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# PRESIDENCY UNIVERSITY
# BENGALURU

## SCHOOL OF ENGINEERING
## END TERM EXAMINATION - JAN 2023

**Semester :** Semester III - 2021
**Course Code :** EEE2003
**Course Name :** Sem III - EEE2003 - Electromagnetic Fields
**Program :** B.Tech. Electrical and Electronics Engineering

**Date :** 9-JAN-2023
**Time :** 1.00PM - 4.00PM
**Max Marks :** 100
**Weightage :** 50%

**Instructions:**
*(i) Read all questions carefully and answer accordingly.*
*(ii) Question paper consists of 3 parts.*
*(iii) Scientific and non-programmable calculator are permitted.*

### PART A

**ANSWER ALL THE TEN QUESTIONS** **10 X 2 = 20M**

**1.** In vector calculus, the curl is a vector operator that describes the infinitesimal circulation of a vector field in three-dimensional Euclidean space. The curl of a field is formally defined as the circulation density at each point of the field. A vector field whose curl is zero is called

a) Rotational (CO1) [Knowledge]
b) Solenoidal
c) Irrotational.
d) Sinusoidal

**2.** All vector fields can be classified in terms of their vanishing or non-vanishing divergence or curl. If the divergence of a vector field is zero, it is called

a) Solenoidal (CO1) [Knowledge]
b) Non Solenoidal
c) Irrotational
d) Rotational

**3.** The electric potential V is a --------- quantity

a) Scalar (CO2) [Knowledge]
b) Vector
c) directional
d) All the above

**4.** Gauss's law states that the total electric flux through any closed surface is equal to
a) Zero (CO2) [Knowledge]
b) Infinity
c) the total charge enclosed by that surface
d) the current density

**5.** Ampere's circuit law states that the line integral of the tangential component of H around a dosed path is the same as
a) the net current enclosed by the path (CO3) [Knowledge]
b) The net charge enclosed
c) Potential difference
d) None of the above

**6.** The relative permeability of free space is ----------
a) 0 (CO3) [Knowledge]
b) Infinity
c) 10
d) 1

**7.** A loop is rotating about the y-axis in a magnetic field B = Ba sin wt ax Wb/m2 . The voltage induced in the loop is due to
a) Motional emf (CO4) [Knowledge]
b) Transformer emf
c) A combination of motional and transformer emf
d) None of the above

**8.** For a distortionless transmission line ---------- condition has to be satisfied.
a) R/L = G/C (CO4) [Knowledge]
b) R/G = L/C
c) RC = LG
d) All the above

**9.** The range of the value of coefficient of coupling in a magnetic circuit is
a) -1<K<1 (CO3) [Knowledge]
b) 0<K<1
c) 1<K<10
d) -1<K<0

**10.** The angle between E and H during Electromagnetic wave propagation is
a) 0 degree (CO4) [Knowledge]
b) 180 degree
c) 90 degree
d) 120 degree

## PART B

**ANSWER ALL THE FOUR QUESTIONS** **4 X 10 = 40M**

**11.** In some cases vector field behaves like a source at a given point**.** If a gas is heated, it will expand. This will cause a net motion of gas particles outward in all directions. Consider the vector field given below, and identify its strength at the point Q(-2,1,6). Comment on the result.
P = x^2yz ax + xz az

(CO1) [Comprehension]

**12.** A total charge Q = 60 μC is split into two equal charges located at 180° intervals around a circular loop of radius 4 m. Estimate the potential at the center of the loop.

(CO2) [Comprehension]

**13.** Consider a magnetic field with intensity H (or flux density B) passing from one magnetic media to another having relative permeability μr1 and μr2. List down all the boundary conditions possible during the transfer with suitable sketches.

(CO3) [Comprehension]

**14.** Poynting's theorem is a statement of conservation of energy applied to electromagnetic fields. Justify the statement with mathematical expression and schematic diagram. Explain the significance of Poynting vector.

(CO4) [Comprehension]

## PART C

**ANSWER ALL THE TWO QUESTIONS** **2 X 20 = 40M**

**15.** The xy-plane serves as the interface between two different media. Medium 1 (z < 0) is filled with a material whose μr = 6, and medium 2 (z > 0) is filled with a material whose μr = 4. If the interface carries current (1/μo) ay mA/m, and B2 = 5ax, + 8az mWb/m2, find H1 and B1.

(CO3) [Application]

**16.** A distortionless line has Zo = 60 Ohm, Attenuation factor is 20mNp/m, u = 0.6c, where c is speed of light in vaccum, frequency of propagation is 100MHz. Identify all the unknown parameters that can be calculated from the above data and estimate them.

(CO4) [Application]

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