the critical frequency of a filter. What is the expression for the cut-off frequency for the C-R circuit .

4+2+2+2

14) a) A 2Ω resistor is connected in parallel with a 4Ω resistor and the combination is connected across a 12V source .Find the current through each resistor and the total current supplied by the source . 3

b)Calculate the Thevenin voltage and equivalent resistance between terminals A,B of circuit (fig.13) . 4

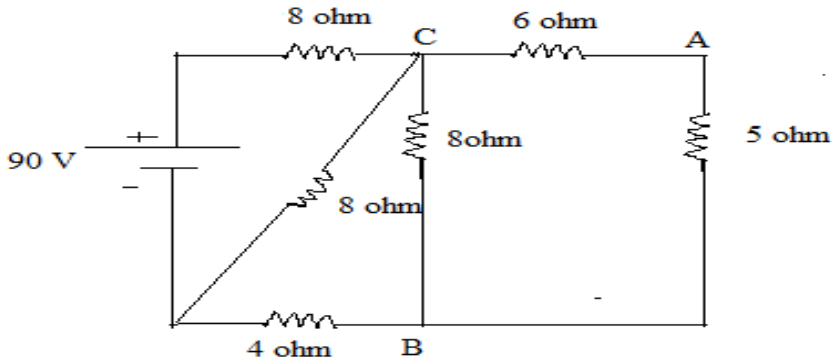


Figure 13.

c) For circuit 2 (fig.14) find the value of K so that the equivalent resistance is minimum. Explain the steps.

3

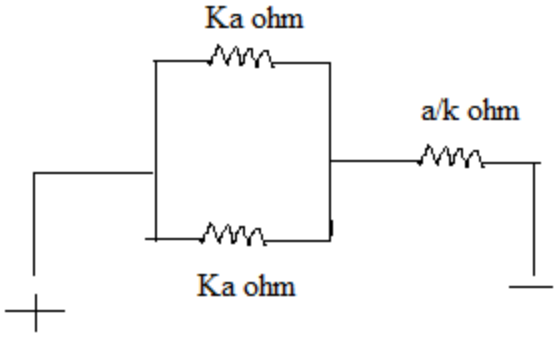


Figure 14

15) In an electric circuit containg a Resistance R ,an inductance L and a capacitance C in series ,a dc source of voltage E is applied . Using Laplace transformation method calculate the current flowing through the circuit .

16) The circuit shown below is operating under steady state condition when the switch is at position a. At t=0 , switch is moved to position b. Determine the current i(t) using Laplace transformation method.

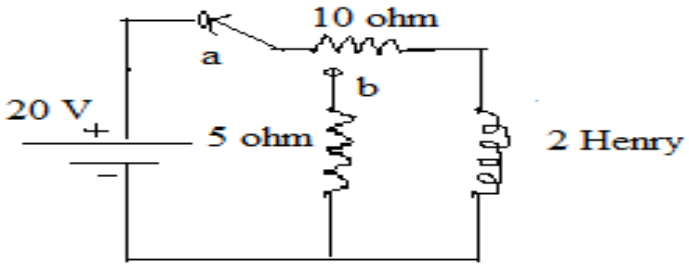


Figure 15

17) a) Convert a T network into its equivalent π network. 3

b) What is filter ? What is the cut off frequency of filter ? 2+2

c) Draw a differentiator circuit and explain its principle . 3

18) a)State Maximum power transfer theorem .

3

b)Find the load resistance RL that enables the circuit (left of the terminals a and b) to deliver maximum power to the load. Find also the maximum power delivered to the load. 7

