Ref No:

Sri Krishna Institute of Technology,
Bangalore

COURSE PLAN

Academic Year 2019-2020

Program:	B E – Electrical and Electronics Engineering
Semester :	4
Course Code:	18EE45
Course Title:	Electromagnetic Field Theory
Credit / L-T-P:	03/2-2-0
Total Contact Hours:	52
Course Plan Author:	ARUN G

Academic Evaluation and Monitoring Cell

Sri Krishna Institute of Technology
#29,Chimney hills,Hesaraghata Main road, Chikkabanavara Post
Bangalore – 560090, Karnataka, INDIA

Copyright ©2017. cAAS. All rights reserved.

Phone / Fax :08023721477/28392221/23721315
Web: www.skit.org.in , e-mail: skitprinci@gmail.com

Table of Contents

Copyright ©2017. cAAS. All rights reserved.

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	EE
Semester:	4	Academic Year:	2019-2020
Course Title:	Electromagnetic Field theory	Course Code:	18EE45
Credit / L-T-P:	03/2-2-0	SEE Duration:	180 minutes
Total Contact Hours:	52	SEE Marks:	60 marks
CIA Marks:	40	Assignment	40 marks
Course Plan Author:	ARUN G	Sign ..	
Checked By:		Sign ..	
CO Targets	CIA Target :	SEE Target:	

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute.

Module	Content	Teaching Hours	Blooms Learning Levels
1	Vector Analysis: Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector Components and unit vectors. Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems. Numerical. Electrostatics: Coulomb's law, Electric field intensity and its evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions. Electric flux density, Gauss law and its applications. Maxwell's first equation (Electrostatics). Divergence theorem. Numerical	12	L3
2	Energy and Potential: Energy expended in moving a point charge in an electric field. The line integral. Definition of potential difference and potential. The potential field of a point charge and of a system of charges. Potential gradient. The dipole. Energy density in the electrostatic field. Numerical. Conductor and Dielectrics: Current and current density. Continuity of current. Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates.Numerical.	12	L4
3	Poisson's and Laplace Equations: Derivations and problems, Uniqueness theorem. Steady magnetic fields: Biot - Savart's law, Ampere's circuital law. The Curl. Stokes theorem. Magnetic flux and flux density. Scalar and vector magnetic potentials. Numerical	10	L4
4	Magnetic forces: Force on a moving charge and differential current element. Force between differential current elements. Force and torque on a closed circuit. Numerical. Magnetic Materials and Magnetism: Nature of magnetic materials, magnetisation and permeability. Magnetic boundary conditions. Magnetic circuit, inductance and mutual	10	L4

Copyright ©2017. cAAS. All rights reserved.

	inductance. Numerical		
5	Time Varying Fields and Maxwell's Equations: Faraday's law, Displacement current. Maxwell's equations in point form and integral form. Numerical. Uniform plane wave: Wave propagation in free space and in dielectrics. Pointing vector and power considerations. Propagation in good conductors, skin effect. Numerical	08	L4
-	**Total**		

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).
1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	-	-
1	Engineering Electromagnetics William H Hayt et al McGraw Hill 8 thEdition, 2014	1,2,4,5, 6,7	In Lib & Dept
2	Principles of Electromagnetics Matthew N. O. Sadiku Oxford 6 th Edition, 2015	3,4,5,6	In Lib & Dept
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
1	Fundamentals of Engineering Electromagnetics David K. Cheng Pearson 2014		In lib
2	Electromagnetism -Theory (Volume -1) -Applications (Volume-2) AshutoshPramanik PHI Learning 2014		In lib
3	Electromagnetic Field Theory Fundamentals Bhag Guru et al Cambridge 2005		In lib
C	**Concept Videos or Simulation for Understanding**	-	-
C1			
C2			
C3			
C4			
C5			
D	**Software Tools for Design**	-	-
E	**Recent Developments for Research**	-	-
F	**Others (Web, Video, Simulation, Notes etc.)**	-	-
1			

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	17MAT11	Engineering Mathematics	1. Knowledge of vectors and Scalars.	1	Diploma students will be given extra classes	L3

Copyright ©2017. cAAS. All rights reserved.

