

2017

M.Sc. Part-II Examination

PHYSICS

PAPER—XI

Full Marks : 75

Time : 3 Hours

The figures in the right-hand margin indicate full 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 *five* from the rest.

1. Answer any *five* bits : 5×3

- (a) Find the first three bands in a simple cubic lattice in [100] on the basis of empty lattice approximation.
- (b) What is meant by Mott metal to insulator transition?
- (c) Clearly distinguish luminescent and non-luminescent solid on the basis of E-q diagram.

(Turn Over)

- (d) Prove that entropy in superconducting state is lowered as compared to normal state.
- (e) Explain clearly the origin of Frenkel exciton in a solid?
- (f) Find the spectroscopic notation of Fe^{2+} having $3d^6$ electronic configuration. Also find the g value.
- (g) Find an expression of critical shear stress according to Frenkel. Estimate in a solid.
- (h) Explain what is meant by relaxation time? What is Mathisen's rule?
2. (a) Find an expression of Concentration of Schotky defects in an ionic crystal at any Temperature T.
- (b) Find an expression of diffusion coefficient in an ionic crystal.
- (c) What is meant by Madeling constant? 4+6+2
3. (a) Explain what is meant by Electrostatic screening.
- (b) Find an expression of Thomas Fermi Dielectric Function assuming electrostatic screeing in a metal.
- (c) What is meant by Screening lengths. 2+9+1
4. (a) Find an expression of energy of electron in a solid according to Tight Binding approximation. 9+3

- (b) Find the Bandwidth of a simple cubic crystal in [111] direction.
5. (a) Derive the energy expression corresponding to Landau levels in a solid.
- (b) What is De Haas Van Alphen Effect. 10+2
6. (a) What is Physical origin of domain in a Ferromagnetic solid?
- (b) Explain how can you distinguish Ferromagnetic and anti-ferromagnetic solid on the basis of exchange integral.
- (c) Derive an expression of Neel temperature in the high temperature region of an anti-ferromagnetic solid. 3+3+6
7. (a) Describe in details AC Josephson Effect and find an expression of current.
- (b) What is meant by Fluxoid. 8+4
8. (a) Describe in details the characteristics of transition in Ferroelectric solid like Barium Titanate.
- (b) Find an expression of Lorenty field in a dielectric. 7+5

Electronics Special*(Use separate scripts for Group-A and Group-B)***Analog Electronics****Group-A**Answer Q. No. 1, 2, 3 and any *two* from the rest

1. Answer any *five* questions : 5×2
- Calculate the frequency of the colour subcarrier and sound carrier for channel 5 of TV transmission.
 - Discuss the merits of electromagnetic deflection over electrostatic deflection in television picture tubes.
 - Draw the circuit diagram of a voltage controlled oscillator.
 - Why a logarithmic amplifier using matched pair of transistors cannot be used at very low and very high input voltages?
 - Draw the circuit diagram of a zero crossing detector and explain its operation.
 - Draw the cross sectional diagram of an SCR and draw its output characteristics.
 - Explain the terms 'Saturation' and 'Hue' related to colour television principle.

2. Attempt any *two* questions : 2×3
- Why negative modulation is used in TV transmission system?
 - How vertical and horizontal sync pulses are separated from the composite video signal? Explain with circuit diagram.
 - How a band stop filter can be constructed using one low pass filter and one high pass filter? Write the necessary condition of operation of this filter.
3. Attempt any *one* question : 1×4
- Draw the block diagram of a monochrome TV receiver.
 - Explain the operation details of any type of digital voltmeter with proper block diagram.
4. (a) Explain with proper circuit/block diagram, the operation details of a chopper stabilized amplifier. What are the advantages of this amplifier over simple OP-Amp amplifiers? 5
- (b) Explain the operation of a phase locked loop (PLL) with explanation of its different blocks. Hence explain how a PLL can be used as a frequency synthesizer? 5
5. (a) Explain with proper circuit diagram how Schmitt Trigger circuit can be converted to generate square

waves. Derive the expression for the output frequency of oscillation and draw the output waveforms. How can the duty cycle of the output waveform be changed? 1+3+1

(b) Draw the circuit diagram of an instrumentation amplifier using OP-Amps, which does not load emitter input terminals and derive the expression for its output voltage in terms of input voltages. 1+4

6. (a) Explain the construction details and operation of a delta gun colour picture tube with necessary diagrams. What is the need of the shadow mask in a colour picture tube? 5

(b) Discuss with picture details about the development of vertical blanking and synchronisation pulses in CCIR system-B B/W TV transmission system. 5

Digital Electronics

Group-B

Answer Q. No. 1, 2 and any two from the rest

1. Answer any three questions : 3×2

(a) What is quantization error in PAM digital communication?

(b) What are the basic differences between TTL and ECL gates?

(c) What are the different flag register in 8085 μ P ?

(d) Give the circuit of 2 bit CMOS NOR gate.

(e) Give the circuit of 1 : 4 Demux circuit.

2. Answer any three questions : 3×3

(a) Give the meaning of the following 8085 μ P Program. What will be the value of A register?

SUB A

MVI B OF

ANA B

HLT

(b) Give the writ cell structure of DRAM.

(c) Describe digital to analog conversion (D/A) with proper circuit diagram.

(d) What is CCD? Give the idea of 'bit' in CCD. How does it move?

(e) What is TDM? Explain TDM-PAM with proper sketch.

3. (a) Describe quantization process in pulse code modulation?

(b) If digital communication system is changed from 4 bit to 8 bit then what are the changes in quantum level and signal to noise ratio?

(c) What is differential pulse code modulation (DPCM)?

4+3+3

4. (a) Give the schematic block diagram of 8085 μ P showing the following items
- General purpose register
 - Address bus and Data bus
- (b) Write a program in 8085 μ P to subtract (20)decimal from (30)decimal.
- (c) Give the circuit to find out the solution of the following equation by 8 : 1 multiplexer IC:

$$Y = \sum_m (3, 4, 7) \quad 3+4+3$$

5. (a) Give the circuit of 2-bit TTL NAND gate with totempole connection and explain the operation briefly.
- (b) What are the features of ROM? Give the FPLA ROM structure to store SUM and CARRY output of a full adder.
- (c) Explain the operation of the circuit. $4+4+2$