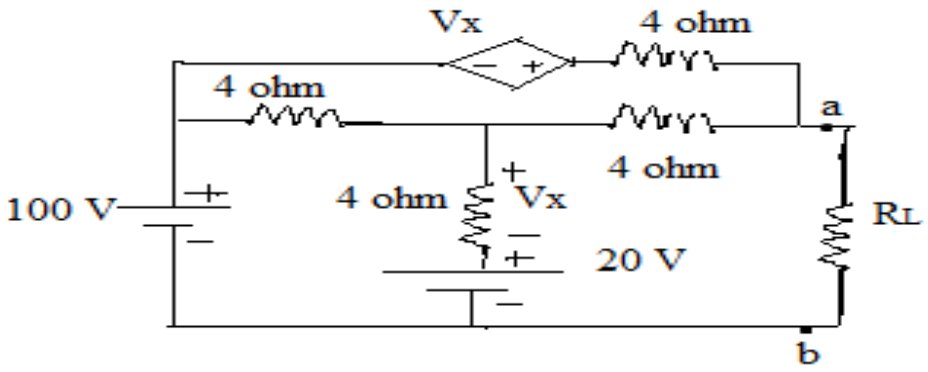


Figure 16

19) a)Find out the condition for balance of Maxwell's bridge . 4

b) What is the mutual inductance (M) between two inductances L1 and L2.3

c) In an ideal transformer show that the ratio of output voltage to the ratio of input voltage is equal to the ratio of the number of secondary turns to primary turns . 3

20) a) A series RC circuit is subjected to a step input voltage .

(i) When can the transient be said to practically die out ?1

(ii) What are the state current and steady state voltage across the capacitor?2

(iii) When is the rate of growth of charge on the capacitor a maximum ? What is the maximum growth rate ?

1+1

b) What is the magnetic energy stored in inductance L carrying current i. 2

c) Draw the phasor diagrams of a series LCR circuit fed by a sinusoidal voltage of angular frequency ω for $\omega<\omega_o$, $\omega = \omega_o$ and $\omega > \omega_o$ where ω_o is the resonant frequency.

3

21) Write down Kirchoff's current law and voltage law . 4

Determine the voltage V_{AB} across the node A and B , in the following circuit using nodal analysis :

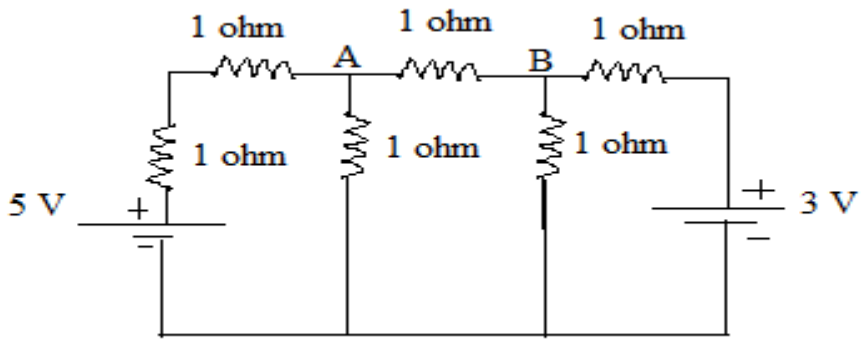


Figure 17

6

22) a)Find the expression for current in a series L.C.R circuit dc excitation. 5
b) Discuss all possible cases. 5

23) a)In a series LCR circuit if f_o be the resonant frequency , Δf be the bandwidth .Show that the voltage magnification factor is $Q_R = f_o/\Delta f$. 6
b) Compare between series and parallel resonances. 4

24) a)Derive the expression in dB for the magnitude of the transfer function of an R-C high pass filter (1^{st} order).What is the expression for phase response of such a filter . 3+2
b) Prove that a high pass RC circuit behaves as a differentiator when the time constant RC of the circuit is negligible with respect to the time constant of the input signal.2
c) Write the input file in PSPICE of the following network.3

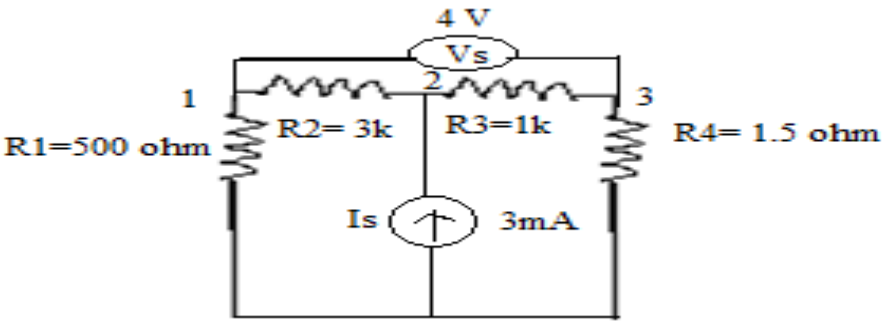


Figure 18

25) a)Explain the working principle of a transformer . 5
b)Draw the equivalent circuit of a transformer and explain the components . 5

III: NON LINEAR DEVICES AND CIRCUITS :

Each question carries 5 marks .

