Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech (EIE-NEW)/SEM-7/EI-701/2010-11
2010-11
TELEMETRY AND REMOTE CONTROL

Time Allotted : 3 Hours   *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words
as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :   10 x 1 = 10

   i)   What is the equivalent Hamming code of 1010 ?

   a)   1110010

   b)   1010010

   c)   1011010

   d)   1111010.

   ii)   What is the bit rate, if a signal of a bandwidth of 5 kHz is sampled at Nyquist sampling rate and digitized into 8-bit per sample ?

   a)   20 kB/s   b)   40 kB/s

   c)   80 kB/s   d)   160 kB/s.

CS/B.Tech (EIE-NEW)/SEM-7/EI-701/2010-11

iii) In Baudot system, the information pulse width is 20 ms and stop pulse width is 28·4 ms. The baud rate is

a) 50   b) 35

c) 10   d) 7.

iv) A 20 bit data format consists of 16, for bits of information and 4 bits for parity and sign. What is the efficiency ?

a) 100%   b) 80%

c) 75%   d) 60%.

v) What is the frequency deviation for carrier frequency of 22 kHz in standard PBW format of IRIG stipulation ?

a) 1·1 kHz   b) 2·2 kHz

c) 3·3 kHz   d) 4·4 kHz.

vi) Which of the following types of intensity modulation exhibits better signal to noise ratio ?

a) AM-IM   b) PM-IM

c) FM-IM   d) DSB-IM.

vii) What is the function of WDM ?

a) Change the transmission speed of the input signal

b) Combine signals of different wavelengths to pass through a single fibre

c) Separate signals of different wavelengths and couple them to different detectors

d) Tap off part of energy of the incoming signal.

CS/B.Tech (EIE-NEW)/SEM-7/EI-701/2010-11

viii) Which one is the fastest type of ADC ?

    a)   Slope integration type

    b)   Successive approximation type

    c)   Parallel type

    d)   Counter type.

ix) A TDM system comprises twenty-four channels with quantization level of 0·5 mV and maximum analog signal of 2·048 V. What will be the frame length in terms of number of bits ? Assume one channel is allotted for synchronization.

    a)   25   b)   150

    c)   300   d)   600.

x) For step index fibre of core diameter of 50×10^{-6} m and NA of 0·352, what is the number of modes for $\lambda = 55 \, \mu m$?

    a)   2   b)   4

    c)   8   d)   16.

xi) Which one is better for satellite telemetry system ?

    a)   CDMA   b)   FDMA

    c)   TDMA   d)   None of these.

xii) The design of TDM system is better with which of the following ?

    a)   JFET   b)   Bipolar transistor

    c)   MOSFET   d)   Gunn diode.

CS/B.Tech (EIE-NEW)/SEM-7/EI-701/2010-11

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. a) What do you mean by differential coding ? Explain with block diagram the scheme of differential coding.

   b) Prove that in case of differential coding always we obtain the correct output.   1 + 2 + 2

3. Draw the detail block diagram of an Earth station & explain the functions of each block.

4. a) What do you mean by the 'figure of merit' of the optical fibre ? How does the channel bandwidth vary with the fibre length ?

   b) In a fibre-optical cable the refractive indices of the core, cladding and air are 1·59, 1·56 and 1·00 respectively. Calculate the critical incidence angle and the numerical aperture.   1 + 2 + 2

5. Explain the operation of a QPSK receiver with the help of a block diagram.

6. Schematically explain the operation of a PLL and its application as a frequency divider.   3 + 2

CS/B.Tech (EIE-NEW)/SEM-7/EI-701/2010-11

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

7.   a)   How does TDM system differ from FDM system ?   2

     b)   Draw a hardware circuit and explain the operation of a 8-channel TDM-PAM telemetering transmitter system and draw the pulse waveforms at the outputs of the clock generator, counter, multivibrator and gates for one time-frame.   8

     c)   If the sampling frequency is 8 kHz and we use 8-bit ADC then calculate line speed of two channel TDM-PCM.   2

     d)   Describe the operation of sample and hold circuit with suitable circuit diagram.   3

8.   a)   What are the differences between connectors and splices ? Where connectors are used in optical fibre telemetry system ?   1 + 2

     b)   Explain different techniques for splicing with suitable diagram.   4

     c)   Draw and explain detail circuit diagram of the transmitter and receiver of optical fibre telemetry system.   4

CS/B.Tech (EIE-NEW)/SEM-7/EI-701/2010-11

d) When the mean optical power launched into an 8 km length of fibre is 120 µW, the mean optical power at the fibre output is 3 µW. Determine :

    i) the overall signal attenuation or loss in decibels through the fibre assuming there are no connectors or splices.

    ii) the signal attenuation per kilometre for the fibre

    iii) the overall signal attenuation for a 10 km optical link using the same fibre with splices at 1 km intervals, each giving an attenuation of 1 dB.

    iv) The numerical input/output power ratio in 8 (c). 4

9. a) What do you mean by pipeline telemetry ?   3

    b) Explain the operation of a position telemetry system using synchro transmitter and receiver.   4

    c) Determine the orbital velocity of a satellite moving in a circular orbit at a height of 150 km above the surface of earth given that gravity constant $G = 6 \cdot 67 \times 10^{-11} \, \text{N-m}^2/\text{kg}^2$, mass of the earth $M = 5 \cdot 98 \times 10^{24}$ kg, radius of earth $R = 6370$ km.   3

    d) What are the advantages and disadvantages of satellite communication system ?   5

7003   6

CS/B.Tech (EIE-NEW)/SEM-7/EI-701/2010-11

10. a) Explain the functioning of TT & C subsystems of a satellite communication system with necessary sketches. 8

   b) Mention the different subsystems in

   i) satellite stations and

   ii) earth stations.

   How do they work for data transfer and other functions ? 7

11. Write short notes on any *three* of the following : 3 × 5

   a) Frequency telemetry system

   b) Satellite telemetry and MA techniques

   c) Smart and intelligent telemetry system

   d) Optical detectors used in telemetry system

   e) Importance of M2M system in modern society.