RF-3475-76/100

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M. Sc. - I Examination

April / May – 2010

Electronics : Paper - III

(Communication Electronics - I and Solid State Devices)

Time : Hours] [Total Marks : **52**

RF-3475

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :
☛ M. Sc. - 1

Name of the Subject :
☛ Electronics - 3

☛ Subject Code No. : 3 4 7 5 ☛ Section No. (1, 2,.....) : 1

Seat No. :

Student's Signature

(2) Answers to the two sections must be written in separate answer books.
(3) Figures to right hand side of each question indicate full marks.
(4) Assume the data if necessary.

1 (a) Discuss the different forms of pulse modulation. 2

(b) Give the comparison of various amplitude modulation systems. 3

(c) The signal $v(t) = \cos 5\pi t + 0.5\cos 10\pi t$ is instantaneously sampled. The interval between samples is T_S. 3

(i) Find the minimum allowable value for T_S

(ii) If the sampling signal is $S(t) = 5 \sum_{k=\infty}^{\infty} \delta\,(t-0.1\,k)$

the sampled signal $v_S(t) = v(t)s(t)$ consists of a train of impulses each with a different strength

$$v_S(t) = \sum_{k=-\infty}^{\infty} I_k\ \delta(t-0.1k)$$, Find I_0, I_1 and I_2.

2 (a) Explain the importance of second order phase locked loop. Explain the operation of it. 5

(b) The waveform $v(t) = (1 + \mu \cos w_m t)$, with $(\mu \le 1)$ is applied to the diode demodulator. Show that, if the demodulator output is to follow the envelope of $v(t)$, it is required that at any time to 4

$$\frac{1}{RC} \ge w_m \left(\frac{\mu \sin w_m t_o}{1 + \mu \cos w_m t_o} \right)$$

OR

2 (a) With necessary block diagram, explain the working of a delta modulator system. What is the drawback of this system. 5

(b) For a signal $v(t) = A_1 \cos(w_1 t + \theta_1) + A_2 \cos(w_2 + \theta_2)$. 4

Find the autocorrelation function $R(y)$ and the power of a signal $v(t)$.

3 (a) Discuss the importance of sampling in communication system. State and prove sampling theorem. 5

(b) The first stage of a two stage amplifier has voltage gain of 12, input resistance of 500 Ω, equivalent noise resistance of 1200 Ω and output resistor of 20 kΩ. The second stage has voltage gain of 16, input resistance of 10 kΩ, equivalent noise resistance of 12 kΩ and output resistor of 600 kΩ. Calculate the equivalent input noise resistance for this two stage amplifier. Also compute the total voltage at the input of the first stage given that the bandwidth of amplifier is 10 KH_2 and T = 27°C. 4

OR

3 (a) (i) Explain the concept of random process. 4

(ii) Define the cumulative distribution function and show that it is a non decreasing function. 1

(b) Derive the radar range equation. Discuss the factors influencing the maximum radar range. 4

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Name of the Examination :

☛ **M. Sc. - 1**

Name of the Subject :

☛ **Electronics - 3**

☛ Subject Code No. : **3 4 7 6** ☛ Section No. (1, 2,.....) : **2**

Seat No. :

Student's Signature

(2) Answers to the two sections must be written in separate answer books.

(3) Figures to right hand side of each question indicate full marks.

(4) Assume the data if necessary.

4 (a) What is backward diode? Explain the operation of it. What are its applications? 2

(b) Draw the basic equivalent circuit of a tunnel diode and derive the expressions for reactive cut-off frequency and resistive cut-off frequency. 3

(c) What are the advantages of Schottky based FET over a normal JFET? 3

5 (a) Discuss various modes of operation of a gunn oscillator. 5

(b) Draw the switching circuit using an n-p-n transistor and explain it. Derive the expression for turn on time τ_o. 4

OR

5 (a) Explain the second breakdown phenomenon in power transistor. 5

(b) Consider a sinusoidally modulated optical signal P(t) of frequency w, modulation index m and average power P_o given by 4

$P(t) = P_o\,[1+m\cos wt]^2$

Show that when this optical signal falls on a photodetector, the mean square signal current is given by

$$\langle i_s^2 \rangle = (R_o P_o)^2 + \frac{1}{2}(m\, R_o P_o)^2$$

where R_o is the responsivity.

6 (a) Draw the energy band diagram of p-n junction diode showing the intrinsic Fermi level, quasi Fermi level and carrier distributions under the forward and reverse biased conditions and comment on it. 5

(b) Using basic device model, draw the energy band diagrams of two isolated semiconductors (forming heterojunctions) in which the space charge neutrality is assumed to exist in each region and explain it. 4

OR

6 (a) Using necessary I-V characteristics, explain three different regions of transistor switching. 5

(b) Using thermionic emission theory, derive the equation of the carrier density flowing the metal-semiconductor junction diode. 4