End Semester Examination of Semester–I, 2015
Subject : PHYSICS (PG)
Paper : PHS–104 (Theory)
Group : A & B
Full Marks : 40
Time : 2 Hrs

The figures in the margin indicate the marks corresponding to the question

Candidates are requested to give their answers in their own word as far as practicable.

Illustrate the answers whenever necessary

Use separate Answer scripts for Group A and Group B

Group A (Mark 20)

Answer Question **No. 1** and **any one** out of Question **No. 2** and Question **No. 3.**

1. Answer **any five** questions: 2x5=10

    i) What is Omni-directional antenna?

    ii) Design the load circuit for a linear diode detector if the signal of 4 Kc/s with 70% modulation is to be detected satisfactorily (consider R = 1 kΩ).

    iii) What are the factors that determine whether the wave will be reflected from ionosphere or not?

    iv) Which type of diode should be used for the demodulation of AM signal and why?

v) Which frequency band is used for satellite communication and why?

vi) What do you mean by radiation resistance of an antenna and write down its expression.

vii) Briefly discuss why are audio signals hot directly transmitted and what is the need of modulation.

viii) Explain the terms dispersion and losses in a fibre optic communication system.

2. a) Draw the circuit diagram of balanced modulator and explain how DSB-SC signal can be generated using it.   5

b) For a DSBTC signal prove that total power

$$P_T = P_C\left(1+\frac{m^2}{2}\right),$$ where P_C is the Carrier power and

m is the modulation index.   3

c) Explain the principle of operation of an envelope detecter.   2

3. a) Explain how light is guided inside an optical fibre, discuss acceptance angle and numerical aperture.
     2+1+1

b) Derive radar range equation. Explain how the maximum range covered by a radar can be increased?   3+2

c) What do you mean by geostationary satellites?   1

Group – B (Mark 20)

Answer Question **No. 1** and **any one** out of
Question **No. 2** and Question **No. 3.**

1. Answer **any five** questions: 2x5=10

    i)   Express the Boolean function F(A, B) = A + B in
         canonical form and draw its K. M.

    ii) What is Redundant group? Give an example.

    iii) What do you mean by 2-level AND–OR
         implementation? Give an example.

    iv) What is propagation delay? Discuss its effect on the
         response of a logic-gate.

    v)   How many 74LS00 NAND-gates inputs can be
         connected to the output of 7400 when the output of
         one gate of 7400 is in the HIGH state?

         (Given : $I_{OH(max)}$ for 7400 is -400 μA and $I_{IH(max)}$ for
         74LS00 is 20 μA)

    vi) Draw a 4-to-1 multiplexer and give the corresponding
         truth table.

    vii) Explain with ckt-diagram the operation of a parity
         checker.

    viii) Show that a NAND-NAND circuit is equivalent to
         an AND-OR circuit.

2. a) What is a Karnangh map? Simplify to a minimized expression for

$$Y = F(A,B,C) = \overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}C + \overline{A}BC + A\overline{B}C,$$

using Karnangh map. 1+3

b) Sketch the segments in a 7–segment indicator and give the corresponding truth–table of BCD–7–segment decoder. 1+2

c) What is a magnitude Comparator? Draw the logic circuit of a 1-bit digital comparator and explain its operation. 3

3. a) What is a demultiplexer? show how two 1-to-16 demultiplexers can be connected to get a 1-to-32 demultiplexer. 1+2

b) Casecade two 4-to-1 MUX IC-chips (IC–74153) to make an equivalent 8-to-1 MUX and explain its operation. 4

c) Draw the circuit diagram of an odd parity generator with 8-bit input and explain its operation. 3