Register Number:……..

KUMARAGURU
college of technology
character is life

GENERAL INSTRUCTIONS TO THE CANDIDATES

1. Candidates are instructed to answer the questions as per Bloom's Taxonomy knowledge level (K_1 to K_6)
2. Candidates are strictly instructed not to write anything in the question paper other than their roll number.
3. Candidates should search their pockets, desks and benches and handover to the Hall Superintendent/ Invigilator if any paper, book or note which they may find therein as soon as they enter the examination hall.
4. Candidates are not permitted to bring electronic watches with memory, laptop computers, personal systems, walkie-talkie sets, paging devices, mobile phones, cameras, recording systems or any other gadget / device /object that would be of unfair assistance to him / her.
5. Corrective measures as per KCT examination policies will be imposed for malpractice in the hall like copying from any papers, books or notes and attempting to elicit the answer from neighbours.

B.E DEGREE EXAMINATIONS: DEC 2015

(Regulation 2014)

Third Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

U14EET302: Electro Magnetic Fields

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Two charges are placed at a distance apart. Now if a glass slab is inserted between them, then the force between the charges will CO1 [K_2]

   a) reduce to zero b) increase

   c) decrease d) not change

2. Consider the following statements associated with the basic electrostatic properties of ideal conductors: CO1 [K_2]

   1. The resultant field inside is zero.
   2. The net charge density in the interior is zero.
   3. Any net charges reside on the surface.
   4. The surface is always equipotential.

5. The field just outside is zero.

   Which of the above statements are correct?

a) 1,2,3 and 4 b) 3,4 and 5 only

c) 1,2 and 3 only d) 2 and 3 only

3. The electric field intensity in the vicinity of two oppositely charged parallel conductors is CO2 [K_1]

a) radial uniformly b) In parallel lines between the two imaginary parallel planes passing through centres of the two conductors

c) not uniform and its direction changes from point to point d) In parallel circular paths between the two conductors, with the centre of the circles located at the mid-point of a line joining the two centres of the two conductors

4. The magnetic flux density of an infinitely long conductor carrying a current I at a radial distance R is CO1 [K_1]

a) $\frac{\mu_0 I}{2\pi R}$ b) $\frac{I}{2\pi R}$

c) $\frac{\mu_0 I}{2\pi R^3}$ d) $\frac{4\pi R^2 I}{3}$

5. The equation of continuity defines the relation between CO2 [K_1]

a) Electric field and magnetic field b) Electric field and charge density

c) Flux density and charge density d) Current density and charge density

6. Consider the following: CO3 [K_1]

   1. AM Radio broadcast
   2. FM Radio broadcast
   3. UHF TV broadcast
   4. Satellite broadcast

   What is the decreasing order of frequency ranges for the above applications in electromagnetic spectrum?

a) 4,3,2,1 b) 4,3,1,2

c) 3,4,2,1 d) 3,2,1,4

7. The current in a coil changes from 5A to 1A in 0.4 seconds. The induced voltage is 40V. The CO3 [K_2]

self inductance in henry is

a) 1 b) 2

c) 4 d) 10

8. Assertion (A): Polarization is due to the application of an electric field to dielectric materials. CO2 [K_1]
Reason (R): When dipoles are created, the dielectric is said to be polarized or in a state of polarization.

a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is NOT the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

9. A signal of 10 V is applied to a 50 Ω coaxial transmission line terminated in 200 Ω. The magnitude of the reflected voltage will be CO3 [K_2]

a) 6 V b) 10 V

c) 0 V d) 1 V

10. Match List I with List II and select the correct answer using the code given below the lists. CO1 [K_1]

List I	List II
A. Magnetic flux	i. Resistance
B. Magneto motive force	ii. Electric Current
C. Reluctance	iii. Conductivity
D. Permeability	iv. Electromotive force

	A	B	C	D
a)	ii	i	iv	iii
b)	iii	i	iv	ii
c)	ii	iv	i	iii
d)	iii	iv	i	ii

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11. The following point charges are located in air: CO1 [K_2]
+0.008 μC at (0,0) m; +0.05 μC at (3,0) m; -0.009 μC at (0,4) m. Determine the total electric flux over the sphere of 5m radius with centre at (0,0).

