## 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 $\mathrm{R}_{\mathrm{f}}=10 \mathrm{k} \Omega, \mathrm{R}_{1}=10 \mathrm{k} \Omega, \mathrm{R}_{2}=5 \mathrm{k} \Omega$, $\mathrm{R}_{3}=5 \mathrm{k} \Omega, \mathrm{V}_{1}=3 \mathrm{~V}, \mathrm{~V}_{2}=2 \mathrm{~V}, \mathrm{~V}_{3}=-2 \mathrm{~V}$.


OR
(C) Explain the principle and working of a phase shift oscillator with necessary circuit diagram.
(D) Explain Class A, Class B, Class AB and Class C amplifiers. $2^{11 / 2}$
(E) State and explain the Barkhausen's criterion for sustained oscillations.
(F) In a Colpitts oscillator, $\mathrm{C}_{1}=0.001 \mu \mathrm{~F}, \mathrm{C}_{2}=0.01 \mu \mathrm{~F}$ and $\mathrm{L}=5 \mu \mathrm{H}$. Find the required forward current gain for oscillation and frequency of oscillation.

## EITHER

2. (A) What is an optical fiber ? Give its structure and explain the propagation of light waves in an optical fiber.
(B) (i) Define Acceptance Angle. Derive an expression for Acceptance Angle of an optical fiber.
(ii) A signal of power $4.2 \mu \mathrm{~W}$ 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 $2.1 \mu \mathrm{~W}$.

## 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.
(E) Explain Electrical Bandwidth, Optical Bandwidth and Bandwidth Length product.
(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 .

## 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?
(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. $2 \frac{1122}{2}$
(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.
(F) Explain Modulation Index, Carrier Swing and Deviation Ratio in frequency modulation.

## EITHER

4. (A) Explain Conversion method for Decimal to Binary number with suitable example.
(B) (i) What is Binary Coded Decimal (BCD) system ? Encode the decimal numbers (56) ${ }_{10}$, $(628)_{10}$ and (5179) ${ }_{10}$ into 8421 BCD code.
(ii) Subtract $(101)_{2}$ from $(1110)_{2}$ by 1's complement method.

OR
(C) What are the basic logic gates ? Give their circuit symbols and truth tables.
(D) Explain how basic gates can be constructed using NOR gates only. $2 \frac{1}{2}$
(E) State and prove De Morgan's Theorems.
(F) Using Boolean algebraic technique, simplify the following expression and draw logic diagram for reduced equation :

$$
\begin{equation*}
Y=A B C+\bar{A} B C+A \bar{B} C+A B \bar{C}+A \overline{B C} \tag{1/2}
\end{equation*}
$$

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 : $\mu_{\text {core }}=2$ and $\mu_{\text {cladding }}=\sqrt{3}$.
(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 ?
