JHARKHAND UNIVERSITY OF TECHNOLOGY

Diploma 3rd Semester Examination

ELECTRONICS MEASUREMENTS & TESTTING TECHNIQUES (EMTT)

Time: 3 Hours **Full Marks: 70** **SET: 3**

INSTRUCTIONS:

1. Question No. 1 is Compulsory.
2. Answer any **FOUR** questions from the remaining (Q.2 to Q.7).
3. **Important:** Students are advised to draw relevant diagrams (Smith Chart sketches, Boundary Conditions, Polarization types) on their own.

Q.1. Multiple Choice Questions [2 × 7 = 14]

(i) The curl of a gradient of a scalar field ($\nabla \times \nabla V$) is:

(a) 1 (b) 0

(c) $\nabla^2 V$ (d) Infinite

(ii) Which antenna parameter measures concentration of radiation?

(a) Bandwidth (b) Directivity

(c) Polarization (d) Impedance

(iii) For a Quarter Wave Transformer ($l = \lambda/4$), input impedance is:

(a) Z_0^2 / Z_L (b) Z_L^2 / Z_0

(c) $Z_0 Z_L$ (d) Z_0

(iv) In a Smith Chart, a complete revolution (360°) represents:

(a) λ (b) $\lambda/2$

(c) $\lambda/4$ (d) 2λ

(v) The energy density in an electrostatic field is:

(a) $0.5\ \varepsilon E^2$ (b) $0.5\ \mu H^2$

(c) εE (d) E^2 / ε

(vi) Lorentz Force equation is:

(a) $F = Q(E + v \times B)$ (b) $F = QE$

(c) $F = IL \times B$ (d) $F = ma$

(vii) Two vectors A and B are orthogonal if:

(a) $A \times B = 0$ (b) $A \cdot B = 0$

(c) $A + B = 0$ (d) $A = B$

SECTION B (LONG ANSWER TYPE)

Q.2. (a) Explain **Smith Chart**. What are the properties of Constant-R and Constant-X circles? How is it used for Impedance Matching? **[7]**

Q.2. (b) What is **Impedance Matching**? Explain the operation of a **Quarter Wave Transformer (λ/4 line)** for matching a load ZL to a line Z_0. **[7]**

Q.3. (a) Derive the **Boundary Conditions** for **Magnetic Field (H and B)** at the interface between two different magnetic materials (μ_1, μ_2). **[7]**

Q.3. (b) Define **Electric Potential (V)** and **Electric Potential Difference**. Derive the potential due to a **Point Charge** at a distance r. **[7]**

Q.4. (a) Explain **Uniform Plane Wave** propagation in a **Lossy Dielectric** (General Case). Derive the expressions for Attenuation Constant (α) and Phase Constant (β). **[7]**

Q.4. (b) What is **Polarization**? Explain Linear, Circular, and Elliptical polarization. Describe how the E-vector traces the path in each case. **[7]**

Q.5. (a) Explain the term **Gradient**, **Divergence**, and **Curl** with their physical significance. State **Divergence Theorem** and **Stokes' Theorem**. **[7]**

Q.5. (b) A transmission line has $Z_0 = 75\ \Omega$. It is terminated by a load $ZL = 75 + j50\ \Omega$. Calculate Reflection Coefficient (Γ) and VSWR. **[7]**

Q.6. (a) Explain the concept of **Retarded Potential** (Time-Varying Potentials). Why do we need it in time-varying fields? **[7]**

Q.6. (b) Derive the expression for **Energy Density** in Electrostatic and Magnetostatic fields. **[7]**

Q.7. Write Short Notes on (Any FOUR): **[3.5 × 4 = 14]**

a. Single Stub Matching

b. Total Internal Reflection & Critical Angle

c. Properties of Good Conductors vs Dielectrics

d. Telegrapher's Equations

e. Magnetic Flux & Flux Density

Diploma Wallah: Solution Key

MCQ: (i) b, (ii) b, (iii) a, (iv) b, (v) a, (vi) a, (vii) b.

Q5(b) Solution:

$\Gamma = (ZL - Z0)/(ZL + Z0) = (j50) / (150 + j50)$.

Convert to polar and solve for magnitude $|\Gamma|$.

Then use $VSWR = (1 + |\Gamma|) / (1 - |\Gamma|)$.

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