

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: BTECH
BRANCH: ECE**

**SEMESTER: IV
SESSION: SP/2023**

SUBJECT: EC257 ELECTROMAGNETIC FIELDS AND WAVES

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

		CO	BL
Q.1(a) Derive the integral form of the Maxwell's equations, from the differential form, and identify each equation with its proper experimental law. What is the significance of displacement current density?	[5]	2	3
Q.1(b) Derive the expression for wave equation of scalar potential (V) and Magnetic Vector potential(A).	[5]	1	4
Q.2(a) Derive the values of α , β and η for good conductors. Define skin depth and how is it related with α .	[5]	3	3
Q.2(b) For a uniform plane wave incident normally at the interface between two dielectrics, establish the mathematical expression of reflection coefficient and transmission coefficient in term of intrinsic impedances.	[5]	3	4
Q.3(a) Derive the equation for input impedance of transmission line(lossy and lossless).	[5]	3	3
Q.3(b) A transmission of length 0.40λ , has a characteristic impedance of 100Ω and terminated in a load impedance of $200+j180\Omega$. Find the i)voltage reflection coefficient ii)voltage standing wave ratio iii)input impedance of the line.	[5]	4	4
Q.4(a) Define the following term i) dominant mode of waveguide ii) guided wave length and Cut-off wave length iii) Draw the field lines diagram for TM_{11} and TE_{10} mode. Also explain the physical significance of the subscripts m and n which are used to designate a mode in a RWG .	[5]	3	2
OR			
Q.4(b) Write short note on Cavity resonator. A Rectangular waveguide (RWG) with dimensions $a=3$ cm and $b= 2$ cm operates at 10 GHz. Find f_c , λ_g , β_g , v_p of TE_{10} Mode.	[5]	4	4
Q.5(a) i))Define Hertzian dipole antenna and write down the radiation resistance of Hertzian dipole, short dipole, half wave dipole, and quarter wave monopole antenna. ii)The field components of Current element (idl) Hertzian dipole are E_θ , H_ϕ , E_r have terms varying as $(1/r^3)$, $(1/r^2)$, $(1/r)$. What is the significance of each term.	[3+2]	3	3
Q.5(b) i)Draw the Horizontal and Vertical radiation pattern for elementary dipole.(current element) ii)Determine the electric field intensity at a distance of 5Km from an antenna having a directive gain of 5dB and radiating total power of 10KW.	[1+4]	4	4

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