

**NRT/KS/19/2170**

**Bachelor of Science (B.Sc.) Semester—VI Examination**  
**ELECTRONICS, FIBER OPTICS, COMMUNICATION AND DIGITAL ELECTRONICS**  
**Optional Paper—2**  
**(Physics)**

Time : Three Hours]

[Maximum Marks : 50

**Note** :— (1) All questions are compulsory.

(2) Draw neat and labelled diagrams wherever necessary.

**EITHER**

1. (A) What do you understand by transistor oscillator ? Draw the circuit diagram and explain the working of Colpitt's oscillator. Write the expression for frequency of oscillation. 5
- (B) (i) Draw the circuit diagram of a transistor RC phase shift oscillator and explain its working. 3
- (ii) In a phase shift oscillator  $R_1 = R_2 = R_3 = 500 \text{ k}\Omega$  and  $C_1 = C_2 = C_3 = 100 \text{ pF}$ . Find the operating frequency. 2

**OR**

- (C) Explain classification of amplifiers on the basis of position of operating point. 2½
- (D) Explain the working of OP-Amp as a differentiator. 2½
- (E) What are the different parameters of OP-Amp ? Explain. 2½
- (F) An operational amplifier is used as an inverting amplifier. It is required that the closed loop gain of the inverting amplifier should be  $-50$ . Evaluate the values of the resistor,  $R_2$  required in the circuit if  $R_1 = 20 \text{ k}\Omega$ . 2½

**EITHER**

2. (A) What is optical fibre ? Explain function of core and cladding of the fibre. Explain how light propagated through optical fibre. 5
- (B) (i) Define Numerical Aperture. Derive an expression for Numerical Aperture. 3
- (ii) Calculate the refractive indices of the core and cladding material of a Fibre from the following data : N.A. = 0.22,  $\Delta = 0.012$ . 2

**OR**

- (C) Define Acceptance Angle. Obtain an expression for it. 2½
- (D) For an optical fibre, the refractive index difference is 2%. Calculate the numerical aperture and the critical angle if  $n_1 = 1.58$ . 2½
- (E) State different types of optical fibre based on refractive index profile. Explain Graded index fibre. 2½
- (F) What are the advantages of optical fibre communication over other modes of communication ? 2½

**EITHER**

3. (A) What are the different types of Modulation ? Give the analysis of frequency modulation and give the frequency spectrum of FM waves. 5
- (B) (i) Derive an expression for power in AM wave. 3
- (ii) A carrier wave of frequency 670 kHz and peak value 10 V is amplitude modulated by 5 kHz signal. The maximum change in amplitude is 5V; determine the modulation index and range of side frequencies. 2

**OR**

- (C) Compare the amplitude modulation with frequency modulation. 2½
- (D) Discuss the frequency spectrum of A.M.wave. 2½
- (E) Define the term modulation index and deviation ratio. 2½
- (F) A bandwidth of 15 MHz is available for AM transmission. If the maximum audio signal frequency used for modulating the carrier is not be exceed 15 kHz, how many stations can broadcast within this band simultaneously without interfering with each other ? 2½

**EITHER**

4. (A) Explain working of full subtractor with logic diagram. Draw its Truth Table and write expression for borrow and difference. 5
- (B) (i) Explain method of conversion of decimal number into equivalent binary number. Convert decimal number (15.625) into binary number. 3
- (ii) Convert octal number (15.21) into its binary equivalent. 2

**OR**

- (C) Explain with suitable logic diagram, how NOR gates only can be used to construct AND, OR, NOT and NAND gate. 2½
- (D) What is Hexadecimal number system ? Convert  $(9F2.1A)_{16}$  into binary equivalent. 2½
- (E) State and prove De Morgan's theorems. 2½
- (F) Reduce the expression  $Y = ABCD + ABCD$  and draw logic diagram for reduced equation. 2½
5. Attempt any **ten** of the following :—
- (i) State any two characteristics of ideal OP Amp.
- (ii) Give the Pin diagram of IC741.
- (iii) Define Slew rate.
- (iv) Compute the acceptance angle of an optical fibre from the following data  $n_1$  (core) = 1.55 and  $n_2$  = (cladding) = 1.50.
- (v) Define Acceptance Cone.
- (vi) Define bandwidth length product.
- (vii) State any two drawback of amplitude modulation.
- (viii) Define Phase Modulation.
- (ix) A modulated carrier wave has maximum and minimum amplitudes of 750 mV and 250 mV, calculate the value of percentage modulation.
- (x) Draw logic diagram of X-NOR gate and its symbol.
- (xi) Define nibble and Byte of a data.
- (xii) If  $(110.11)_2 = (X)_{16}$  find X. 1×10=10