RE-MIDSEM EXAMINATION MARCH-2019
University Physics: Electricity and Magnetism (PHY 2001)

Programme: B. Tech **Semester: 2nd**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
UPEM/ a, e	L_1, L_2, L_3	1	6
UPEM/ a, e, g	L_1, L_2, L_3	2	6
UPEM/ a, e	L_1, L_2, L_3	3	6
UPEM/ a, e	L_1, L_2, L_3	4	6
UPEM/ a, e, g	L_1, L_2, L_3	5	6

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) Find the net force and torque on an electric dipole in a uniform external electric field. 2
   (b) Two equal positive charges $q_1 = q_2 = 2\mu C$ are located at $x = 0, y = 0.3m$ and $x=0, y= -0.3m$, respectively. What are the magnitude and direction of the total electric force that q_1 and q_2 exert on a third charge $Q = 4\mu C$ located at $x = 0.4m, y = 0$. 2
   (c) An electric dipole is placed in a region of uniform electric field E, with the electric dipole moment P, pointing in the direction opposite to E. Is the dipole (i) in stable equilibrium (ii) in unstable equilibrium (iii) neither? Justify 2
2. (a) An infinitely long thin wire is uniformly charged. If the charge per unit length is λ, find the electric field at a distance r from the wire. 2
   (b) A solid metal sphere with radius $0.45\ m$ carries a net charge of $0.25nC$. Find the magnitude of the electric field at a point $0.1\ m$ outside the surface of the sphere. 2
   (c) What is the magnitude of electric field E at a point $2.0\ m$ from a point charge $q = 4.0\ nC$ in air? 2
3. (a) A solid conducting sphere of radius R has a total charge Q. Find the electric potential everywhere, both inside and outside the surface. 2

   (b) A total electric charge of $3.5\ nC$ is distributed uniformly o surface of a metal sphere of radius 24 cm. Find the value of pot the following distances from the centre of the sphere; (i) $48\ cm$ $12\ cm$.
   (c) Graphically, show how the electric field and electric potential charged conducting sphere vary with the distance 'r' from its ce
4. (a) Derive the expression for energy stored in a capacitor with th between the plates being vacuum. If a dielectric is inserted in t the plates keeping the charge on each plate constant, how stored energy be affected?
   (b) What is the magnitude of electric field required to store $1J$ of potential energy in a volume of $1m^3$ in vacuum? (Given $\varepsilon_0 =$ $10^{-12}\ C^2/Nm^2$)
   (c) You want to connect a $4\ \mu F$ capacitor and an $8\ \mu F$ capacitor. I type of connection will the $4\ \mu F$ capacitor have a greater am energy than that of $8\ \mu F$ capacitor? Justify your answer.
5. (a) Derive the expression for current density in a conducting wire i of drift velocity of moving charges.
   (b) A source of emf of $24V$ is connected to an external resistance terminal voltage supplied by the source is $21.2\ V$ and curren circuit $4A$, find the external resistance 'R' and internal resistanc
   (c) An 18 gauge copper wire with a diameter of $1.02\ mm$ c constant current of $1.67\ A$ to a $200\ W$ lamp. The free-electron in the wire is 8.5×10^{28} per cubic meter. Find the drift speed.