NKT/KS/17/5203

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

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) **ALL** questions are compulsory.
(2) Draw neat diagrams/circuits wherever necessary.
(3) The symbols used have their usual meanings.

EITHER

1. (A) Explain terms summing point and virtual ground in an operational amplifier. Explain how an operational amplifier can be used as inverting amplifier. Derive the expression for its voltage gain. 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, $R_1 = R_2 = R_3 = 1$ mΩ and $C_1 = C_2 = C_3 = 75$ pf. At what frequency, does the circuit oscillate ? 2

OR

(C) Define terms :—

(i) Common Mode Rejection Ratio (CMRR)

(ii) Slew Rate

(iii) Input bias current

in an operational amplifier. 2½

(D) With neat diagram discuss the function of operational amplifier as differentiator. 2½

(E) Calculate the output of an operational amplifier having CMRR = 100 if the two inputs are 1 mV and 0.9 mV. The open loop gain of op-amp is 10^5. 2½

(F) What is a multistage amplifier ? Derive an expression for overall voltage gain of a three stage amplifier in terms of the individual voltage gains. 2½

EITHER

2. (A) Explain acceptance cone and Numerical Aperture of an optical fiber. Derive an expression for Numerical Aperture for a step index optical fiber in terms of refractive index of core and relative refractive index difference between the core and the cladding. 5

(B) (i) What is dispersion in optical fiber ? What are various mechanisms responsible for pulse dispersion in optical fibers. 3

(ii) An optical power of 1 mW is launched into an optical fiber of length 100 m. If the power emerging from the other end is 0.3 mW, calculate the attenuation loss per unit length. 2

OR

(C) State different types of optical fibers based on refractive index profile and explain step index optical fiber. 2½

(D) Explain various types of losses associated with optical fiber. 2½

(E) In an optical fiber, the core material has refractive index 1.6 and refractive index of clad material is 1.3. What is the value of critical angle ? Also calculate the value of angle of acceptance cone. 2½

(F) What are advantages of optical fiber communication over other modes of signal communication ? Give at least five points. 2½

EITHER

3. (A) Explain the need for modulation in communication. Derive the voltage equation for an amplitude modulated wave. 5

(B) (i) Derive an expression for total power contained in an amplitude modulated wave. 3

(ii) An AM transmitter is to deliver a total power of 100 W to an antenna. The modulation is to be 100%. Determine the power contained in the carrier frequency. 2

OR

(C) Define modulation factor. Show that percentage modulation is given by $\frac{V_{c(max)} - V_{c(min)}}{V_{c(max)} + V_{c(min)}}$. 2½

(D) In FM, the signal is given by $e_s = 15 \cos 1000\ \pi t$ and the carrier by $e_0 = 1000 \sin 2 \times 10^8\ \pi t$, the coefficient of modulation $K_f = 60{,}000$. Find out frequency deviation and modulation index. 2½

(E) What are merits and demerits of frequency modulation ? 2½

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

EITHER

4. (A) What is a full adder ? Draw the circuit diagram of a full adder and explain its working with truth table. 5

(B) (i) State De-Morgan's theorems and prove them. 3

(ii) Applying Boolean algebra show that :

$(AB + C) \cdot (AB + D) = AB + CD$. 2

OR

(C) What is an octal number system ? Explain with an example how an octal number can be converted into a decimal number. 2½

(D) What is an Exclusive OR gate ? Draw logic diagram of EX-OR gate using basic gates and explain its working with truth table. 2½

(E) Convert the decimal number 19.638 into binary equivalent. 2½

(F) What are Binary Codes ? State advantages of 8421 BCD code (any **THREE**). 2½

5. Solve any **TEN** :—

(i) State any two characteristics of an ideal operational amplifier.

(ii) Give two applications of integrator circuits.

(iii) In a negative feedback amplifier gain without feedback is A = 100, β = 0.04 and V_i = 50 mV. What is the gain with feedback.

(iv) Why refractive index of core material is greater than cladding material in an optical fiber ?

(v) Define critical angle.

(vi) In an optical fiber, the refractive index of core is 1.50 and cladding is doped to give relative refractive index difference of 0.0005. What is refractive index of cladding ?

(vii) What is meant by carrier swing in frequency modulation ?

(viii) State at least two limitations of amplitude modulation.

(ix) A sinusoidal carrier voltage of 80 volts amplitude and 1 MHz frequency is amplitude modulated by sinusoidal voltage of frequency 5 KHz producing 50% modulation. Calculate the amplitude of lower and upper side bands.

(x) What is a nibble ?

(xi) Give the truth table of NAND gate.

(xii) Write 2's complement of 1011. 1×10=10