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

N.B. :— (1) **All** questions are compulsory.

(2) Draw neat and labelled diagrams wherever necessary.

EITHER

1. (A) What is an electronic oscillator ? Draw the circuit diagram and explain the working of Hartley oscillator. Write an expression for the frequency of oscillation. 5

(B) (i) Draw the circuit diagram of a transistor RC phase shift oscillator and explain its working. 3

(ii) In phase shift oscillator, $R_1 = R_2 = R_3 = 1$ MΩ and $C_1 = C_2 = C_3 = 75$ pf. At what frequency does the circuit oscillate ? 2

OR

(C) Define Slew Rate. Obtain an expression for slew rate when sinusoidal input signal is applied. 2½

(D) Explain the working of OP-Amp as an Integrator. 2½

(E) An OP-AMP with closed loop gain of 36 operated in non-inverting mode, find the feedback resistor R_f if input resistance $R_1 = 1$ kΩ. 2½

(F) Draw the block diagram of OP-AMP. Explain function of each block in short. 2½

EITHER

2. (A) What is an optical fibre ? Give its structure and explain the propagation of light wave in an optical fibre. 5

(B) (i) Define acceptance angle. Derive an expression for acceptance angle of an optical fibre. 3

(ii) For a 5 km long fibre with $\mu_{core} = 1.42$ and $\mu_{clad} = 1.38$. Find the intermodal dispersion in fibre. 2

OR

(C) What is Numerical Aperture ? Obtain an expression for it. 2½

(D) Calculate the Numerical Aperture, acceptance angle and critical angle of fibre having core refractive index 1.5 and refractive index of cladding 1.45. 2½

(E) State different types of optical fibre based on refractive index profile and explain step index optical fibre. 2½

(F) What are the advantages of optical fibre communication over other modes of communication ? 2½

EITHER

3. (A) What is Amplitude Modulation ? Obtain an expression for an amplitude modulated wave and show that it contains upper and lower side bands alongwith the carrier wave. 5

(B) (i) Define modulation factor. Show that the percentage modulation is given by $\frac{V_{c(max)} - V_{c(min)}}{V_{c(max)} + V_{c(min)}}$. 3

(ii) The load current in transmitting antenna of an unmodulated AM transmitter is 6 A, what will be the antenna current when modulation is 60% ? 2

OR

(C) Derive an expression for total power contained in an amplitude modulated wave. 2½

(D) Discuss the frequency spectrum of frequency modulated wave. What are the significant side bands ? 2½

(E) The centre frequency of FM carrier wave is 105 MHz. The highest frequency of the modulating signal is 105.04 MHz, when modulated by a signal of 8 kHz. Find the modulation index. 2½

(F) What are the advantages of FM over the AM ? 2½

EITHER

4. (A) Explain the working of full Adder with truth table and logic diagram. Simplify the following Boolean equation :

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

Draw the logic diagram of simplified equation. 5

(B) (i) Explain method of conversion of decimal number into equivalent binary number. Convert decimal number (75.125) into equivalent binary number. 3

(ii) Convert octal number (635.472) into its binary equivalent. 2

OR

(C) Explain NOT, AND and OR gate with their truth table. 2½

(D) What is Hexadecimal number system ? Convert $(11)_{16}$ into its decimal equivalent. 2½

(E) State and prove De Morgan's Theorems. 2½

(F) Using Boolean laws, show that $(A \cdot B \cdot C) + (A \cdot \overline{B} \cdot C) + (A \cdot B \cdot \overline{C}) = A \cdot (B + C)$. 2½

5. Attempt any **TEN** of the following :

(i) State any two characteristics of ideal OP-Amp.

(ii) State Barkhausen criterion for oscillator.

(iii) In an inverting amplifier, R_1 = 1 kΩ and R_f = 10 kΩ. Assuming an ideal OP-Amplifier, find the voltage gain.

(iv) State any two advantages of optical fibre over metal wire.

(v) Define bandwidth length product.

(vi) Calculate the velocity of light in glass having refractive index 1.5.

(vii) State any two drawbacks of amplitude modulation.

(viii) Define demodulation.

(ix) A carrier wave of 500 watts is subjected to 100% amplitude modulation. Calculate power in each side band.

(x) What is nibble ?

(xi) State any two limitations of Half Adder.

(xii) Find the 1's complement of the binary number $(10001010)_2$. 1×10=10