2015

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) Show that change of thermal entropy in a perfect crystal is zero.

   (b) The E-k relation in a particular semiconductor is given by $E = Ak^2 + Bk^3$, where A and B are positive constants. Find the wavevector for which the electron group velocity

is zero. Determine also electron effective mass at this wavevector.

(c) Find the spectroscopic ground state and effective number of Bhor magneton of Fe^{3+} having $3d^5$ electronic configuration.

(d) Find an expression of critical shear stress in a solid according to Frenkel estimate.

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

(f) Explain Motts metal to insulator transition in a solid.

(g) Clearly distinguish the characteristics of type I and type II superconductors.

(h) Derive Clausius Mosolti relation in a dielectric. What is polarisation catastrophe.

2. (a) Derive Thomas Fermi screening length in a solid.

(b) What is polaron ?   10+2

3. (a) Find an expression of equilibrium concentration of Schotky defects in a solid at a temperature T.

(b) Find an expression of diffusion coefficient in an ionic crystal.   5+7

4. (a) Derive energy of electron in a solid according to Tight Binding Approximation.

(b) Find the bendwidth of a simple cubic crystal along [III] according to Tight Binding Approximation.   9+3

5. (a) Apply Landu's theory of Phasi transition to Rochelle Salt & hence show all the characteristics for this sample.

(b) What is meant by dielectric loss ?   10+2

6. (a) Device London equation for a superconductor. Derive Meissner effect from London equation.

(b) Explain what is the origin of energy gap in a superconductor.

(c) What is fluxoid ?   7+3+2

7. (a) Derive Exchange energy in a Ferromagnetic solid on the basis of Heitler London Scheme.

(b) What is Magnon ?   10+2

8. (a) What is the physical origin of energy gap in a solid ?

(b) What is meant by DeHaasVan Alphen Effect ?

(c) How will you determine Fermi Surface experimentally ?   5+5+2

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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) Draw the circuit diagram of an instrumentation amplifier which will not load both the input signals.

   (b) How extra high tension in generated in a TV receiver ?

   (c) Draw the block diagram of any type of digital voltmeter.

   (d) Why logarithmic amplifier is unsuitable for use with very low and very high input voltages ?

   (e) Differentiate between capture range and lock-in range of a PLL.

   (f) Explain how a band stop filter can be realised using a given LPF and a HPF. What is the necessary condition ?

   (g) Find out the frequencies of picture carrier and sound carrier for the channel 6 in CCIR system B TV transmission system.

2. Answer any *two* questions :   2×3

   (a) Explain the operation of a phase locked loop as a programmable frequency divider.

   (b) Draw the circuit diagram of a triangular wave generator and write down the expression for the frequency of oscillation.

   (c) Explain the operation of a D flip flop as a digital phase detector.

3. Attempt any *one* question :   1×4

   (a) What are the advantages of using negative modulation over positive modulation in case of TV transmission ? Explain with necessary diagrams.

   (b) Draw the circuit diagram of a series voltage regulator using an OP-Amp as a comparator and a transistor as a pass element. Derive the expression for its output regulated voltage.

4. (a) What do you mean by a regenerative comparator ? Draw the circuit diagram of a regenerative comparator using OP-Amp and explain its operation with necessary theory.

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(b) How can the circuit of a regenerative comparator be modified to generate a square wave signal with necessary circuit diagram ? Derive the expression for the output frequency of oscillation and draw the output waveforms.

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5. (a) What do you mean by Butterworth response of active filters ? Draw the circuit diagram of an active all pass filter and derive the expression for its transfer function as a function of frequency. What is the use of such type of filter ?   1+3+1

(b) Draw the cross-sectional diagram of a silicon controlled rectifier and its two transistor equivalent circuit. Also draw its I-V characteristics with proper labelling of different voltages and currents and explain analytically its I-V characteristics.   1+1+1+2

6. (a) Explain the construction details and operation of a monochrome TV picture tube with necessary diagram.

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(b) Discuss about the development of vertical blanking and sync pulses in CCIR system-B TV transmission standard.

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(Applied Electronics Special)

Group–B

[Marks : 35]

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

1. Answer any three bits :   3×2

   (a) What is amplitude shift keying ?

   (b) What do you mean by anti-aliasing filter ?

   (c) What is the difference between PCM and DPCM ?

   (d) Name different register in 8085 μp.

   (e) Give the idea of data and address multiplexing in 8085 μp.

2. Answer any three questions :   3×3

   (a) What are the different characteristic parameters of SCR ?

   (b) State the concept of FDMA.

   (c) Give the basic idea of PCM.

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(d) Give the circuit of A/D converter. Explain briefly.

(e) Mention different control unit of 8085 μp.

3. (a) What is sampling theorem ? Explain briefly sample and hold system.

(b) What are the conditional and unconditional jump in 8085 μp programming ? Explain with example.

(c) Explain the idea of PSK modulation.

(d) What do you mean by MOV BA ?   3+3+3+1

4. (a) State the idea of TDMA in digital communication.

(b) Write a short note on Triac.

(c) Explain with example, the operation of instruction by timing diagram in 8085 μp.   4+3+3

5. (a) Describe the phenomena of quantization in PCM. How the error comes into account ?

(b) Write a short note on oscilloscope.

(c) Give the idea of digita voltmeter.   4+4+2

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