QP CODE	2028000383

Reg.No: | | | | | | | | | | | |

DMI-ST. EUGENE UNIVERSITY
DEGREE EXAMINATION – JANUARY 2023

SEM: II **800PH203 PHYSICS II**

Time: 3 Hours Max. Marks: 100

Answer any Five questions (5 x 20 = 100 Marks)

1. a) A horizontal spring (K = 300 N/m) with a mass of 0.75 kg attached to it is undergoing simple harmonic motion. Calculate the (a) period, (b) frequency and (c) angular frequency of this oscillator. (5 marks)

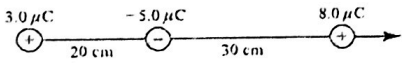
b) The periodic time of a body executing S.H.M. is 2 s. After how much time interval from $t = 0$ will its displacement be half the amplitude? (5 marks)

c) A particle performs S.H.M. of period 4 s. If the amplitude of its oscillations is 4 cm, find the time it takes to move 1 cm from the positive extreme position. (5 marks)

d) Derive an equation for the period of a pendulum undergoing simple harmonic motion. (5 marks)

2. a) Two coins lie 1.5 m apart on a table. They carry identical charges. Approximately how large is the charge on each if a coin experiences a force of 2? (5 marks).

b) Three-point charges are placed on the x-axis as shown below. Find the net force on the $-5\ \mu C$ charge due to the two other charges.



(5 marks)

c) A sample of HCl gas is placed in a uniform electric field of magnitude $3 \times 10^4\ NC^{-1}$. The dipole moment of each HCl molecule is 3.4×10^{-30}Cm. Calculate the maximum torque experienced by each HCl molecule. (5 marks)

d) In the Bohr model of the hydrogen atom, an electron ($q = -e$) circles a proton ($q' = e$) in an orbit of radius 5.3×10^{-11} m. The attraction of the proton for the electron furnishes the centripetal force needed to hold the electron in orbit. Find the force of electrical attraction between the particles. Note that the electronic charge is 1.6×10^{-19}C. (5 marks)

3. a) A current of 2 A flows for 30 seconds through a lamp. How much charge has moved? (4 marks)

b) A copper wire has a cross sectional area of 7.85×10^{-7} m^2. The number density of copper is 8.5×10^{28} m^{-3}. Calculate the mean drift velocity of the electrons through the wire when the current is 1.4 A. Note that the electronic charge is e=$1.6 \times 10^{-19} C$. (5 marks)

c) Calculate the resistivity of a material with a resistance of 2 and a cross-sectional area and length of 25 cm^2 and 15 cm, respectively. (5 marks)

d) The wire's length and area are 0.2 m and 0.5 m^2, respectively. Calculate the resistivity of that wire whose resistance is 3Ω. (6 marks)

4. a) Give any four factors affect the inductance in a circuit. (2 marks)

b) State Faraday's second law of electromagnetic induction. (2 marks)

c) Give the electromagnetic spectrum in order of increasing frequencies. (7 marks)

d) A 40uF capacitor is in series with a 100mH inductor, a 30 ohm resistor, and a 15 VAC signal with a frequency of 60 Hz. (a) Calculate the capacitive reactance and the inductive reactance in the circuit. (b) Determine the impedance. (c) Calculate the i current in the circuit. (d) Calculate the voltage across the resistor, the inductor, and the capacitor. (9 marks)

5. a) Give any four Characteristics of electromagnetic waves. (2 marks)

b) In a series RLC, circuit $R = 30\Omega, L = 15\text{mH}$, and $C = 51\mu\text{F}$. If the source voltage and frequency are 12 V and 60 Hz, respectively, what is the current in the circuit? (2 marks)

c) Give the electromagnetic spectrum in order of increasing wavelengths. (7 marks)

d) Give any four differences between Self and Mutual Inductance. (9 marks)

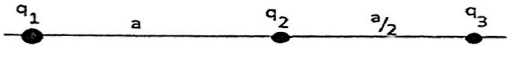
6. a) Elaborate in detail on the types of oscillation and give examples. (10 marks)

b) Note down the difference between transverse wave and longitudinal wave (5 marks)

c) Define wavelength and list the characteristics of wave motion. (5 marks)

7. a) Point A is in an electric field. The magnitude of the electric field at point $A = 0.5\text{NC}^{-1}$. If a 0.25 C charge placed at point A, then what is the electric force exerted on the charge? (5 marks)

b) Electric charge $+q_1 = 10\mu\text{C}; +q_2 = 20\mu\text{C}$; and q_3 are separated, as shown in figure below. The electric force exerted on charge $q_2 = 0$, then what is the charge of q_3?



(5 marks)

c) Derive an expression for electric field due to an electric dipole at a point p, at a distance r away from p, on its axial line. (10 marks)