1) Write down the differences between insulators , semiconductors and conductors. Draw the band structure of each and explain the influence of their band structure on their conductivity . 2+3
2) What do you mean by space-charge region ? How is it formed ?2+3
3) What do you mean by barrier potential ?Derive the expression for barrier potential across the P-N junction. 2+3
4) What do you mean by diode capacitance ? How many types of capacitances are seen in PN Junction diode ? Which capacitance is dominant under reverse bias condition ? 2+2+1
5) Derive the expression of the width of the depletion layer in terms of barrier potential and in terms of donor and acceptor atoms . 5
6) Derive the expression for the transition capacitance for an abrupt PN junction diode ? 5
7) What is load line ? Explain briefly the difference between ac and dc load line ? 2+3
8) What are the ideal characterestics of a diode ?Explain briefly the piece-wise linear model of a diode ? Draw the equivalent circuit of a diode . 2+2+1
9) Why the conductivity of metals decreases with increase of temperature whereas the conductivity of semiconductors increases with increase in temperature ? 2½+2½
10) Write down the basic differences between intrinsic and extrinsic semiconductor ?What do you mean by law of mass action ? 3+2
11) Write in brief the working principle of a diode in forward and reverse biased condition ?Draw the energy-band diagram of the Diode in each of the above cases ?3+2

12) What do you mean by the diode in a state of equilibrium ?Draw the energy-band diagram of the Diode in the state of equilibrium ?

3+2

13) Write down the Shockley diode equation and explain the equation for reverse bias , forward bias and equilibrium condition . 5

14) What do you mean by dc and ac resistances of a diode ?What do you mean by operating point in the context of diode ? 2+3

15) Distinguish between Zener and avalanche diode ?Draw the symbol of Zener diode .

4+1

16) Explainthe working principle of a Varactordiode . Draw the symbol of varactor diode .Write down some applications of Varactor diode . 3+1+1

17) What is LED and how does it work ? 2+3

18) Explain the working principle of a photodiode and plot its V-I characterestics ?What do you mean by short circuit current and open circuit voltage in the context of photodiode ?

3+2

19) How does temperature affect the working of a p-n Junction diode ?5

20) What do you mean by doping in semiconductors and why is it necessary ?Explain how n type semiconductors are formed ? 2+3

21) Draw the energy band diagram of p type semiconductors ? What do you mean by acceptor level and donor level? 2+3

22) What do you mean by Clipper ? Draw a circuit of a negative clipper and explain briefly its working principle . 2+3

23) What do you mean by clamper ? Draw the circuit of a positive Clamper and explain its working principle briefly ? 2+3

24) What do you mean by voltage multiplier ? Draw the circuit of voltage doubler and explain its working briefly ?

2+3

25) What do you mean by rectifier ? Why rectification is necessary ? How many types of rectifiers are basically there ?

2+2+1

26) What do you mean by half-wave rectifier and full wave rectifier ? Write down the working principle of full wave rectifier along with their circuit diagrams .

2+3

27) What are the differences between center tapped full wave rectifier and bridge rectifier ?

5

28) Write down the working principle of a center tapped full wave rectifier ? What will happen if the center tapped transformer is replaced by an ordinary transformer by keeping all the other parts of the circuit same ?

3+2

29) Write down the working principle of a bridge rectifier ?Write down the advantages and disadvantages of bridge rectifier over center tapped full wave rectifier .3+2

30) What do you mean by filters in connection to rectifiers ? Why do we need filters ?

3+2

31) What do you mean by ripples ? Derive the expression of ripple factor for full wave rectifier?

2+3

32) What do you mean by PIV of a diode ? What is the PIV of a half wave rectifier, center tapped full wave rectifier and bridge rectifier ?

2+3

33) What is the need of bleeder resistor in electronic circuits ?

5

34) Derive the efficiency and form factor for each of half wave and full wave rectifier ?

2½+2½

35) What do you mean by switching characteristic of a diode ?

5

36) Explain how Zener diode can be used as a voltage regulator ? What do you mean by load and line regulation of a diode ?

3+2

37) Explain briefly how the ripple factor in case of capacitor filter , inductor filter , pi type LC filter and L type LC filter varies with load resistance ?

5

38) What is reverse recovery time ? Why ordinary diodes causes problem in case of high frequency rectification ?

3+2

39) Explain the working principle of a Schottky barrier diode ? Why Schottky barrier diode is well suited to high frequency applications?

