M.Sc. 4th Semester Examination, 2010

PHYSICS

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

(*Applied Electronics Special*)

PAPER—PH-2204 A

[*Marks* : 20]

Answer **Q. No. 1** and any **one** from the rest

1. Attempt any *five* bits : 2 × 5

(*a*) How horizontal and vertical blanking pulses are separated from the composite video signal ?

(*b*) How EHT is generated in a TV receiver ?

(*c*) Why vestigial sideband modulation is used for transmission of TV picture signal ?

(*d*) Draw the timing details of a horizontal blanking pulse with proper naming of different portions.

(*e*) What is aspect ratio ? What is its standard value a TV scanning system ?

(*f*) What is the normal channel width allotted for transmission of both picture and sound in TV ? What is the maximum frequency deviation kept normally for frequency modulated sound transmission ?

(*g*) What do you mean by horizontal and vertical synchronization frequencies ?

(*h*) Write three advantages of a digital Ohm-meter over an analog one.

2. (*a*) Briefly explain the operation of an Image orthicon TV camera with a neat diagram.

(*b*) Sketch and fully label the desired response of a TV receiver that includes necessary correction on account of the discrepancy caused by VSB transmission. Comment on the response curve drawn by you. 6 + 4

3. (*a*) What is the structure of an SCR ? Draw also the symbol of an SCR ? Draw also the SCR half-wave power control circuit diagram and explain its operation by drawing the wave shapes of SCR current and anode voltage in the circuit.

(*b*) Briefly explain the operation of a staircase ramp type digital voltmeter with proper block diagram. $\left(1+\frac{1}{2}+3\frac{1}{2}\right)+5$

PAPER – PH-2204 B

[*Marks* : 20]

Answer **Q. No. 1** and any **one** from the rest

1. Answer any *five* questions : 2 × 5

(*a*) What is quantization error in PCM system ?

(*b*) What are the advantages of digital modulation over analog modulation ?

(*c*) What is the output of *B* register after the execution of the following program :

```
ANI  OO
MVI  B  OF
ORA  B
MOV  B  A
HLT
```

(*d*) Give example of conditional jump statement in 8085 μP.

(*e*) Explain the concept of Delta modulation.

(*f*) What do you mean by ASK in digital modulation ?

(*g*) Discuss briefly the technique of time division multiplexing in PAM system.

(*h*) What do you mean by Pulse Width Modulation (PWM) ?

2. (*a*) Find the Nyquist rate for the signal

$$X(t) = \frac{1}{2\pi} \cos(4000\pi t) \cos(1000\pi t)$$

(*b*) Explain the QPSK modulation technique.

(*c*) If a voice signal is changed from 6 bit to 8 bit then what should be the change in signal to noise ratio ? 3 + 5 + 2

3. (*a*) Give the internal structure of 8086 μP.

(*b*) Write a program to find out the smallest number in an array of 10 numbers stored at memory location 'X' onwards in 8085 μP.

(*c*) Discuss the Data and Address multiplexing technique in 8085 μP. 3 + 5 + 2

(*Solid State Special*)

PAPER – PH-2204

Answer **Q. No. 1** and any **three** from the rest

1. Answer any *five* bits : 2 × 5

(*a*) Find the spectroscopic notation and effective no of Bhor magneton for Nd^{3+} having $4f^3 5s^2 5p^6$ electronic configuration.

(*b*) Show the schematic spin arrangement in ferrous ferrite and calculate the net magnetic moment per unit cell.

(*c*) Show the condition under which susceptibility in an anti-ferromagnetic solid below Neel temperature remains constant.

(*d*) Find the frequency of pair tunnelling current when a dc voltage of 1μV is applied across the tunnelling junction of two superconductors.

(*e*) Find an expression for the energy gap associated with the superconductor in terms of scattering potential *V*.

(*f*) A superconducting tin has a critical temperature of 3·7 K in zero magnetic field and a critical field of 0·0306 T at 0K. Find the critical field at 2K.

(*g*) Write down the fundamental condition for magnetic resonance absorption. What information is obtained from NMR study of a material ?

(*h*) What are Cooper pairs ?

2. (*a*) Consider a linear chain of atoms, each having only the spin motion. Find the dispersion relation for a spin wave excited on the chain.

(*b*) Derive Bloch's $T^{3/2}$ law. 7 + 3

3. (*a*) Find the possible wavefunctions corresponding to singlet and triplet state assuming two normal hydrogen atoms as developed by Heitler and London.

(*b*) What is a Bloch Wall ? Calculate its thickness.

(*c*) Derive Curie - Weiss law assuming a ferromagnetic material well above Curie temperature. 4 + 3 + 3

4. (*a*) Derive an expression of susceptibility in a diamagnetic material.

(*b*) Assuming quantum theory of paramagnetism show that in case of narrow multiplets for iron groups the effective number of Bhor magneton can be expressed as

$$p_{\text{eff}} = \sqrt{4s\,(s+1)}.$$ 6 + 4

5. (*a*) What is Meissner effect? What is the value of magnetic susceptibility in a type-I superconductor? Express the London equations which specify the electromagnetic properties of a superconductor. Obtain an expression for penetration depth.

(*b*) What do you mean by coherence length in a superconductor? Find an expression for coherence length.

(*c*) Explain the formation of + ve and -ve surface energy at normal-superconductor junction and explain the occurrence of type I and type-II superconductors. 4 + 2 + 4

6. (*a*) Find an expression for maximum current density in a bulk superconductor in terms of energy gap associated with the superconductor.

(*b*) Obtain an expression for tunnelling current between two identical superconductors separated through a very thin layer of insulator due to pair tunnelling.

(*c*) Discuss flux quantization in a superconducting ring.

(*d*) Discuss the superconducting quantum interferrometer and draw the critical current versus field strength. 2 + 2 + 2 + 4