2	17MAT11	Engineering Mathematics	2. Knowledge of coordinate system	1	Diploma students will be given extra classes	L3
3	17MAT11	Engineering Mathematics	3.Knowledge of matrix ,trignometry, differentiation and integration.	1	Diploma students will be given extra classes	L3
4	17PHY12/22	Engineering Physics	4. Knowledge of columbs law or Gauss Law	2	Diploma students will be given extra classes	L3

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1	Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector Components and unit vectors. Scalar field and Vector field ,	FT	Problems solving and Implementation	L3
1	Coulomb's law, Maxwell's first equation (Electrostatics). Divergence theorem	FT	Problems solving and Implementation	L4
2	Poisson's and Laplace Equations	FT	Problems solving and Implementation	L3
5	Faraday's law, Displacement current. Maxwell's equations in point form and integral form	FT	Problems solving and Implementation	L3

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Instr Method	Assessment Method	Blooms' Level
1	18EE45.1	Understand the rectangular, sheperical and cylindrical coordinate system using scalar and vector dot product.	10	Lecture	Slip Test	L2
2	18EE45.2	Determine point, line, volume charges in an electric field using dot product.	10	Lecture	Assignment	L4 Analyze
3	18EE45.3	Understand the point form of gauss law using rectangular coordinate system	10	Lecture	Assignment and Slip Test	L2 Understand
4	18EE45.4	Apply line integral for the movement of charges	10	Lecture / PPT	Assignment	L3 Apply
5	18EE45.4	Apply maxwell equations for a EM wave in x axis.+	10	Lecture	Slip test	L3 Apply
-	**-**	**Total**	**50**	**-**	**-**	**L2-L4**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level

Copyright ©2017. cAAS. All rights reserved.

1	Evaluate scalar and vector parametres and calculate the dot and cross product	CO1	L2
2	Understanding electric field intensity	CO2	L4
3	Use guass law to understand divergence	CO3	L2
4	Apply line integral to find the energy and potential.	CO4	L3
5	Apply divergence to compute uniqueness theorem	CO5	L3
	Apply faradays law to compute point form and integral form of maxwell equation		
	Apply poynting theorem and calculate skin effect in time varying fields.		

3. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	18EE45.1	Understand the rectangular, sheperical and cylindrical coordinate system using scalar and vector dot product.	2	1	1	1			2					2	2			L2
2	18EE45.2	Determine point, line, volume charges in an electric field using dot product.	3	2	1	1			2					3		2		L2
3	18EE45.3	Understand the point form of gauss law using rectangular coordinate system	3	1	2	1			2		1			2			1	L3
4	18EE45.4	Apply line integral for the movement of charges	3	1	2	1			2		1			2	1			L2
5	18EE45.5	Apply maxwell equations for a EM wave in x axis.+	2	2	2		2	2	3				1			3		L3
-	**15EE662.**	Average																**-**
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																

4. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1		Seminar	2nd week / date	Dr XYZ, Inst	List from B4 above
2		Seminar	3rd Week		

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Vector Analysis and Electrostatics	10	2			1	1	2	CO1,CO2	L2, L4
2	Energy and Potential	10	2			1	1	2	CO1,CO2	L2,L3

Copyright ©2017. cAAS. All rights reserved.

3	Poissons and Laplace Equations	10		2		1	1	2	CO3,CO4	L2,L3
4	Magnetic forces	10		2	2	1	1	2	CO3,CO4	L2,L3
5	Time varying Fields	10			2	1	1	2	CO4,CO5	L2,L4
-	**Total**	**50**	**4**	**4**	**4**	**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	30	CO1,CO2	L2
3, 4	CIA Exam – 2	30	CO3,CO4	L2
5	CIA Exam – 3	30	CO4,CO5	L2
1, 2	Assignment - 1	10	CO1,CO2	L2,L2
3, 4	Assignment - 2	10	CO3,CO4	L2,L2
5	Assignment - 3	10	CO4,CO5	L2,L2
1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz - 1		-	-
3, 4	Quiz - 2		-	-
5	Quiz - 3		-	-
1 - 5	Other Activities – Mini Project	-		
	Final CIA Marks		**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:	Vector Analysis and Electrostatics	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
1	Understand the rectangular, sheperical and cylindrical coordinate system using scalar and vector dot product.	CO1	L2
2	Determine point, line, volume charges in an electric field using dot product.	CO2	L3
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
1	Scalars and Vectors, Vector algebra,	CO1	L2
2	Cartesian co-ordinate system, Vector Components and unit vectors	CO1	L2
3	Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field	CO1	L2
4	Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems.	CO1	L2
5	Expression for gradient, divergence and curl in rectangular,	CO1	L2
6	cylindrical and spherical co-ordinate systems. Numerical.	CO1	L2
7	Coulomb's law, Electric field intensity	CO1	L2
8	Evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions.	CO1	L2

Copyright ©2017. cAAS. All rights reserved.