3+2

40) What do you mean by diffusion current and drift current in P-N junction diode ?Derive the expression of diffusion capacitance of a diode . 2+3

41) Explain diode as a switching device . 5

42) What do you mean by abrupt and linearly graded p-n junctions . What is the expression of junction capacitance for each ? 3+2

OBJECTIVE QUESTIONS :

Each question carries 1 mark .

1) For the same a.c. voltage and load impedance, which of the following statements about rectifier are correct?
   a. The average load current in a full wave rectifier is twice than in a half wave rectifier
   b. The average load current in a full wave rectifier is n times that in a half wave rectifier
   c. Half wave rectifier will have a bigger sized transformer compared to full wave rectifier
   d. Half wave rectifier will have a small sized transformer compared to full wave rectifier

2) The depletion region of a pn junction is one, that is depleted of
   a. Atoms
   b. Mobile charges
   c. Immobile charges
   d. Velocity of carriers

3) The depletion region with in a pn junction is reduced when the junction has :

   a) Zero bias
   b) Forward bias
   c) Reverse bias
   d) All of these

4) A silicon pn junction in forward condition has a voltage drop closer to
   a) 0.1v

b) 0.7v
c) 1.6v
d) 2.1v

5) The transition capacitance of a reverse biased pn junction having uniform doping on both sides, varies with junction voltage (V_B) as

a) $1/V_B$
b) V_B
c) $V_B^{-1/2}$
d) V_B^2

6) The junction capacitance of linearly graded junction varies with the applied reverse bias, V_R as

a) $1/V_B$
b) V_B
c) $V_B^{-1/3}$
d) V_B^2

7) The diffusion capacitance of a forward biased P^-N junction diode with a steady electric current I depends on

a) width of the depleted region.
b) mean life time of the holes.
c) mean life time of the electrons.
d) junction area

8) The knee voltage (cut in voltage) of silicon diode

a) 0.2V
b) 0.7V
c) 0.9V
d) 1V

9) When the diode is forward biased, it is equivalent to

a) On switch
b) Off switch
c) A high resistance
d) None of the above

10) Under normal reverse bias voltage applied to diode, the reverse electric current in Si diode

a) 100 mA
b) Orders of microamp
c) 1000 microamp
d) None of them

11) Avalanche breakdown in a diode occurs when

a) Potential barrier is reduced to 0
b) forwardelectric current exceeds certain value.
c) reverse bias exceeds a certain value.

d) None of the above

12) Reverse saturation electric current in a silicon P-N junction diode nearly doubles for very
   a) 10 °C rise in temp
   b) 2 °C rise in temp
   c) 5 °C rise in temp
   d) 6 °C rise in temp

13) When a reverse bias is applied to a diode, it will
   a) raise the potential barrier.
   b) Lower the potential barrier .
   c) increases the majority carrier an electric current greatly.
   d) none of these.

14) For the same a.c. voltage and load impedance, which of the following statements about rectifier are correct?
   a) The average load current in a full wave rectifier is twice than in a half wave rectifier
   b) The average load current in a full wave rectifier is n times that in a half wave rectifier
   c) Half wave rectifier will have a bigger sized transformer compared to full wave rectifier
   d) Half wave rectifier will have a small sized transformer compared to full wave rectifier

15) For small signal ac operation, a practical forward biased diode can be modeled as
   a) Resistance and capacitance in series
   b) Ideal diode and resistance in parallel
   c) Resistance and ideal diode in series
   d) Resistance

16) Which diode can be used as a voltage regulator ?
   a) Zener diode
   b) Normal P-N junction diode
   c) Schottky diode
   d) LED

17) Which diode is called hot carrier diode ?
   a) Zener diode
   b) Normal P-N junction diode
   c) Schottky diode
   d) LED

18) In a p–n junction diode:

   a)The depletion capacitance increases with increase in the reverse-bias
   b)The depletion capacitance decreases with increase in the reverse-bias
   c)The diffusion capacitance increases with increase in the forward-bias
   d)The diffusion capacitance is much higher than the depletion capacitance when it is forward-biased

19) The width of the depletion region is:

   a)Directly proportional to doping

b)Inversely proportional to doping
c)Independent of doping
d)None of the above

20) In a p–n diode, for constant value of current at room temperature, dv/dt varies approximately at the rate of:

a)–2.5 $mV/^0C$
b)–25$mV/^0C$
c)2.5$mV/^0C$
d)25$mV/^0C$