2016

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) Draw the first three bands in a simple cubic lattice in [110] on the basis of empty lattice approximation.

(b) Explain why polarization direction changes in a perovskite structure as temperature is lowered.

(c) Explain what is plasmon ?

(d) What is Frenkel defect & find an estimate of it at any temperature T ?

(e) Find the spectroscopic notation and effective number of Bhor-magneton of Mn^{2+} having $3d^5$ electron configuration.

(f) Superconducting tin has a critical temperature 3.7K in zero magnetic field and a critical field of 0.0306 T at 0K. Find the critical field at 2K.

(g) Distinguish the luminescent and non luminescent solid on the basis of E – q diagram.

2. Device LST relation for an ionic solid. What is meant by soft Optical phonon ? 10+2

3. Describe the essential features of Kronig Penny model. What is meant my Reduced zone scheme ? 10+2

4. (a) What is a Bloch wall ? Calculate the thickness of the wall. 8

(b) Describe in details molecular field theory of antiferromagnetism and hence find an expression of susceptibility at high temperature region.

(c) Find an expression of Neel temperature in such temperature region. 5+5+2

5. (a) Derive an expression of electrical conductivity in an ionic crystal assuming positive ion vacancy predominates.

(b) What is screw dislocation and find an expression of elastic energy per unit length of dislocation ? 6+6

6. (a) What do you mean by Flux quantization in a superconducting ring ? Derive an expression of Fluxoid in this connection.

(b) What do you mean by coherence length in a superconductor ? Find an expression of coherence length. 6+6

7. (a) Describe in details the characterestics of a Ferroelectric material.

(b) Device an expression of Lorentz field assuming a dielectric.

(c) Describe the characterestics of transition in Ferroelectric like Rochelle salt. 3+2+7

8. (a) Describe in details De Haas Van Alphen Effect .

(b) Explain the mechanism thermoluminescence in solid and find an expression of infinity of luminescence. 6+6

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(Applied Electronics Special)

Group–A

[Marks : 40]

Answer Q. No. *1, 2, 3* and any *two* from the rest.

1. Answer any *five* questions : 5×2

(a) Explain the operation of a precision detector with necessary circuit diagram.

(b) 'An analog phase detector is nothing but an analog multiplier' . — Explain.

(c) Explain the operation of a chopper modulator.

(d) Explain how a Phase Locked Loop (PLL) can be used for demodulation of FM signal ?

(e) What are the characteristic features of a regulated power supply ?

(f) Find the length of the dipole of an Yagi-Uda antenna for reception of channel 8 (Band III).

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

2. Answer any *two* questions : 2×3

(a) Give the schematic block diagram of a monochrome TV system.

(b) What do you mean by horizontal and vertical synchronisation ? Write the values of horizontal and vertical synchronisation frequencies for CCIR–B transmission system.

(c) Draw the circuit diagram of a voltage controlled oscillator and write down the expression for its output frequency.

3. Attempt any *one* question : 1×4

(a) Draw the cross-sectional diagram of a TRIAC. Explain its use as a light dimmer with necessary circuit diagram.

(b) Give a neat circuit diagram of differential instrumentation amplifier using a transducer bridge.

4. (a) What is the advantage of a digital voltmeter over analog one ? With supporting block diagram discuss the method of developing a staircase ramp type digital voltmeter. 1+4

(b) Draw the circuit diagram of a 2nd order Butterworth active low pass filter (LPF) and derive the expression for its transfer function. Show that the pass-band gain of the filter should be 1.586 only to act as a 2nd order Butterworth low pass filter. 1+3+1

5. (a) Draw the circuit diagram of a logarithmic amplifier using matched pair of transistors and derive the expression for its output voltage in terms of its input voltage. Why this amplifier cannot be used for input voltages of the order of several millivolts ? 1+3+1

(b) Draw the circuit diagram of a triangular wave generator and derive the expression for the frequency of the generated triangular waveform. How can you change the offset value of the output triangular wave ? 5

6. (a) Write a short note on the construction details and operation of a monochrome TV video camera. 5

(b) What is interlaced scanning and why it is used in TV transmission system ? Distinguish between even and odd fields. What are the values of field frequency and frame frequency used in Indian TV transmission system ? 2+2+1

Group–B

[Marks : 35]

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

1. Answer any *three* bits : 3×2

(a) Draw the circuit of CMOS transmission gate and explain briefly.

(b) If a signal has 20 kHz maximum frequency then what will happen in case of

(i) 30 kHz surrounding frequency

(ii) 60 kHz surrounding frequency.

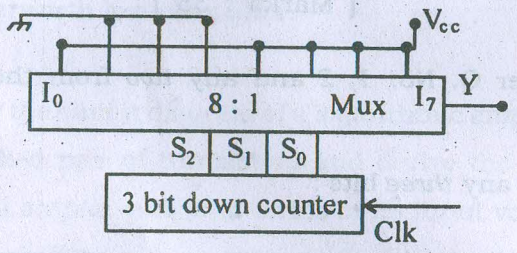
(c) If a memory cell is specified as (64K × 32) then :

(i) How many data bus are there ?

(ii) How many address bus are there ?

(iii) What is the capacity in byte ?

(d) Draw the waveform of the following circuit.



(e) Mention advantages of digital communication over analog communication.

(f) Comment on the application of microprocessor in relation to digital computer.

2. Answer any *three* questions : 3×3

(a) Design a 3 : 8 decoder circuit using NAND gate.

(b) Write the basic differences of 8085 & 8086 μp in address bus, data bus and general purpose register.

(c) Give the unit cell structure of S RAM using MOSFET.

(d) Explain the operation of 2 ipnt TTL NAND gate.

(e) What is aparture effect in digital communication ? So that sampling pulse width 'τ' should not be too small or too big.

3. (a) Show that in 'T1' transmission line, where the frame consisting of 24 voice signals, the required speed is 1.54 MBPS.

(b) A continuous time signal is given below :

$x(t) = 8 \cos 200\pi t$

Determine (i) the minimum sampling rate and (ii) if the sampling frequency fs = 400 Hz, What would happen ?

(c) What do you mean by amplitude shift keying ?

How it is different from F.S.K. ? 3+3+4

4. (a) Give the block diagram of A.L.U. What are the different actions that can be excuted by A.L.U. ?

   (b) Explain how 20 bit physical address is formed from 16 bit register in 8086 μp.

   (c) Write a program to add 20 data stored in memory location 3000 onwards in 8085 μp. 3+3+4

5. (a) Design 3 input CMOS NAND gate and explain briefly.

   (b) Compare T T L and ECL by their characteristics features.

   (c) Write a short note on any one of the following memory (i) CCD or (ii) DVD. 3+2+5
