End Semester Examination of Semester–I, 2016
Subject : PHYSICS (PG)
Paper : PHSPG–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 over modulation in AM? Why is over modulation undesirable?

    ii) What is Secant law in case of radiowave propagation and what its significance?

    iii) What is 'Perigee' and 'Apogee' position of a elliptical path of an satellite?

    iv) What is TDM and FDM in digital/analog communications?

v) Write down radar range equation. How the range can be increased?

vi) What is fading? What is duct propagation?

vii) State Cason's rule of thumb for bandwidth of FM. Calculate the bandwidth of a FM having modulating signal frequency of 10 KHz and a maximum frequency deviation of 50 KHz.

viii) What is radiation resistance of a thin linear antenna?

2. a) Draw a circuit diagram of Balanced slope detector for demodulation of FM signal and describe its operation qualitively. Also draw the transfer characteristics curve for it.

An FM transmitter sends out a 100 MHz carrier wave frequency modulated by a 15 KHz sinusoidal audio signal. The maximum frequency deviation is 30 KHz find the modulation index.

b) What is Doppler radar? (2+3+3)+2

3. a) What is acceptance angle of an optical fibre and how is it related to the refractive indices of the core and claddings.

b) Explain the working principle of the optical fibre communication system. If the optical power launched into on optical fibre of length 9 m is 1.8 mW and optical power emending out from other end of the fibre is 9 μW, compute the attenuation in the fibre.

c) Deduce the height of a Geo-stationary satellite. 4+4+2

(3)

Group–B (Mark 20)

Answer **Q1**, and any **one** out of **Q2** and **Q3**:

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

   i) Design a logic circuit to realise the function
   $F = W\overline{X}\overline{Y}Z + W\overline{X}\overline{Y}\overline{Z}$ using only AND and OR-gates. The number of inputs to any gate should not exceed two.

   ii) Discuss Fan-in and Fan-out of a logic family.

   iii) Implement the function $F = \sum m(1,4,7,10,14,15)$ using 2-level NAND-NAND circuit.

   iv) Write the electrical characteristic of basic TTL circuit.

   v) Using AND-OR-AND structure find a 3 level circuit to realise the function
   $F(A, B, C, D) = (A + B + C)(A + B + D)(A + C + D)(B + C + D)$.

   vi) Design a logic circuit of 2–to–4 decoder.

   vii) If 1 KHz and 2 KHz signals are applied in input of an Ex-OR gate then draw the output waveform.

   viii) What is add parity? Give the truth table of odd parity generator for a 4-bit input system.

2. a) Design a BCD to Binary Code Convertor and explain its operation.

b) Write down the conversion table for a 4 bit binary-to-BCD converter. Hence find the minimal expression for BCD output and implement the circuit.   5+(2+2+1)

3. a) Design two-input NMOS NAND gate and explain briefly.

b) Map the following functions in a suitable K. Map and simplify them–

i) $F_1 = \sum m(0, 2, 3, 7, 8, 9, 10, 11, 13)$

ii) $F_2 = \Pi M(0, 5, 8, 9, 11, 12, 15)$ 4+(3+3)