9	Electric flux density, Gauss law and its applications.	CO1	L2
10	Maxwell's first equation (Electrostatics). Divergence theorem. Numerical.	CO1	L2
c	**Application Areas**		
-	Students should be able employ / apply the Module learnings to . . .		
1	Use to find intensity and density	CO1	L3
2	Used in coordinate system	CO2	L4
d	**Review Questions**		
-			
1	Find the expression of the field component at a far point due to a dipole	CO1	L1
2	Discuss coordinate system	CO1	L3
3	Explain vector and scalar product	CO2	L2
4	Write and explain electric field intensity	CO2	L4
5	Illustrate coloumbs law	CO2	L2
6	With usual notations derive the equation for the magnetic force between two differential current elements.	CO2	L5
7	State and Prove i) Ampere circuit law ii) Stoke's Theorem	CO2	L2
8	Use columbs law	CO2	L3
9	Write and solve electric flux density	CO2	L4
10	List asymptotic notations for omega and theta?	CO1	L1
e	**Experiences**	-	-
1		CO1	L2
2			

Module – 2

Title:	Energy and Potential	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-		-	**Level**
1	Apply line integral for the movement of charges Understand the point form of gauss law using rectangular coordinate system	CO3	L2
2	Apply line integral for the movement of charges Understand the point form of gauss law using rectangular coordinate system	CO4	L3
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
11	Energy expended in moving a point charge in an electric field. The line integral	CO3	L2
12	Definition of potential difference and potential	CO3	L3
13	The potential field of a point charge and of a system of charges.	CO3	L2
14	Potential gradient. The dipole	CO3	L3
15	Energy density in the electrostatic field. Numerical	CO3	L2
16	Current and current density. Continuity of current.	CO3	L3
17	Metallic conductors, conductor's properties and boundary conditions	CO3	L2
18	Perfect dielectric materials, capacitance calculations.	CO3	L2
19	Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates	CO3	L3
20	Numericals	CO3	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Use to find performance of Line integral	CO3	L3
2	Used in current density	CO4	L4

Copyright ©2017. cAAS. All rights reserved.

d	**Review Questions**	-	-
-			
11	Use current density to find continuity of current.	CO3	L3
12	Explain energy expended in moving a charge	CO3	L2
13	Write and explain iterative binary line intergral	CO4	L4
14	Illustrate potential gradient.	CO4	L2
15	Describe the advantage of potential energy	CO3	L5
16	Explain current density	CO3	L2
e	**Experiences**	-	-
1		CO3	L2
2			

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	18EE45	Sem:	4	Marks:	30	Time:	75 minutes
Course:	Electromagnetic Field Theory						

-	-	**Note: Answer any ONE FULL questions, FROM EACH MODULE each carry equal marks.**	**Marks**	**CO**	**Level**
		MODULE _1			
1	a	What are scalars and vectors.	15	CO1	L1
	b	Find the expression of the field component at a far point due to a dipole.			L2
	c	A spherical volume charge density is given by $\rho = \rho_o (1-r^2/a^2)$ $r \leq a$ $r > a$ i. Calculate the total charge Q ii. Find the electric field intensity E outside the charge distribution iii. Find the electric field intensity for $r \leq a$. iv. Show that the maximum value of E is at $r = 0.745a$		CO2	L3
2	a	Discuss different coordinate system.	15	CO1	L2
	b	Explain electric flux density.			L4
		MODULE _2			
3	a	Explain gauss law and divergence theorem	15	CO3	L1
	b	Explain current and current density		CO4	L2
4	a	Compute the potential difference	15	CO3	L2
	b	Compute line intergral		CO4	L2

b. Assignment -1

Model Assignment Questions							
Crs Code:	18EE45	Sem:	4	Marks:	10	Time:	75 minutes
Course:	Electromagnetic Field Theory						

SNo	Assignment Description	Marks	CO	Level
1	Discuss various coordinates system.	10	CO1	L2
2	Discuss coulombs law.	10	CO1	L2
3	Discuss electric field intensity.	10	CO1	L2

Copyright ©2017. cAAS. All rights reserved.

