Bsc Physic Sem - IV

Paper 2 (Solid state electronics, and Molecular physics)

Question Bank

1. Considering transistor as two port device, write h-parameter equations for transistor in common emitter mode. Define h-parameters of a transistor in CE mode. Why these parameters are called hybrid parameter ?
2. Explain the construction and working of light emitting diode.
3. Calculate the energy band gap of Ga As P semiconducting material of LED with output light having wavelength 6715 Å. (Given : $q = 1.6 \times 10^{-19}$ C, $C = 3 \times 10^{8}$ m/s, $h = 6.626 \times 10^{-34}$ J-s)
4. Draw the circuit diagram of common emitter transistor amplifier and explain its working
5. A germanium transistor has a collector cut-off current ICBO = 14 µA at room temperature and b = 50. It is used in common emitter amplifier.
6. Calculate the collector current when base current I B = 0.2 µA. (ii) Assuming b does not change with temperature, find the new collector current, if the temperature of the transistor rises through 50°C.
7. Explain construction and working of solar cell.
8. What is stabilization? Explain the necessity of bias stabilization of transistor amplifier circuit.
9. What is MOSFET? What are different types of MOSFETs ? Discuss the drain and transfer characteristics of n-channel depletion MOSFETs.
10. Draw the circuit diagram of JFET as an amplifier. Explain its working.
11. Calculate the voltage gain of JFET voltage amplifier having transconductance 4000 µmho and the load resistance 10 kW
12. What is JFET ? Explain the output characteristics of a JFET.
13. Define transconductance, drain resistance and amplification factor in JFET. State the relation between them.
14. Draw the well labelled diagram showing the construction of p-channel enhancement MOSFET. State special features of MOSFETs.
15. Give the theory of origin of pure rotational spectra for a di atomic molecule. Write the selection rules for it.
16. Discuss the different type of rigid molecules on the basis of their moment of inertia.

17. The spacing of a series of line in the microwave spectrum of AIH is constant at 12.604 cm–1. Calculate the moment of inertia of AIH molecule about its axis of rotation. (h = 6.602 × 10–27 erg-s).
18. Discuss in brief Born-Oppenheimer approximation
19. Draw the energy level diagram for the allowed transitions in rotation-vibration emission spectra when the vibrational transition takes place between V = 1 to V = 0.
20. Explain the intensity distribution of rotational spectral lines.
21. Moment of inertia of carbon monooxide molecule is 1.46×10^{-46} kg-m^2 . Calculate the energy of this molecule in lowest rotational energy level in eV.
22. What is Raman effect ? Explain Raman effect using quantum theory.
23. Describe the experimental arrangement to study the Raman effect.
24. For the exciting line of 4358 Å spectrum of benzene shows Raman lines for Dn = 608, 846, 995 and 1178 cm–1. If Benzene is irradiated by monochromatic light of wavelength 5461Å, what will be the wavelength of Raman lines for benzene.
25. State Frank-Condon principle. Explain morse curve.
26. Explain Electron Spin Resonance (ESR).
27. A substance shows a Raman line at 4567 Å when exciting line 4358 Å is used. Deduce the position of stokes' and anti-stokes' lines for the same substance when the exciting line 4047 Å is used.
28. Draw main components of Nuclear Magnetic Resonance Spectrometer. State any four applications of NMR.
29. State necessity of heat sink in transistor.
30. Draw the transfer characteristics of transistor in common emitter mode.
31. The current gain for a transistor is b = 350. Calculate the current gain a.
32. Why MOSFETs have higher input resistance than JFET ?
33. Define pinch off voltage in a JFET.
34. In a FET, transconductance is 6 mA/V, when reverse gate to source voltage changes by 0.2 V. Find corresponding change in drain current.
35. Why homonuclear molecule H2 and N2 donot show rotational spectra ?
36. The force constant for HCl molecule is 468.2 N/m and reduced mass of HCl molecule is 1.556×10^{-27} kg. What is the natural frequency of vibration of HClmolecule ?
37. Why a monochromatic source is necessary to study Raman effect ?
38. With the exciting line 4358 Å a sample gives stokes' line at 4458 Å. Express this stokes' line in wave number.
39. Define h-parameters; obtain fundamental equation of a transistor in C.E mode and draw h-parameter equivalent circuit for it.

40. Draw the circuit diagram of a common emitter NPN transistor amplifier and explain its working in brief.
41. For a transistor the collector current is 10.525 mA, leakage current ICBO is 5 mA when base current is 100 mA. Calculate the value of β .
42. Explain the working of NPN transistor.
43. Define stability factor. Why does the transistor require special biasing in CE mode ?
44. Draw the output characteristics of a transistor connected in common base mode and explain the three regions.
45. A transistor having hie = 800 W, hfe = 50, hoe = 80 × 10–6 , and hre = 2.5×10^4 is used as a CE amplifier. If load resistance is 5 kW and effective source resistance is 500 W; calculate the current gain, input impedance and voltage gain.
46. What is MOSFET? State its principle of operation. Explain the construction and working of n-channel depletion MOSFET.
47. Define three parameters of JFET and hence obtain the relocation between them.
48. When a reverse gate voltage of 15 V is applied to a JFET, the gate current is 10^{-3} mA. Find the resistance between gate and source.
49. Draw the circuit diagram of a common source amplifier using a n-channel JFET. Explain its working.
50. Explain drain characteristics of a JFET. Define pinch off voltage.
51. Calculate the transconductance of JFET with change in drain current 0.3 × 10–3 A and change in gate to source voltage 0.3 V, when drain to source voltage is constant. Also find amplification factor if drain resistance is 33.3 kW.
52. Explain the transfer and output charactristics of n-Channel enhancement MOSFET with diagrams.
53. Show that the energy levels of a vibrating diatomic molecule are equidistant. State the selection rule.
54. Explain various types of molecules based on the principal moments of inertia.
55. Find the rotational constant of H2 molecule if H – H bond is 7.4×10^{-12} meter. Given :mH = 1.67×10^{-27} kg, h = 6.626×10^{-34} J-s.
56. Mention the three types of quantization of molecular energies. According to it explain in short three types of molecular spectra.
57. State and explain selection rules for rotation-vibrational spectra of a molecule. Draw the energy level diagram for rotational vibrational spectra and show P, Q & R branches on it.
58. The spacing between series of lines in the microwave spectrum of Al H is constant at 12.604 cm–1 . Reduced mass of AlH molecules is 0.9718 u. Calculate the inter

nuclear distance in the molecules. (h = 6.63 × 10–17 erg-sec 1 u = 1.67 × 10–24 gm).

59. Explain the intensity distribution of rotational spectral lines.