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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION - JULY 2024

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| **Semester : III & IV** | **Date :11-07-2024** |
| **Course Code :** **Electromagnetic Theory** | **Time :9:30 AM-12:30 PM** |
| **Course Name :** **ECE3004** | **Max Marks :100** |
| **Program :BTech** | **Weightage :50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** | | | |
| 1 | What is the statement of Coloumb’s law? Write down the mathematical form of this law. | (CO 1) | [Knowledge] |
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| 2 | Out of the two - conduction current and displacement current, what kind of current is associated with a capacitor? | (CO4) | [Knowledge] |
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| 3 | Write down the mathematical relationship between electric field and electric potential. | (CO2) | [**Understand]** |
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| 4 | Find the gradient of the function x^{2}+y^{2}+z^{2}=9 | (CO2) | [**Understand]** |
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| 5 | Write down the mathematical form of Stoke’s theorem. | (CO1) | [**Remember**] |
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| 6 | What are the unit vectors in the spherical coordinate system? | (CO1) | [**Remember**] |
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| 7 | For what numeric value of \lambda does the vector \overrightarrow{A}=x^{2}\hat{i}+\lambda y\hat{j}+z^{2}\hat{k} become solenoidal at the point \left(1,0,1\right)? | (CO4) | [**Evaluate**] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 8 | Write down the Maxwell’s in both the differential and integral forms. | (CO3) | [**Apply**] |
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| 9 | Write down the mathematical relationships between the tangential and normal components of E-fields at the interface between two dielectrics of different permittivities ( \varepsilon_{1} \,\text{and} \,\varepsilon_{2} ). | (CO4) | [**Evaluate**] |
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| 10 | Consider two charges in free space Q_{1}=1*10^{-6}\,\,\text{C} and Q_{2}=40*10^{-6}\,\,\text{C} at a distance 2\,\,\text{m} apart. Find the electrostatic force between the charges using the Coulomb's law. Mention whether the force is attractive or repulsive. | (CO2) | [**Understand]** |
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| 11 | . Suppose the potential function V is given by V=xyz\,\,\text{(in V)}. Find the electric field vector at a point P( 1,2,3 ) . | (CO2) | [**Understand]** |
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| 12 | Find the scalar triple product of three vectors \overrightarrow{a}=\hat{i}+\hat{j}+\hat{k}, \overrightarrow{b}=2\hat{i}+3\hat{j}+4\hat{k} and \overrightarrow{c}=4\hat{i}+3\hat{j}+2\hat{k}, i.e. evaluate \overrightarrow{a}\cdot\left(\overrightarrow{b}\times\overrightarrow{c}\right) | (CO1) | [**Remember**] |
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| 13 | For a region in free-space having an electric field given by \overrightarrow{E}=x^{2}\hat{i}+y^{2}\hat{j}+z^{2}\hat{k}\,\, \text{(in V/m)}, determine the electric flux-density and charge-density at a pointP\left(1,1,1\right) using Gauss's law in differential form. | (CO3) | **[Apply]**] |
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| 14 | (a) Give the statement of Gauss’s law. (b) Write down the mathematical form of Gauss's law for both electrostatics and magnetostatics. (c) Consider an infinite line charge placed in the z-axis that has a uniform charge density of ƿ C/m . Using Gauss’s law, find the electric field due to line charge. | (CO2) | [**Understand]** |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** | | | |
| 14 | (a) Write down the statement of Faraday's law (b) Write down the mathematical form of mathematical law (c) What is the unit of magnetic flux density? (d) Can a static magnetic field produce an electric field? Why? Or why not? (e) If the electric field intensity in free-space is given as \overrightarrow{E}=E_{0}\sin\left(\alpha x \right )\sin\left(\omega t \right ), find the magnetic field intensity \overrightarrow{H}using Faraday’s law. | (CO4) | [**Evaluate**] |
|  | | | |
| 15 | Write down the divergence theorem (both the statement and the differential and integral form). If \overrightarrow{D}=\left(2y^{2}+z \right )\hat{i}+4xy\hat{j}+x\hat{k} in \text{C}/{m}^{2} find the following (a) The volume charge density at http://guqbms.inpods.com:57953/api/v1/downloadFile?fileId=15465&tenantid=13       (b) The flux through the cube defined by http://guqbms.inpods.com:57953/api/v1/downloadFile?fileId=15463&tenantid=13 (c) Total charge enclosed by the cube | (CO3) | **[Apply]**] |
|  | | | |
| 16 | Suppose the xy-plane is the common boundary between two dielectric slabs (Regions \textcircled{1} and \textcircled{2}) of relative permittivities 1.1 and 6 respectively. If the electric field in Region \textcircled{1} is \overrightarrow{E}_{1}=0.5\hat{a}_{x}-1.2\hat{a}_{y}+1.5\hat{a}_{z}\,\,\text{(in V/m)}, find the E-field intensities in Regions \textcircled{1} and \textcircled{2} and the angles made by theE-fields with the normals to the interface. | (CO4) | [**Evaluate**] |
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