4	Describe line integral, surface integral, volume integral.	10	CO1	L3
5	Calculate electric flux density at A(0,0,4) due to q=6 micro c at origin.	10	CO1	L3
6	If E=-8xy a_x-4x^2 a_y+a_z v/m. Find the work done in carrying a 6C of charge from A(1,8,5) to B(2,18,6) along the path y=3x+2, z=x+4.	10	CO3	L3
7	State and prove divergence theorem.	10	CO2	L2
8	If V=3x^2+3y^2+3z^2 v Find (i) V (ii) E (iii) D at P(-4,5,4)	10	CO2	L3
9	A spherical volume charge density is given by ρ= ρ_o (1-r^2 /a^2) r≤a r>a i. Calculate the total charge Q ii. Find the electric field intensity E outside the charge distribution iii. Find the electric field intensity for r ≤a. iv. Show that the maximum value of E is at r= 0.745a	10	CO2	L3
10	If V=3x^2+3y^2+3z^2 v Find (i) V (ii) E (iii) D at P(-4,5,4)	10	CO1	L2
11	Calculate electric flux density at A(0,0,4) due to q=6 micro c at origin.	10	CO1	L2
12	Explain electric flux density.	10	CO1	L2
13	Explain gauss law and divergence theorem.	10	CO2	L2
14	Explain current and current density.	10	CO2	L2
15	If E=-8xy a_x-4x^2 a_y+a_z v/m. Find the work done in carrying a 6C of charge from A(1,8,5) to B(2,18,6) along the path y=3x+2, z=x+4.	10	CO2	L3
16	Compute line intergral.	10	CO1	L2

D2. TEACHING PLAN - 2

Module – 3

Title:	Poissons and Laplace Equations	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Understand the current density and vector operator	CO3	L2
2	Understand uniquiness theorem	CO3	L3
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
21	Derivations and problems	CO3	L2,L3
22	Uniqueness theorem.	CO3	L2,L3
23	Biot - Savart's law	CO3	L2,L3
24	Ampere's circuital law	CO3	L2,L3
25	The Curl	CO3	L2,L3
26	Stokes theorem	CO3	L2,L3
27	Magnetic flux & flux density	CO3	L2,L3
28	Scalar potentials	CO3	L2,L3
29	vector magnetic potentials	CO3	L2,L3
30	numericals	CO3	L2,L3
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Use to find potential wrt laplace equations	CO3	L4
2	Used in current and magnetic field	CO3	L3
d	**Review Questions**	-	-

Copyright ©2017. cAAS. All rights reserved.

-	The attainment of the module learning assessed through following questions	-	-
1	State and prove Uniqueness theorem	CO3	L4
2	Show that V satisfies Laplace equation in spherical coordinate system	CO3	L3
3	Solve the Laplace equation for the potential field and find the capacitance in homogeneous region between two concentric conducting spheres with radii a and b such that b>a if V=0 at r=b, V=V_0 at r=a.	CO3	L4
4	Explain the scalar and vector magnetic potentials	CO3	L3
5	With usual notations derive the equation for the magnetic force between two differential current elements.	CO3	L4
6	State and Prove i) Ampere circuit law ii) Stoke's Theorem	CO3	L3
7	In an infinitely long coaxial cable carrying a uniformly current I in the inner conductor and –I in the outer conductor, find the magnetic field intensity is a function of radius and sketch the field intensity variation.	CO3	L4
8	Derive the expression for **H** due to straight conductor of finite length.	CO3	L3
9	**Find the magnetic flux density at the centre O of a square of sides Equal to 5m and carrying 10 A of current**	CO3	L4
10	**A conductor in the form of regular polygon of n sides inscribed in a circle of radius R. Show that the expression for magnetic flux density B is given by B=(μ_0I/2R)tan(/n) at the centre where I is the current. Show also when n is indefinitely increased then the expression reduces to B= (μ_0I/2R). A circuit carrying a direct current of 5 A forms a regular hexagon inscribed in a circle of radius 1m. Calculate the magnetic flux density at the centre of the current hexagon. Assume the medium to be free space.**	CO3	L3
e	**Experiences**	-	-
1		CO6	L2
2			

Module – 4

Title:	Magnetic forces	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Understand the magnetic field parameters like intensity and density	CO4	L2
2	Understand maxwell eqautions	CO4	L3
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
31	Force on a moving charge and differential current element	CO4	L2,L3
32	Force between differential current elements	CO4	L3
33	Force and torque on a closed circuit	CO4	L2,L3
34	Numerical	CO4	L3
35	Nature of magnetic materials	CO4	L3
36	Magnetisation and permeability.	CO4	L3
37	Magnetic boundary conditions	CO4	L2,L3
38	Magnetic circuit	CO4	L3
39	Inductance	CO4	L2,L3
40	Mutual inductance and numerical	CO4	L3
c	**Application Areas**	**-**	**-**

Copyright ©2017. cAAS. All rights reserved.

