PG/IVS/PHS-404/15

M.Sc. 4th Semester Examination, 2015

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

PAPER – PHS-404

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

1. Answer any *five* bits : 2 × 5

   (*a*) Explain what is meant by Quenching of orbital angular momentum ?

   (*b*) Find the Hund's ground state for Cr^{2+} having $3d^4$ electron configuration.

(*c*) Explain how inductive impedance arises in a superconductor ?

(*d*) What is the origin of positive surface energy in a superconductor.

(*e*) Explain what is meant by Garnet ?

(*f*) Explain how ESR is able to detect a defect, in a solid ?

(*g*) Prove that entropy in a superconductory state is lower than normal state.

(*h*) What is Bloch $T^{3/2}$ law ?

2. (*a*) Find the effective number of Bhor magneton in case of narrow multiplets of a paramagnetic material. 6

(*b*) How does the effective number of Bhor magneton is modified in case of iron group ion. 2

(*c*) State the meaning of wide multiplet in case of paramagnetic system. 2

3. (*a*) Explain what is the origin of spin waves in a solid according to Bloch ? 2

(*b*) Derive the dispersion relation for spin waves in one dimension assuming nearest neighour interactions. 8

4. Explain exchange interaction in a Ferromagnetic solid on the basis of Hitler London scheme and hence find an expression of exchange interaction energy. 10

5. (*a*) Explain what is meant by persistent current and why the duration of thin current is large. 4

(*b*) Prove that the quantum of flux in superconductor can be expressed as

$$\phi_0 = \frac{2\prod\hbar c}{q}.$$ 6

6. (*a*) What is meant by cooper pairs ? 2

(*b*) Prove that electron-phonon-electron interaction in a superconductor is altractive. Derive the necessary expression. 8

7. What is magnetic resonance ? Explain the mechanism of electron spin resonance in a solid ? What is meant by spin-spin interaction. 2 + 5 + 3

PHS-404(A)

[*Marks* : 20]

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

1. Attempt any *five* questions : 2 × 5

(*a*) Why vestigial side band modulation is used in the modulation of video signal in TV transmission system ?

(*b*) Find the length of the dipole of an Yagi-Uda antenna used for receiving channel 7 (Band III).

(*c*) Why TEM mode is not possible in a wave guide ?

(*d*) Why green colour difference signal is not used in colour signal transmission ?

(*e*) How horizontal and vertical blanking pulses are separated form the composite video signal ?

(*f*) Differentiate between even field and odd field.

(*g*) Differentiate between TE and TM mode.

2. (*a*) With proper diagram discuss the construction and operation of a monochrome TV picture tube. 5

(*b*) Discuss about the development of vertical blanking and synchronisation pulses in CCIR system-B TV transmission system. 5

3. (*a*) Explain the operation of a staircase ramp type digital voltmeter with proper block diagram. 4

(*b*) How can you convert a digital voltmeter into a digital ohmmeter ? 2

(*c*) Why a coaxial cable cannot be used at microwave radio frequencies ? Which type of transmission line is used at these frequencies and why ? 4

PHS-404(B)

[*Marks* : 20]

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

1. Answer any *five* questions : 2×5

(*a*) Why 8085 microprocessor generater ALE signal.

(*b*) Show that $f(t) = \sum_{-\alpha}^{\alpha} e^{jnw_0 t}$ forms the orthogonal set of basis signals.

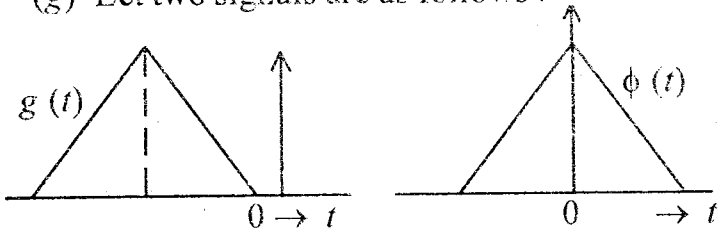
(*c*) What are slope overload and granular distortion in Delta Modulation technique.

(*d*) Find the Fourier transform of a delta function and show its waveform. Comment on the nature of the signal.

(*e*) State and explain Parsevals theorem.

(*f*) What are energy and power signals ?

(*g*) Let two signals are as follows :



Find $g(t-T)$ and $g(t+T)$

and $\phi(2t)$ and $\phi(t/2)$.

2. (*a*) State sampling theorem. 2

(*b*) Prove the sampling theorem with the help of frequency convolution. 4

(*c*) How does the original signal may be recovered from the sampled signal. 4

3. (*a*) Design and explain the circuit operation to generate PWM and PPM signals with the help of 555 timer. 6

(*b*) How ASX, FSX and PSX are generated. 4
