GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

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Registration No: | | | | | | | | | | |

Total Number of Pages : 2 **B.TECH**

4th Semester Regular Examination-April-May 2019

BELPC4040 ELECTROMAGNETIC FIELDS

(Regulations 2017) Common to EE/EEE ENGG.

Time : 3 Hours Maximum : 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) 10 x 2=20 Mark

Q.1. Answer *All* Questions.

a	Which of the following is a meaningless combination? (a) grad div (b) div curl (c) curl grad (d) non of these	[CO1] [PO1]
b	If H = $4a_\rho$ - $3a_\varphi$ + $5a_z$, at (1,π /2, 0) the component of H parallel to surface ρ= 1 is (a) $4a_\rho$ (b) $5a_z$ (c) $-3a_\varphi$ (d) $-3a_\varphi + 5a_z$	[CO1] [PO2]
c	Where surfaces $\rho = 2$ and $z = 1$ intersect is (a) an infinite plane (b) a semiinfinite plane (c) a circle (d) a cylinder	[CO1] [PO2]
d	The work done by the force F = $4a_x$ - $3a_y$ + $2a_z$ N in giving a 1 nC charge a displacement of $l0a_x$+ $2a_y$ - $7a_z$ m is (a) 103 nJ (b) 60 nJ (c) 64 nJ (d) 20 nJ	[CO2] [PO2]
e	Plane z = 10 m carries charge 20 nC/m^2. The electric field intensity at the origin is (a) $-10a_z$,V/m (b) $-18\pi\ a_z$V/m (c) $-72\ \pi\ a_z$V/m (d) $-360\ \pi\ a_z$V/m	[CO2] [PO2]
f	An electric potential field is produced by point charges 1 μC and 4μC located at (-2, 1, 5) and (1, 3, - 1) , respectively. The energy stored in the field is (a) 2.57 mJ (b) 5.14 mJ (c) 10.28 mJ (d) None of the above	[CO2] [PO2]
g	Two thin parallel wires carry currents along the same direction. The force experienced by one due to the other is (a) Parallel to the lines (b) Perpendicular to the lines and attractive (c) Perpendicular to the lines and repulsive (d) Zero	[CO3] [PO1]
h	The concept of displacement current was a major contribution attributed to (a) Faraday (b) Lenz (c) Maxwell (d) Lorentz	[CO3] [PO1]
i	A loop is rotating about the y-axis in a magnetic field B = B_0 sin $wt\ a_x$ Wb/m^2. The voltage induced in the loop is due to (a) Motional emf (b) Transformer emf (c) A combination of motional and transformer emf (d) None of the above	[CO4] [PO1]
j	The Poynting vector physically denotes the power density leaving or entering a given volume in a time-varying field. (a) True (b) False	[CO4] [PO1]

PART – B: (Short Answer Questions) 10x2=20 Marks

Q.2. Answer *ALL* questions

a	State Divergence theorem and its significance?	[CO1] [PO1]
b	Define stokes Theorem?	[CO1] [PO1]
c	Write the point form of Maxwell's first equation?	[CO2] [PO1]
d	Give the expression for energy stored in static electric field?	[CO2] [PO1]
e	What is potential gradient?	[CO3] [PO1]
f	Express the integral form of displacement current?	[CO3] [PO1]
g	Define Vector Magnetic Potential and its unit?	[CO3] [PO1]
h	Write about uniqueness theorem?	[CO2] [PO1]
i	What is the Wave equation in free space?	[CO4] [PO1]
j	Define good dielectrics?	[CO4] [PO1]

PART – C: (Long Answer Questions) 4x15=60 Marks

Answer *ALL* questions

Q.3

a	Explain the cylindrical coordinate system and relationship between cartesian to cylindrical system, write transformation of vector 'A' in matrix form?	15 Marks	[CO1] [PO1]
b	Determine the divergence of these vector fields: (a) $P = x^2yz\ a_x + xz\ a_z$ (b) $Q = \rho \sin\varphi\ a_\rho + \rho^2 z\ a_\varphi + z\cos\varphi\ a_z$ (c) $T = 1/r^2 (\cos\theta)\ a_r + r\sin\theta\ \cos\varphi\ a_\Theta + \cos\theta\ a_\varphi$		[CO1] [PO2]
	OR		
c	Explain the spherical coordinate system and relationship between spherical to cylindrical system, write transformation of vector 'A' in matrix form?	15 Marks	[CO1] [PO1]
d	Find the curl of the following vectors: (a) $A = e^{xy}\ a_x + \sin xy\ a_y + \cos^2 xz\ a_z$ (b) $B = \rho\ z^2 \cos\varphi\ a_\rho + z\sin^2\varphi\ a_z$ (c) $C = r\cos\theta\ a_r - 1/r\sin\theta\ a_\theta + 2r^2\sin\theta\ a_\varphi$		[CO1] [PO2]

Q.4

a	State and explain Coulomb's law.	15 Marks	[CO2] [PO1]
b	Explain Gauss's law and its limitations?		[CO2] [PO1]
	OR		
c	Derive the relation between electric field intensity and electric potential.	15 Marks	[CO2] [PO1]
d	Derive Poisson's and Laplace equations from fundamentals.		[CO2] [PO1]

Q.5

a	State and explain Ampere's Circuital law.	15 Marks	[CO3] [PO1]
b	A single-phase circuit comprises two parallel conductors A and B, each 1 cm diameter and spaced 1 m apart. The conductors carry current of +100 and -100 Amps respectively. Determine the filed intensity at the surface of each conductor and also in space exactly midway between A and B.		[CO3] [PO2]
	OR		
c	Derive Biot-Savart law and relate it to Amperes law. Show that the divergence magnetic induction is always zero.	15 Marks	[CO3] [PO1]
d	The vector magnetic potential, A due to direct current in a conductor in free space is given by $A = (x^2 + y^2)\ a_Z\ \mu Wb/m^2$. Determine the magnetic Field produced by the current element at (1, 2, 3).		[CO3] [PO2]

Q.6

a	Derive the expression for displacement current density	15 Marks	[CO4] [PO1]
b	State and explain Faraday's laws of electromagnetic induction in both integral and differential forms.		[CO4] [PO1]
	OR		
c	State and prove Pointing vector?	15 Marks	[CO4] [PO1]
d	Discuss about reflection and refraction of plane waves for normal incidence at the interface between two dielectrics.		[CO4] [PO1]

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