FIELD THEORY (SEMESTER - 4)

CS/B.TECH(EE-O)/SEM-4/EE-402/09

1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

CS/B.TECH(EE-O)/SEM-4/EE-402/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

FIELD THEORY (SEMESTER - 4)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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Marks Obtained

	Group – A										Group – B			Group – C			***Total Marks***	***Examiner's Signature***
Question Number																		
Marks Obtained																		

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Head-Examiner/Co-Ordinator/Scrutineer

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ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

FIELD THEORY

SEMESTER - 4

Time : 3 Hours] [Full Marks : 70

Graph sheet is provided on Page 31.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) The electric field on equipotential surface is

a) unity

b) always parallel to the surface

c) always perpendicular to the surface

d) zero.

ii) The magnitude of the vector product of two vectors is $\sqrt{3}$ times their scalar product. The angle between them is

a) $\pi/2$ b) $\pi/6$

c) $\pi/3$ d) $\pi/4$.

iii) Ohm's law in point form is

a) $\vec{J} = a\vec{E}$ b) $\vec{J} = \frac{\vec{E}}{a}$

c) $\vec{J} = \frac{E^2}{a}$ d) $\vec{J} = a^2 \vec{E}^2$.

iv) Curl of a gradient of a scalar field results in

a) a scalar function with non-zero value

b) a zero vector

c) a periodic function

d) a vector function with non-zero value.

v) The electric potential difference around any closed path is

a) 1 b) 0

c) 2 d) – 1. ☐

vi) Gauss's law relates the electric field intensnly $\vec{E}$ with volume charge density ρ at a point as

a) $\nabla \times \vec{E} = \in_o \rho$ b) $\nabla \times \vec{E} = \frac{\rho}{\in_o}$

c) $\nabla \cdot \vec{E} = \frac{\nabla \rho}{\in_o}$ d) $\nabla \cdot \vec{E} = \frac{\rho}{\in_o}$. ☐

vii) Which one of the following is not Maxwell's equation ?

a) $\nabla \cdot \vec{D} = \rho$ b) $\nabla \times \vec{E} = -\frac{\partial B}{\partial t}$

c) $\nabla \times \vec{H} = J + \frac{d\vec{D}}{dt}$ d) $\nabla \cdot \vec{J} = -\frac{\partial \rho}{\partial t}$. ☐

viii) The electric field at the centre of a circular loop of radius Ω & carrying current I is

a) I b) $\frac{I}{\Omega}$

c) $\frac{I}{2\Omega}$ d) $\frac{I^2}{2\Omega}$. ☐

ix) Electrostatic field is

a) solenoidal b) conservative

c) both solenoidal & conservative d) none of these. ☐

x) The direction of induced *emf* in a conductor can be determined by

a) Work law b) Ampere's law

c) Fleming's right land rule d) Fleming's left land rule. ☐

xi) One weber is equal to

a) 10^6 lines b) $4\pi \times 10^{-7}$ lines

c) 10^{12} lines d) 10^8 lines. ☐

xii) A charged particle enters a magnetic field $\bar{B}$ with a velocity $\bar{V}$ making an angle less than 90° with $\bar{B}$,

The trajectory of the particle will be

a) straight line b) circle

c) spiral d) helical.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) Define electric potential & electric potential difference.

   b) show that $\vec{E}$ = – grad V. 2 + 3

3. Explain the physical significances of the following terms :

   a) Divergence of a vector field

   b) Curl of a vector field.

4. Derive the expression for electric field intensity at any point p due to infinite line charge.

5. Establish the relation $\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$.

   The symbol has usual meaning.

6. State & prove divergence theorem.

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

7. a) A plane polarized wave is travelling along z-axis. Show graphically the variation of $\vec{E}$ & $\vec{H}$ with z. Show that $\frac{E_y}{H_z}$ = 377Ω for such wave.

   b) Develop the analogy between the uniform plane E.M. waves & the electric transmission line.

   c) A uniform transmission line has constants R = 12 mΩ/m, G = 0·8 $\mu\Omega^{-1}$ /m, L = 1·3 μH/m & C = 0·7 nF/m.

   At 5 kHz, find

   i) impedance

   ii) dB attenuation in 2 km. 5 + 5 + 5

8. a) State & explain Biot-Savart law in vector form.

   b) An infinitely long wire is carrying a current I. Find the magnetic field intensity due to this current at a point, which is Ωm away from the wire.

c) Derive an expression for Lorentz force on a moving charge in an electromagnetic field. 5 + 6 + 4

9. a) It is required to hold four equal point charges +q each in equilibrium at the corners of a square. Find the point charge which will do this if placed at the centre of the same.

Dia.

b) Explain the significance of transformer & motional EMF.

c) Explain skin effect. 8 + 4 + 3

10. a) Write & explain differential & integral forms of Maxwell's equation.

b) Explain the terms instantaneous, average & complex poynting vectors. 10 + 5

11. Write short notes an any *three* of the following : 3 × 5

a) Stock's theorem

b) Green's theorem

c) Helmholtz theorem

d) Laplace & Poison's equation

e) Uniqueness theorem.

END