-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Use to find potential energy	CO4	L2,L3
2	Used in magnetic boundary conditions	CO4	L3
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Explain differential current elements	CO4	L2,L3
2	Explain Force between differential current elements.	CO4	L3
3	Explain Magnetization and permeability	CO4	L2,L3
4	Write the Maxwell's equations in point and integral form for time varying fields. State each Maxwell's equation.	CO4	L3
5	Given $\mu=10^{-5}$ H/m, 4×10^{-9} F/m, =0 and $_v$=0. Find k so that each of the following pairs of fields satisfies Maxwell's equation i) $D=6a_x-2ya_y+2za_z$ nC/m^2 and $H=kza_x+10ya_y-25za_z$ A/m ii) $E=(20y-kt)a_x$ V/m and $H=(y+2000000t)a_z$ V/m . Write the unit of k in both the cases	CO4	L2,L3
6	Explain the concept of self inductance and mutual inductance	CO4	L3
7	Derive the boundary conditions at the interface between two different magnetic materials.	CO4	L2,L3
8	A Solenoid with air core has 2000 turns and a length of 500mm. Core radius is 40mm. Find its inductance.	CO4	L3
9	Calculate the vector current density at a point P(1.5, 90°, 0.5) if $H=(2/\rho)\cos0.2\phi\ a_\rho$.	CO4	L2,L3
10	With usual notations derive the equation for the magnetic force between two differential current elements.	CO4	L3
e	**Experiences**	-	-
1		CO7	L2
2			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	18EE45	Sem:	4	Marks:	30	Time	75 minutes
Course:	Electromagnetic Field Theory						

-	-	**Note: Answer any ONE FULL questions, FROM EACH MODULE each carry equal marks.**	**Marks**	**CO**	**Level**
		MODULE 3			
1	a	State and prove Uniqueness theorem	5	CO4	L3
	b	Show that V satisfies Laplace equation in spherical coordinate system	10	CO4	L3
2	a	Explain the scalar and vector magnetic potentials	5	CO4	L2
	b	With usual notations derive the equation for the magnetic force between two differential current elements.	10	CO4	L4

Copyright ©2017. cAAS. All rights reserved.

		MODULE 4			
3	a	Derive point form of continuity equation and Maxwell equation	5	CO4	L3
	b	Evaluate the boundary conditions for E and D between two dielectrics.	10	CO4	L3
				CO4	
4	a	Derive the expression for B of a circular loop of radius 'a' carrying a current I using Biot Savart Law.	5	CO4	L3
	b	Obtain the boundary conditions at the interface between two magnetic materials	10	CO4	L3

b. Assignment – 2

Model Assignment Questions							
Crs Code:	18EE45	Sem:	4	Marks:	30	Time:	75 minutes
Course:	Electromagnetic Field Theory						

SNo	Assignment Description	Marks	CO	Level
1	State and prove Uniqueness theorem	10	CO4	L3
2	Show that V satisfies Laplace equation in spherical coordinate system	10	CO4	L2
3	Solve the Laplace equation for the potential field and find the capacitance in homogeneous regio between two concentric conducting spheres with radii a and b such that b>a if V=0 at r=b, $V=V_0$ at r=a.	10	CO4	L3
4	Explain the scalar and vector magnetic potentials	10	CO4	L2
5	With usual notations derive the equation for the magnetic force between two differential current elements.	10	CO4	L3
6	State and Prove i) Ampere circuit law ii) Stoke's Theorem	10	CO4	L3
7	In an infinitely long coaxial cable carrying a uniformly current I in the inner conductor and –I in the outer conductor, find the magnetic field intensity is a function of radius and sketch the field intensity variation.	10	CO4	L3
8	Derive the expression for **H** due to straight conductor of finite length.	10	CO4	L3
9	Find the magnetic flux density at the centre O of a square of sides Equal to 5m and carrying 10 A of current	10	CO4	L3
10	A conductor in the form of regular polygon of n sides inscribed in a circle of radius R. Show that the expression for magnetic flux density B is given by $B=(\mu_0 I/2R)\tan(\ /n)$ at the centre where I is the current. Show also when n is indefinitely increased then the expression reduces to $B= (\mu_0 I/2R)$. A circuit carrying a direct current of 5 A forms a regular hexagon inscribed in a circle of radius 1m. Calculate the magnetic flux density at the centre of the current hexagon. Assume the medium to be free space.	10	CO4	L3
11	Explain Force between differential current elements.	10	CO4	L3
12	Explain Magnetization and permeability	10	CO4	L3
13	Write the Maxwell's equations in point and integral form for time varying fields. State each Maxwell's equation.	10	CO4	L3
14	Given $\mu=10^{-5}$ H/m, 4×10^{-9} F/m, =0 and $_v$=0. Find k so that each of the following pairs of fields satisfies	10	CO4	L3

Copyright ©2017. cAAS. All rights reserved.