12. Determine the divergence of the three dimensional radial vector field r. CO1 [K_1]

13. A parallel plate capacitor consisting of two dielectric materials is shown in the figure 1. The middle dielectric slab is placed symmetrically with respect to the plates. If the potential difference between one of the plates and the nearest surface of dielectric interface is 2 volts, then determine the ratio $\varepsilon_1 : \varepsilon_2$. CO2 [$K_2$]

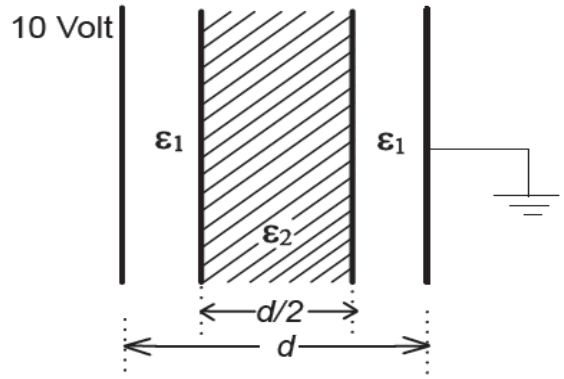

Figure 1

14. Given a vector field $F = y^2x\ a_x - yz\ a_y - x^2\ a_z$, determine the line integral $\int F.dl$ evaluated along a segment on the x-axis from x =1 to x = 2. CO2 [K_2]
15. The magnetic flux density at a point in space is given by $B = 4x\ a_x + 2ky\ a_y + 8\ a_z$ Wb / m^2. Determine the value of constant k. CO2 [K_2]
16. State and explain biot-savart's law. Write the vector expression. CO1 [K_1]
17. Find the inductance per unit length of a coaxial conductor with an inner radius a = 2mm and an outer conductor at b = 9 mm. Assume $\mu_r = 1$. CO3 [K_2]
18. Define the magnetic force on a current element. Write the expression for the force between the two current elements. CO1 [K_1]
19. Determine the propagation constant γ for a material having $\mu_r = 1$, $\varepsilon_r = 8$ and $\sigma = 0.25$ pS/m, if the wave frequency is 1.6 MHz. CO3 [K_2]
20. Define stationary and motional emf 's. Write the expressions. CO3 [K_1]

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. A rectangular conducting loop with a resistance of 0.2 Ω rotates at 500 rpm as in figure 2. The vertical conductor at $r_1 = 0.03$ m is in the field $B_1 = 0.25\ a_r$ Tesla and other conductor is at $r_2 = 0.05$ m and in the field $B_2 = 0.8\ a_r$ Tesla. Find the current flowing in the loop. CO2 [K_3]

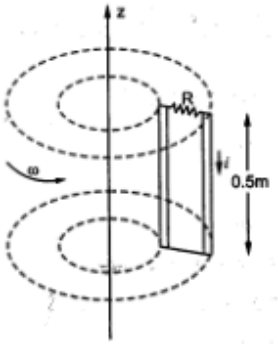

Figure 2

22.	i) A circular disc of radius 'a' m is charged uniformly with a charge density of ρ_s C/m^2. Find the electric field at a point 'h' m from the disc along its axis.	(10)	CO1	[K_2]
	ii) A scalar potential is given by $V = 5x + 4y^2 + 2z^3$ V. Find electric field strength E at (2,3,4).	(4)	CO2	[K_2]
23.	i) Derive an expression for the capacitance of co-axial cable.	(7)	CO2	[K_2]
	ii) Find the total current in outward direction from a cube of 1m, with one corner at the origin and edges parallel to the coordinate axes if, $J = 2x^2 a_x + 2xy^3 a_y + 2xy a_z$ A/m^2.	(7)	CO1	[K_2]
24.	i) Find magnetic field intensity H at the centre of an equilateral triangular loop of side 4 m carrying a current of 5 A.	(10)	CO2	[K_2]
	ii) Write short notes on scalar and vector magnetic potential.	(4)	CO1	[K_1]
25.	i) Find the forces per unit length on two long, straight, parallel conductors if each carries a current of 10A in the same direction and the separation distance is 0.2 m.	(7)	CO2	[K_2]
	ii) Find the torque about the y-axis for the two conductors of length **l** , separated by a distance w in the uniform field B along x-direction. Each conductor is carrying a current of I amperes in the opposite direction. The conductors are placed on xy	(7)	CO3	[K_2]

plane as in figure 3.

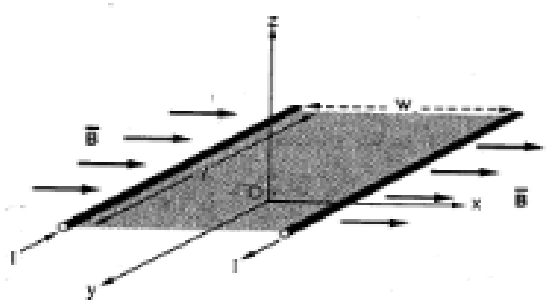

Figure 3

26. i) Derive the expressions for Maxwell's equations in point and integral forms. (10) CO3 [K_1]

ii) Explain the effect of attenuation constant on the amplitude of electric field in a good conductor. (4) CO3 [K_1]

****