M.Sc. 4th Semester Examination, 2012

PHYSICS

PAPER— PHS-404

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

(*Solid State Special*)

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

1. **Answer any *five* bits :** 2 × 5

(*a*) Explain — why Fe, Co, Ni is ferromagnetic but Mn, Cr is not ferromagnetic.

(*b*) Find the effective number of Bhor magneton and spectroscopic notation for Cr^{3+} ion having $3d^3$ electronic configuration.

(*c*) What is meant by Neel temperature ? Give its significance.

(*d*) Give an example of a Ferrite. Why ferrite are technically important ?

(*e*) Explain the current-voltage characteristic when an insulator is placed between metal and a superconductor.

(*f*) What is meant by persistence of current in a superconductor ?

(*g*) Obtain the expression of supercurrent density in a superconductor.

2. What is Josephson tunneling ? Explain DC Josephson effect. Show that supercurrent of superconducting pairs across the junction depends on the phase difference. Give some practical application of Josephson Tunneling. 3 + 5 + 2

3. What is meant by Flux quantization in a super-conducting ring ? And hence derive an expression of fluxoid in this connection. What is the origin of negative surface energy and what type of super-conductor does it lead to ? 7 + 3

4. (*a*) Derive the expression of effective number of 'Bhor Magneton' for a rare earth solid.

   (*b*) What is meant by domain rotation ?

   (*c*) Clearly express Hunde's rule. 6 + 2 + 2

5. (*a*) What is a Bloch wall ? Calculate the total energy per unit area of the Bloch wall.

   (*b*) Describe in details the energy levels of a nucleus of spin $I = \frac{3}{2}$ in a static magnetic field He. 1 + 5 + 4

6. (*a*) Considering a linear chain of atoms, find the dispersion relation for a spin wave excited on the chain.

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

   (*c*) What is meant by Ferrimagnetic ordering ? 6 + 3 + 1

(*Electronics Special*)

PAPER – PHS - 404(A)

[*Marks* : 20]

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

1. Attempt any *five* bits : 2 × 5

(*a*) Why FM is used for audio and AM is used for video signal modulation in TV transmission system ?

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

(*c*) Find the length of the dipole of an Yagi-Uda antenna used for receiving channel 8 (Band III).

(*d*) What do you mean by aspect ratio ? What is its standard value in a TV scanning system ?

(*e*) What is the function of a synchronizing pulse ?

(*f*) What is vestigial side band transmission ?

(*g*) Why 'triac' is called a bidirectional thyristor ?

(*h*) Show the details of frequency distribution of a channel used in CCIR-B system of TV transmission and mark the location of picture and sound carrier frequencies.

2. (*a*) With a proper diagram discuss the operation of an 'Image Orthicon'.

   (*b*) Sketch, level and explain the construction and operation of a B/W TV picture tube. 5 + 5

3. (*a*) Draw the cross-sectional diagram of a SCR and its circuit symbol. Draw also the SCR half-wave power control circuit diagram and explain its operation by drawing the waveforms of SCR current and anode voltage in the circuit.

   (*b*) Write a short note on development of vertical blanking and sync. pulses in CCIR-system-B TV transmission standard. $\left(1\frac{1}{2}+3\frac{1}{2}\right)+5$

PAPER – PHS - 404(B)

[*Marks* : 20]

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

1. Answer any *five* bits : 2 × 5

   (*a*) What is the difference between PWM and PPM ?

(*b*) What are the major advantages of 8086 μP over 8085 μP ?

(*c*) What are the role of PC and SP in 8085 μP ?

(*d*) A base band signal is restricted in 2 kHz - 10 kHz range. If 2 kHz guard band is needed then what will be the sampling frequency of that signal ?

(*e*) Give the output of *A* in the following program when 300 F is stored with data OF :

```
LDA   300F
MOV   B A
DCR   B
XRA   B
HLT
```

(*f*) Give the basic idea of Delta Modulation transmitter section by block diagram.

(*g*) State schematically the idea of analog to digital conversion of a signal $m(t)$.

2. (*a*) Why the DPCM is better than PCM technique ?

(*b*) How one can reduce the quantization error in digital communication ? What will be the limitation of that technique ?

(*c*) How the flag register is different in 8086 μP than 8085 μP ?

(*d*) Write a program for 8085 μP to multiply two numbers by the technique of addition. 2 + 2 + 2 + 4

3. (*a*) Show mathematically that a signal can be reconstructed if it satisfies the Nyquist rate in digital communication.

(*b*) State clearly how a 20-bit address is generated in 8086 μP.

(*c*) What are the role of the following pins in 8085 μP :

(*i*) ALE

(*ii*) $\overline{\text{HLDA}}$

(*iii*) INTR

(*iv*) I/$\overline{\text{O}}$. 4 + 4 + 2