	Maxwell's equation i) $D=6a_x-2ya_y+2za_z$ nC/m^2 and $H=kza_x+10ya_y-25za_z$ A/m ii) $E=(20y-kt)a_x$ V/m and $H=(y+2000000t)a_z$ V/m . Write the unit of k in both the cases			
15	Explain the concept of self inductance and mutual inductance	10	CO4	L3
16	Derive the boundary conditions at the interface between two different magnetic materials.	10	CO4	L3
17	A Solenoid with air core has 2000 turns and a length of 500mm. Core radius is 40mm. Find its inductance.	10	CO4	L3
18	Calculate the vector current density at a point P(1.5, 90°, 0.5) if $H=(2/\rho)\cos 0.2\phi\, a_\rho$	10	CO4	L3
19	With usual notations derive the equation for the magnetic force between two differential current elements.	10	CO4	L3
20	State and prove Uniqueness theorem	10	CO4	L3

D3. TEACHING PLAN - 3

Module – 5

Title:	Loop and Horn Antenna and Antenna Types	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Evaluate maxwell equation on point and integral form	CO5	L3
2	Understand wave propogation and skin effect	CO5	L2
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
41	Faraday's law	CO5	L3
42	Displacement current	CO5	L2
43	Maxwell's equations in point form and integral form	CO5	L3
44	Numericals	CO5	L2
45	Wave propagation in free space	CO5	L3
46	Wave propagation in dielectrics	CO5	L2
47	Pointing vector	CO5	L3
48	Power considerations	CO5	L2
49	Propagation in good conductors	CO5	L3
50	Skin effect. Numerical	CO5	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Use to find skin effect	CO5	L3
2	Used in wave propagation	CO5	L4
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Explain electromagnetic wave propagation in good conductor	CO5	L3
2	The magnetic field intensity of uniform plane wave in air is 20 A/m in a_y ^ direction. The wave s propagating in the z-direction at an angular frequency of $2x10^9$ rad/sec. Find: (i) Phase shift constant (ii) Wavelength(iii) Frequency (iv)mplitude of electric field intensity.	CO5	L4
3	State and explain the faraday's law of electromagnetic induction	CO5	L3

Copyright ©2017. cAAS. All rights reserved.

4	Derive Maxwell's equation for time varying fields.	CO5	L4
5	Given E = Em sin(ωt-βz) a_y^ in free space. Find D, B, H.	CO5	L3
6	Find the amplitude of the displacement current density, In the air near car antenna where the field strength of FM signal is E= 80 cos(6.277x10^8t- 2.09y)a_z v/m Inside a capacitor where ξ_r = 600 and D= 3x10^{-6} sin (610^6t- 0.3464x) c/m^2	CO5	L4
7	State and explain the conditions of Faraday's law	CO5	L4
8	Derive and obtain the solution of 3-D wave equation for all the vector fields, In free space.	CO5	L3
9	A certain material has conductivity =0 and μ_r=1. Make use of Maxwell's equations to find $_r$.Assume E=800sin(10^6t-0.1z)a_y (V/m)	CO5	L4
10	Explain the point and integral form of Poynting Theorem.	CO5	L3
11	Write the point and integral form of Maxwell's equation for free space and conductor	CO5	L4
e	**Experiences**	-	-
1		CO10	L2
2		CO9	

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code	18EE45	Sem:	4	Marks:	30	Time:	75 minutes
Course:	Electromagnetic Field Theory						

-	-	**Note: Answer any ONE FULL questions, FROM EACH MODULE each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Explain electromagnetic wave propagation in good conductor	5	CO5	L4
	b	The magnetic field intensity of uniform plane wave in air is 20 A/m in a_y ^ direction. The wave s propagating in the z-direction at an angular frequency of 2x10^9 rad/sec. Find: (i) Phase shift constant (ii) Wavelength(iii) Frequency (iv)mplitude of electric field intensity.	10	CO5	L3
				CO5	L4
2	a	Derive Maxwell's equation for time varying fields.	5	CO5	L4
	b	Given E = Em sin(ωt-βz) a_y^ in free space. Find D, B, H.	10	CO5	L3
				CO5	L4
3	a	State and explain the conditions of Faraday's law	5	CO5	L4

