B.Sc. Part II Examination 2020
Sir Gurudas Mahavidyalaya
Physics Honours (PHSA)
Paper III

Time: 2Hrs   **Full Marks: 50**

Answer question No. 1 and any four from the rest

1. ANSWER ANY **FIVE** OF THE FOLLOWING QUESTIONS   2x5=10

(a) Distinguish between combinational and sequential logic circuits.

(b) A point charge 'q' is placed symmetrically at a distance 'd' from two perpendicularly placed grounded conducting infinite plates. Calculate the net force **F** on the charge 'q'.

(c) What is amplitude modulation?

(d) What is eddy current?

(e) State Biot-Savart law.

(f) Two coils have self inductances L_1 and L_2 and mutual inductance M. Show that M^2 is less than or equal to L_1L_2.

(g) What is the difference between Fresnel and Fraunhofer class of diffraction?

(h) What is Brewster's law?

1. (a) Define the quantity Common Mode Rejection Ratio (ρ) for a Differential Amplifier.

(b) For a Differential Amplifier if v_1 and v_2 are the input signals, then show that the output signal v_0 is given by:

$V_o = A_d v_d (1 + v_c / \rho v_d)$, where v_d is the difference voltage and v_c is the common mode signal and A_d is the gain of the Differential Amplifier.

(c) consider the situation referred to above, where in the first set of signals v_1 is +50 microvolt and v_2 is - 50 microvolt and in the second set v_1 is 1050 microvolt and v_2 is 950 microvolt. If CMRR(ρ) is 10,000, calculate the percentage difference in the output voltage obtained for the two sets of input signals.   2+4+4

2. (a) show that negative feedback improves the stability of an amplifier.

(b) Draw a clocked S-R flip flop circuit using two input NAND gates and explain its operation with proper state table.   4+3+3

3. (a) What is magnetic dipole moment?

(b)What is its (approximate) magnetic field at points far from the origin?

(c) what do you mean by free current and bound current?   2+4+(2+2)

4. (a) What is the differential form of Gauss's law? Apply this law to calculate the electric field in case of charged infinite plane.

(b) Find the self inductance per unit length of a long solenoid of radius r, carrying n turns per unit length.   (2+3) + 4

5. (a) In the Newton's ring arrangement write down the conditions of maxima and minima for both the reflected and transmitted light. Compare these two fringes.

(b) Newton's rings are formed between a spherical lens surface and an optical flat. If the tenth bright ring of green light(546.1nm) is 7.89nm in diameter, what is the radius of curvature of the lens surface?   5+5

6. (a) Distinguish between single slit and double slit diffraction pattern.

(b) State and explain Rayleigh criterion of resolution.

(c) Explain the phenomenon of double refraction in a uniaxial crystal by applying Hygen's theory.   3+3+4