**KNT/KW/16/5203**

**Bachelor of Science (B.Sc.) Semester–VI (C.B.S.) Examination**

**PHYSICS**

**ELECTRONICS, FIBER OPTICS, COMMUNICATION AND DIGITAL ELECTRONICS**

**Paper–2**

Time : Three Hours] [Maximum Marks : 50

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

(2) Draw neat diagrams wherever necessary.

**EITHER**

1. (A) Draw the circuit diagram of an Op-Amp as inverting amplifier. Derive an expression for its voltage gain, input resistance and output resistance. 5

(B) (i) Explain the concept of feedback in amplifiers. Derive the expression for gain of an amplifier with feedback. 3

(ii) Calculate the voltage gain of the negative feedback amplifier having A = 2000 and $\beta = 1/10$. 2

**OR**

(C) Explain class A, class B, class AB and class C amplifiers. 2½

(D) Explain the principle and working of a phase shift oscillator with necessary circuit diagram. 2½

(E) Explain the use of Op-Amp as Integrator. 2½

(F) In a colpitts oscillator, $C_1 = 0.001\ \mu F$, $C_2 = 0.01\ \mu F$ and $L = 5\ \mu H$. Find the required gain for oscillation and frequency of oscillation. 2½

**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. 3

(ii) A signal of power 4.2 μW exists at the entrance of 0.1 km long fiber. Calculate the signal attenuation of the fiber if the power at the other end of fiber is 2.1 μW. 2

**OR**

(C) Explain single mode, step index fiber and multi mode graded index fiber. 2½

(D) What is numerical aperture ? Obtain an expression for numerical aperture of an optical fiber. 2½

(E) Explain Electrical bandwidth, Optical bandwidth and bandwidth length product. 2½

(F) Compute the numerical aperatue and acceptance angle of an optical fiber surrounded by air. The refractive index of core is 1.5 and that of cladding is 1.45. 2½

**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 and upper and lower sidebands. 5

(B) (i) Derive an expression for the fraction of total power carried by the side bands in amplitude modulated wave. 3

(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 term. 2

**OR**

(C) Explain modulation index, carrier swing and deviation ratio for frequency modulation. 2½

(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. 2½

(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. 2½

(F) What is frequency modulation ? What are the merits and demerits of frequency modulation ? 2½

**EITHER**

4. (A) Explain Binary number system, Hexadecimal number system and their interconversions. 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) Convert octal number $(635.472)_8$ into binary form. 2

**OR**

(C) Explain AND and OR basic logic gates with truth table. 2½

(D) Explain how can you obtain basic logic gates from NAND gates. 2½

(E) Explain the working of full adder with truth table. 2½

(F) Simplify the logical expression

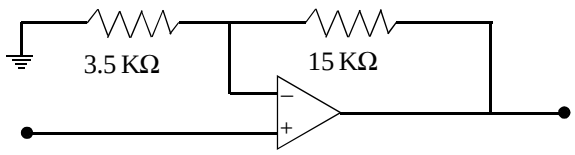
$$Y = (A + B)(A + \overline{B})(\overline{A} + B)$$ 2½

5. Attempt any **ten** :

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

(ii) Why and 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) State two advantages of an optical fiber.

(vi) Find critical angle of an optical fiber. Given : $\mu_{core} = 2$ and $\mu_{cladding} = \sqrt{3}$

(vii) Give any two disadvantages of amplitude modulation.

(viii) 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 bandwidth of the transmitted AM signal.

(ix) Which type of modulation is used in the TV picture transmission ?

(x) What are logic gates ?

(xi) State DeMorgan's theorem.

(xii) State limitation of Half Adder. 1×10=10