Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

THIRD SEMESTER B. Tech. (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2017
SUBJECT: ELECTROMAGNETIC WAVES (ECE - 2102)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Derive the expression for critical angle and Brewster angle in terms of medium constants.

1B. Given $\vec{D} = 6\rho \sin\frac{\emptyset}{2}\,\vec{a}_\rho + 1.5\,\rho\cos\frac{\emptyset}{2}\,\vec{a}_\emptyset\ C/m^2$. Calculate the total charge bounded by $\rho = 2\,m, 0 < \emptyset < \pi$ and $0 < z < 5\,m$.

1C. If $V = e^{-y}\sin x$ find ρ_v and $\vec{E}$ (assume free space).

(5+3+2)

2A. Derive the Maxwell's equation starting from fundamental laws in differential form for sinusoidal varying fields.

2B. Given $\vec{H} = 6r\sin\emptyset\,\vec{a}_r + 18r\sin\theta\cos\emptyset\,\vec{a}_\emptyset$ A/m, calculate the total current flowing from the surface specified by r = 4m, $0 \le \theta \le 0.1\,\pi$ and , $0 \le \emptyset \le 0.3\,\pi$.

2C. If $\in = \in_0$, $\mu = \mu_0$ and $\sigma = 5 \times 10^6\ S/m$ at f = 50 MHz calculate v_{ph} and η.

(5+3+2)

3A. Calculate the capacitance between two concentric spheres of radius 'a' and 'b' filled with dielectric $\in_r$ using Laplace equation.

3B. A dipole of moment $\vec{p} = 6\,\vec{a}_z\,nC\,m$ is located at the origin in the free space. Determine $\vec{E}$ and V at $(4, 20^0, 0^0)$.

3C. If $\vec{H} = \frac{10^6}{\rho}\sin 2\emptyset\,\vec{a}_\rho$ A/m, calculate the flux passing through the region $\rho = 5\,cm$, $15° \le \emptyset \le 60°$ and , $-5 \le z \le 5$ cm in free space.

(5+3+2)

4A. Calculate the electric field intensity $\vec{E}$ at a distance ρ from an infinite line charge of ρ_l C/m charge density placed along the z axis.

4B. Given a non-magnetic material having $\epsilon_r = 3.2$, $\sigma = 1.5 \times 10^{-4}$ S/m at 3 MHz frequency. Calculate loss tangent, attenuation and intrinsic impedance.

4C. Write an explanatory note on wave polarization.

(5+3+2)

5A. Derive an expression for $\vec{H}$ field at (0, 0, h) due to a thin circular ring of radius 'a' carrying current of I placed with its center at the origin in free space.

5B. Let $\eta_1 = 100\ \Omega$, $\eta_2 = 300\ \Omega$ and the incident wave has $\overline{|E|} = 100\ V/m$, calculate the amplitude of reflected and transmitted wave.

5C. Convert the point A (5, -4, 3) into cylindrical and spherical coordinates.

(5+3+2)