NRJ/KW/17/3170

[Maximum Marks : 50

Bachelor of Science (B.Sc.) Semester—VI (C.B.S.) Examination ELECTRONICS, FIBER OPTICS, COMMUNICATION AND DIGITAL ELECTRONICS

Paper-2

(Physics)

Time : Three Hours]

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

(2) Draw neat diagrams wherever necessary.

EITHER

1. (A) Draw block diagram of OP-AMP. Explain function of each block.

- (B) (i) Draw circuit diagram of OP-AMP as an adder and obtain expression for output voltage.
 - (ii) Find the output voltage of an OP-AMP inverting adder shown below for the following sets of input voltages and resistors with feedback resistor $R_f = 10 \text{ k}\Omega$, $R_1 = 10 \text{ k}\Omega$, $R_2 = 5 \text{ k}\Omega$, $R_3 = 5 \text{ k}\Omega$, $V_1 = 3 \text{ V}$, $V_2 = 2 \text{ V}$, $V_3 = -2 \text{ V}$.



OR

(C) Explain the principle and working of a phase shift oscillator with necessary circuit diagram.

21/2

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- (D) Explain Class A, Class B, Class AB and Class C amplifiers. 2¹/₂
- (E) State and explain the Barkhausen's criterion for sustained oscillations. $2\frac{1}{2}$
- (F) In a Colpitts oscillator, $C_1 = 0.001 \ \mu\text{F}$, $C_2 = 0.01 \ \mu\text{F}$ and $L = 5 \ \mu\text{H}$. Find the required forward current gain for oscillation and frequency of oscillation. $2^{1/2}$

(Contd.)

EITHER

- 2. (A) What is an optical fiber ? Give its structure and explain the propagation of light waves in an optical fiber. 5
 - (B) (i) Define Acceptance Angle. Derive an expression for Acceptance Angle of an optical fiber.
 - (ii) A signal of power 4.2 μ W is launched into an optical fiber of length 0.1 km. Calculate the signal attenuation loss per unit length, if the power emerging from the other end is 2.1 μ W.

OR

- (C) What is Numerical Aperture ? Obtain an expression for Numerical Aperture of an optical fiber.
- (D) Explain the various types of losses associated with optical fiber. $2\frac{1}{2}$
- (E) Explain Electrical Bandwidth, Optical Bandwidth and Bandwidth Length product. 2¹/₂
- (F) Compute the Numerical Aperture and Acceptance Angle of an optical fiber surrounded by air if refractive index of core is 1.5 and that of cladding is 1.45.
 2¹/₂

EITHER

- 3. (A) What is amplitude modulation ? Obtain an expression for the amplitude modulated wave and show that the frequency spectrum of the modulated wave consists of the carrier wave, upper and lower side bands.
 - (B) (i) What is modulation factor ? Obtain an expression for percentage modulation of AM Wave.
 - (ii) A sinusoidal carrier voltage of frequency 1 MHz and amplitude 100 V is amplitude modulated by a sinusoidal voltage of frequency 5 kHz producing 50% modulation. Calculate the frequency and amplitude of upper sideband.

OR

- (C) What is frequency modulation ? What are the merits and demerits of frequency modulation over amplitude modulation ? $2\frac{1}{2}$
- (D) A radio signal is prepared by frequency modulating a 100 MHz carrier with a 4 kHz audio tone, causing a frequency deviation of 25 kHz. Determine the carrier swing and modulation index for this modulated wave.
 2¹/₂
- (E) Obtain an expression for the frequency modulated wave and show that the frequency spectrum consists of the carrier wave and infinite number of sidebands. $2\frac{1}{2}$
- (F) Explain Modulation Index, Carrier Swing and Deviation Ratio in frequency modulation. 2¹/₂

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 $2\frac{1}{2}$

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EITHER

4.	(A)	Explain Conversion method for Decimal to Binary number with suitable example.	5
	(B)	(i) What is Binary Coded Decimal (BCD) system ? Encode the decimal numbers	(56) ₁₀ ,
		$(628)_{10}$ and $(5179)_{10}$ into 8421 BCD code.	3
		(ii) Subtract $(101)_2$ from $(1110)_2$ by 1's complement method.	2
	OR	8.3	
	(C)	What are the basic logic gates ? Give their circuit symbols and truth tables.	21/2
	(D)	Explain how basic gates can be constructed using NOR gates only.	21/2
	(E)	State and prove De Morgan's Theorems.	21/2

(F) Using Boolean algebraic technique, simplify the following expression and draw logic diagram for reduced equation :

$$Y = ABC + \overline{A}BC + A\overline{B}C + AB\overline{C} + A\overline{B}\overline{C}$$
 2¹/₂

- 5. Solve any TEN :
 - (i) Define Common Mode Rejection Ratio (CMRR).
 - (ii) Which type of feedback is necessary in oscillating circuits ?
 - (iii) Calculate the voltage gain of the following operational amplifier circuit :



- (iv) What is dispersion in an optical fiber ?
- (v) Give any two advantages of an optical fiber.
- (vi) Find critical angle of an optical fiber. Given : $\mu_{core} = 2$ and $\mu_{cladding} = \sqrt{3}$.
- (vii) A carrier wave of frequency 10 MHz and peak value 10 volts is amplitude modulated by a 5 kHz sine wave of amplitude 6 volts. Determine the modulation index.
- (viii) Give any two disadvantages of Amplitude Modulation.
- (ix) Which type of modulation is used in the TV picture transmission ?
- (x) What is nibble ?
- (xi) Perform the decimal subtraction $(2928)_{10} (416)_{10}$ using 10's complement method.
- (xii) Why NAND and NOR gates are called Universal gates ? $1 \times 10 = 10$

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