

M. Sc. 4th Semester Examination, 2024

PHYSICS

PAPER – PHS-404 (A,B1&B2)

Full Marks : 50

Time : 2 hours

Answer all questions

The figures in the right hand margin indicate marks

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

PAPER – PHS-404A

(Advanced Condensed Matter Physics-II)

[Marks : 40]

A . Answer any four bits : 2 × 4

- 1. Prove that entropy in superconducting state is lower than normal state.**

2. Find the Hund's ground state for Ce^{3+} having unfilled 4f state.
3. Explain why pure ionic crystal does not show ESR but it shows for crystal containing F-Center.
4. Superconducting Tin has a critical temperature 3.7K in zero magnetic field and a critical field of 0.0306 T at 0 K. Find the critical field at 2K.
5. Explain what is meant by Anisotropy energy.
6. What is meant by quenching of orbital angular momentum ?

B. Answer any *four* bits :

4 × 4

7. What is a Bloch Wall ? Calculate the thickness and energy per unit area.

8. Explain NMR and find an expression of resonance condition.
9. Show that flux trapped in a superconducting ring exists in the form of flux quantum.
10. What is meant by Persistence of current in a superconductor and hence find the condition to show that it persists for an infinite time.
11. What is a Ferrite ? Show the schematic spin arrangement in Ferrous Ferrite and calculate its saturation magnetisation.
12. What is coherence length ? Find an expression of it and classify Type-I and Type-II superconductors on this basis.

C. Answer any *two* questions :

8 × 2

13. What is DC Josephson Tunneling ? Find an expression of maximum zero voltage current under this condition.

14. Derive expression of exchange integral assuming Heitler London approach for a ferromagnetic solid.
15. Explain Pauli's Spin Paramagnetism and hence find an expression of paramagnetic susceptibility.
16. Explain antiferromagnetism and describe the temperature variation of its susceptibility. How the molecular field theory accounts for this variation ?

[Internal Assessment – 10 Marks]

PAPER – PHS-404B.1

(Applied Electronics Special: Analog Electronics)

Marks : 20

(Attempt Q.No.1, Q.No.2 and any **one** from Q.No.3 and Q.No.4)

GROUP – A

1 . Attempt any *two* of the following questions : 2 × 2

- (a) Why TEM mode of propagation is not possible in a hollow wave guide ?
- (b) Why automatic gain control (AGC) circuits are used in TV receiver ?
- (c) What do you mean by front porch and back porch ?
- (d) Find the length of the dipole antenna for the reception of Indian TV channel 4.

GROUP-B

2. Attempt any *two* of the following questions : 4×2
- (a) Explain the construction details and operation of a black and white TV picture tube with necessary diagrams.
 - (b) Discuss the merits and demerits of positive and negative Amplitude Modulation and justify the choice of negative modulation in most TV systems.

- (c) Why FM is chosen for the transmission of sound signal in TV systems ? Why are pre-emphasis and de-emphasis circuits provided at the FM transmitter and receiver respectively ?
- (d) Explain briefly how sync pulses are separated from the composite video signal and processed to synchronise the vertical and horizontal oscillators at the television receiver.

GROUP – C

Answer any **one** of the following question : 8×1

3. (a) Describe the construction and operation details of the image orthicon type black and white TV video camera with necessary diagrams. 4
- (b) Draw the block diagram of a black and white TV transmitter with explanation of the operation of its different components. 4

4. (a) Explain the detailed operation of a staircase ramp type digital voltmeter with necessary block diagram and state its advantages over simple ramp type digital voltmeter. 5
- (b) Explain the terms Luminescence, Hue and Saturation in connection with colour TV transmission system. 3

PAPER — PHS-303B.2

(Digital Electronics Spl. Paper)

[Marks : 20]

GROUP— A

Answer any **two** bits : 2 × 2

1. What is the difference between PAM & PWM ?
2. If a monotone signal of 5 KHz is sampled by 12 KHz pulse train, then describe the frequency spectrum.

3. After execution of the program what will be the value of 'A' register ?

```

                                MVI A    OA
                                MVI C    O3
Line 1                          RLC
                                DCR C
                                JNZ Line 1
                                HLT

```

4. Give the schematic diagram to produce DPSK signal.

GROUP- B

Answer any **two** bits :

4 × 2

5. What is the function of BIU and EU of 8086 μ P ? What are the different 'FLAG' in this processor ?
6. Explain the idea of delta modulation. What are the advantage and disadvantage of it ?

7. (a) A signal $m(t) = 5 \cos 12000 \pi t + 10 \cos 20000 \pi t$ has to be sampled for faithful signal reconstruction. What should be the sampling frequency from band pass consideration? 2
- (b) In a TDM-PAM 10 signals are to be transmitted with 10 KHz sampling frequency generating 10 bit per sampling. If 10 bits are required for synchronization then find out the bit transmission rate. 2
8. (a) Differentiate FSK and PSK in digital modulation. 2
- (b) Give the complete block diagram of PCM transmission section and mention the purpose of each unit. 2

GROUP- C

Answer any *one* bit : 8 × 1

9. (a) Write a program for 8085 μ p to find out the minimum number from an array of 50 numbers stored in memory location 4000 onwards. Give the meaning of each instruction. 5

(b) How do you generate 20-bit “physical address” for an instruction in 8086 μp ? 2

(c) How many memory location can be addressed by 8086 μp ? 1

10. (a) Give the block diagram of a ‘quadrature phase shift keying’ transmitter. Give the phasor diagram of QPSK. 4 + 1

(b) Define the following term : 3

(i) Flat top sampling

(ii) Anti-aliasing filter

(iii) Compandor.

[Internal Assessment – 10 Marks]