Copyright ©2017. cAAS. All rights reserved.

	b	Derive and obtain the solution of 3-D wave equation for all the vector fields, In free space.	10	CO5	L3
				CO5	L4
4	a	Explain the point and integral form of Poynting Theorem.	5	CO5	L4
	b	Write the point and integral form of Maxwell's equation for free space and conductor	10	CO5	L3

b. Assignment – 3

Model Assignment Questions							
Crs Code:	18EE45	Sem:	4	Marks:	10	Time:	75 minutes
Course:	Electromagnetic Field Theory						

SNo	Assignment Description	Marks	CO	Level
1	Explain electromagnetic wave propagation in good conductor	10	CO5	L4
2	The magnetic field intensity of uniform plane wave in air is 20 A/m in a_y ^ direction. The wave s propagating in the z-direction at an angular frequency of $2x10^9$ rad/sec. Find: (i) Phase shift constant (ii) Wavelength(iii) Frequency (iv)mplitude of electric field intensity.	10	CO5	L4
3	Explain Skin effect	10	CO5	L3
4	Derive Maxwell's equation for time varying fields.	10	CO5	L4
5	Given E = Em sin(ωt-βz) a_y^ in free space. Find D, B, H.	10	CO5	L4
6	The dry earth has conductivity $=10^{-8}$ (S/m) and relative permittivity $_r=4$. Find the frequency range on which the conduction current dominates the displacement current.	10	CO5	L3
7	State and explain the conditions of Faraday's law	10	CO5	L4
8	Derive and obtain the solution of 3-D wave equation for all the vector fields, In free space.	10	CO5	L4
9	Explain the concept of self inductance and mutual inductance	10	CO5	L3
10	Explain the point and integral form of Poynting Theorem.	10	CO5	L4
11	Write the point and integral form of Maxwell's equation for free space and conductor	10	CO5	L4
12	Explain electromagnetic wave propagation in good conductor	10	CO5	L3
13	The magnetic field intensity of uniform plane wave in air is 20 A/m in a_y ^ direction. The wave s propagating in the z-direction at an angular frequency of $2x10^9$ rad/sec. Find: (i) Phase shift constant (ii) Wavelength(iii) Frequency (iv)mplitude of electric field intensity.	10	CO5	L4
14	Explain Skin effect	10	CO5	L4
15	Derive Maxwell's equation for time varying fields.	10	CO5	L3
16	Given E = Em sin(ωt-βz) a_y^ in free space. Find D, B, H.	10	CO5	L4

Copyright ©2017. cAAS. All rights reserved.

F. EXAM PREPARATION

1. University Model Question Paper

Course:		Electromagnetic Field Theory						Month / Year		May /2019	
Crs Code:		18EE45	Sem:	4	Marks:	100		Time:		180 minutes	
Module		Answer all FIVE full questions. All questions carry equal marks.							**Marks**	**CO**	**Level**
1	a	Define electric scalar potential. With usual notations, establish the relationship between electric field intensity and electric scalar potential.							12	CO1	L2
	b	Calaculate electric field intensity at a point on a sphere of radius 3m if a +ve charge of 2 micro c is at origin.							8	CO2	L3
		OR									
-	a	Describe line integral, surface integral, volume integral.Determine the force between two charges q1= 3x10-4 at m(1,2,3) and q2=-10-9C at N(2,0,5)							12	CO1	L3
	b	Determine the force between two charges q1= 3x10-4 at m(1,2,3) and q2=-10-9C at N(2,0,5)							8	CO2	L3
2	a	Given the potential field $v=50x^2yz+20y^2$ volts in free space, find i)Potential v at p(1,2, ii) Field strength at p iii) $a_{x\hat{}}$ at p							8	Co2	L3
	b	State and prove divergence theorem.							12	CO2	L3
		OR									
-	a	If $V=3x^2+3y^2+3z^2$ v Find (i) V (ii) E (iii) D at P(-4,5,4)							8	CO2	L3
	b	Derive point form of continuity equation and Maxwell equation.							12	CO2	L3
3	a	With usual notations derive the equation for the magnetic force between two differential current elements.							10	CO3	L3
	b	State and Prove i) Ampere circuit law ii) Stoke's Theorem							10	CO3	L2
		OR									
-	a	Derive the expression for **H** due to straight conductor of finite length.							8	CO3	L3
	b	Find the magnetic flux density at the centre O of a square of sides Equal to 5m and carrying 10 A of current							6	CO3	L3
	c	A conductor in the form of regular polygon of n sides inscribed in a circle of radius R. Show that the expression for magnetic flux density B is given by $B=(\mu_0 I/2R)\tan(\ /n)$ at the centre where I is the current. Show also when n is indefinitely increased then the expression reduces to $B= (\mu_0 I/2R)$. A circuit carrying a direct current of 5 A forms a regular hexagon inscribed in a circle of radius 1m. Calculate the magnetic flux density at the centre of the current hexagon. Assume the medium to be free space.							6	CO3	L3
4	a	A Solenoid with air core has 2000 turns and a length of 500mm. Core radius is 40mm. Find its inductance.							5	CO4	L3
	b	Calculate the vector current density at a point P(1.5, 90°, 0.5) if $H=(2/\rho)\cos 0.2\phi\ a_\rho$.							5	CO4	L3
	c	With usual notations derive the equation for the magnetic force between two differential current elements.							10	Co4	L3
		OR									
	a	State and prove Uniqueness theorem							8	CO4	L3

