Total No. of Questions: 24

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

EC3CO08 Engineering Electromagnetics

Programme	:	B.Tech.	**Branch/Specialisation**	:	EC
Duration	:	3 hours	**Maximum Marks**	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

Section 1 (Answer all question(s))

		Marks	CO	BL
Q1.	Convert the point (3,4,5) from Cartesian to spherical coordinates- ○ (7.07,54º,63º) ◉ (7.07,45º,53º) ○ (0.707,45º,53º) ○ (0.707,54º,63º)	1	3	3
Q2.	Stoke's theorem uses which of the following operations? ○ Divergence ○ Gradient ◉ Curl ○ Laplacian	1	2	2
Q3.	The force between two charges is 120 N. If the distance between the charges is doubled, the new force will be- ○ 60 N ◉ 30 N ○ 120 N ○ 15 N	1	3	3
Q4.	A field line and an equipotential surface are- ○ Always parallel ◉ Always at 90° ○ Inclined at any angle Ø ○ None of the above	1	2	2
Q5.	A permeable substance is one- ○ Which is a good conductor ○ Which is a bad conductor ○ Which is a strong magnet ◉ Through which the magnetic lines of force can pass very easily	1	2	2
Q6.	Fleming's left-hand rule is used to find- ○ Direction of magnetic field due to current carrying conductor ○ Direction of flux in a solenoid ◉ Direction of force on a current carrying conductor in a magnetic field ○ Polarity of a magnetic pole	1	2	2
Q7.	As per Faraday's laws of electromagnetic induction, an e.m.f. is induced in a conductor whenever it- ○ Lies perpendicular to the magnetic flux ○ Lies in a magnetic field ◉ Cuts magnetic flux ○ Moves parallel to the direction of the magnetic field	1	2	2
Q8.	An e.m.f. of 16 volts is induced in a coil of inductance 4H. The rate of change of current must be- ○ 64 A/s ○ 32 A/s ○ 16 A/s ◉ 4 A/s	1	3	3

Q9. Find the ratio of the refractive index of medium 1 to that of medium 2, when the incident and reflected angles are given by 30^0 and 45^0 respectively. **1 3 3**

- ○ 0.5
- ○ 1
- ○ 2
- ◉ 1.41

Q10. The power reflected by a wave with incident power of 16 units is (Given that the reflection coefficient is 0.5)- **1 3 3**

- ○ 2
- ○ 8
- ○ 6
- ◉ 4

Section 2 (Answer all question(s))

Marks CO BL

Q11. Given points M(−1, 2, 1) and N(3, −3, 0), find unit vector R_{MN} . **2 3 3**

Rubric	Marks
Formula 1,1 Marks	2

Q12. Transform to cylindrical coordinates: $F = 10a_x - 8a_y + 6a_z$ at point P(10, −8, 6). **3 3 3**

Rubric	Marks
Formulas 1,2 marks	3

Q13. (a) State and prove divergence theorem. **5 3 3**

Rubric	Marks
Statement 1,4 marks	5

(OR)

(b) Derive Poisson's and Laplace's equations.

Rubric	Marks
Derivation of Poisson's equation 3 marks,Derivation of Laplace's equation 2 marks	5

Section 3 (Answer all question(s))

Marks CO BL

Q14. Derive the relationship between potential and electric field intensity. **2 3 3**

Rubric	Marks
Derivation	2

Q15. Justify that electric field is conservative. **3 4 4**

Rubric	Marks
Justification 2 marks,Example 1mark	3

Q16. (a) Given the potential field, $V = 2x^2y - 5z$, and a point P (−4, 3, 6), find at point P: the potential V, the electric field intensity **E**, the direction of **E**, the electric flux density **D**, and the volume charge density ρv . **5 3 3**

Rubric	Marks
the potential V=**66V,** the electric field intensity **E** = 48**a**x − 32**a**y + 5**a**z V/m,the direction of **E,** 0.829**a**x − 0.553**a**y + 0.086**a**z, the electric flux density **D=** *−35.4xy* ***a****x* − *17.71x2* ***a****y* + *44.3* ***a****z* *pC/m3,*the volume charge density ρv =*−106.2 pC/m3*	5

(OR)

(b) Let Region 1 ($z < 0$) be composed of a uniform dielectric material for which $\acute{\varepsilon}r$ = 3.2, while Region 2 ($z > 0$) is characterized by $\acute{\varepsilon}r$ = 2. Let $\mathbf{D}_1$ =−30**a**x +50**a**y +70**a**z nC/m^2. Find: (i) D_{N1}; (ii) D_{t1}; (iii) θ_1 (iv) θ_2; (v) D_2.

Rubric	Marks
$\boldsymbol{D}_{N1}$ = 70**a**z nC/m^2 ***Dt***1 = −30**a**x +50**a**y nC/m2,θ1 = 39.80,θ2 = 27.50,**D**2 = 18.75**a**x + 31.25**a**y + 70**a**z nC/m2 1 Mark each	5

Section 4 (Answer all question(s))

Marks CO BL

Q17. A long straight wire carries a current I = 1 amp. At what distance is the magnetic field H= 1A/m. **2 3 3**

Rubric	Marks
Formula,Answer: 0.15 m , 2 mark	2

Q18. Mention the limitations of scalar magnetic potential. **3 2 2**

Rubric	Marks
Two Limitations	3

Q19. (a) State Ampere's circuital law and explain any two applications of Ampere's circuital law. **5 3 3**

Rubric	Marks
Statement,Mathematical description,Applications 1,1,3 marks	5

(OR)

(b) Derive the equation to show that curl of magnetic field intensity is equal to current density.

Rubric	Marks
Derivation,Justification 3,2 marks	5

Section 5 (Answer all question(s))

Marks CO BL

Q20. What is the significance of displacement current? **2 2 2**

Rubric	Marks
Significance	2

Q21. (a) State and prove Poynting's theorem. Comment on the three energy terms present in the right-hand side of Poynting's theorem. **8 4 4**

Rubric	Marks
State and prove Poynting's theorem,Comment on the three energy terms present in the right-hand side of Poynting's theorem. 4,4 marks	8

(OR)

(b) State and explain Faraday's laws of electromagnetic induction with its integral and point forms. Generalize Ampere's law for time-varying fields.

Rubric	Marks
State and explain Faraday's laws of electromagnetic induction with its integral and point forms?,Generalization of Ampere's law for time varying fields 4,4 marks	8

Section 6 (Answer any 2 question(s))

Marks CO BL

Q22. If one-half the incident power is reflected, find reflection coefficient and standing wave ratio. **5 3 3**

Rubric	Marks
Formula of Reflection Coefficient ,Formula of Standing Wave Ratio,Answer: Reflection Coefficient = 0.707,Answer: Standing Wave Ratio= 5.83 1,1,1.5,1.5 marks	5

Q23. Derive the formulas for reflection coefficient and standing wave ratio. **5 4 3**

Rubric	Marks
Derivation of formula for Reflection Coefficient,Derivation of the formulas for Standing Wave Ratio. 2.5,2.5 marks	5

Q24. Justify the statement "Linear polarization and circular polarization are the special cases of elliptical polarization". **5 4 3**

Rubric	Marks
Justification for Linear Polarisation,Justification for Circular Polarisation 2.5,2.5 marks	5

******