Copyright ©2017. cAAS. All rights reserved.

	b	Show that V satisfies Laplace equation in spherical coordinate system	2	CO4	L3
-	c	Solve the Laplace equation for the potential field and find the capacitance in homogeneous regio between two concentric conducting spheres with radii a and b such that b>a if V=0 at r=b, $V=V_0$ at r=a.	10	CO4	L3
5	a	The magnetic field intensity of uniform plane wave in air is 20 A/m in a_y ^ direction. The wave s propagating in the z-direction at an angular frequency of $2x10^9$ rad/sec. Find: (i) Phase shift constant (ii) Wavelength(iii) Frequency (iv)Amplitude of electric field intensity.	10	CO5	L3
	b	Explain Skin effect	5	CO5	L2
	c	Derive Maxwell's equation for time varying fields.	5	CO5	L3
		OR		CO5	
	a	Derive and obtain the solution of 3-D wave equation for all the vector fields, In free space	10	CO5	L3
	b	Write the point and integral form of Maxwell's equation for free space and conductor	10	CO5	L3

2. SEE Important Questions

Course:	Electromagnetic Field Theory					Month / Year	May 2019	
Crs Code:	18EE45	Sem:	4	Marks:	100	Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.				-	-	
Module	Qno.	Important Question				**Marks**	**CO**	**Year**
1	1	Define electric scalar potential. With usual notations, establish the relationship between electric field intensity and electric scalar potential.				10	CO2	2016
	2	Calaculate electric field intensity at a point on a sphere of radius 3m if a +ve charge of 2 micro c is at origin.				10	CO1	2014
	3	Determine the force between two charges q1= 3x10-4 at m(1,2,3) and q2=-10-9C at N(2,0,5)				5	CO1	2015
	4	Discuss electric field intensity.				5	CO1	2016
	5	Describe line integral, surface integral, volume integral.Determine the force between two charges q1= 3x10-4 at m(1,2,3) and q2=-10-9C at N(2,0,5)				10	CO1	2017
2	1	Given the potential field $v=50x^2yz+20y^2$ volts in free space, find i)Potential v at p(1,2, ii) Field strength at p iii) a_x^ at p				10	CO2	2017
	2	State and prove divergence theorem.				10	CO2	2016
	3	If $V=3x^2+3y^2+3z^2$ v Find (i) V (ii) E (iii) D at P(-4,5,4)				10	CO2	2010
	4	Derive point form of continuity equation and Maxwell equation.				10	CO2	2014
	5	Explain gauss law				10	CO2	2016
	6	Derive maxwells equation in point form				10	CO2	2015
	7	Explain work done wrt equipotential surface.				10	CO2	2010
3	1	With usual notations derive the equation for the magnetic force between two differential current elements.				10	CO3	2014
	2	State and Prove i) Ampere circuit law ii) Stoke's Theorem				10	CO3	2014
	3	In an infinitely long coaxial cable carrying a uniformly current I in the inner conductor and –I in the outer conductor, find the magnetic field intensity is a function of radius and sketch the field intensity variation.				10	CO3	2011
	4	Derive the expression for **H** due to straight conductor of finite length.				10	CO3	2016
	5	Find the magnetic flux density at the centre O of a square of sides Equal to 5m and carrying 10 A of current				10	CO3	2016
	6	A conductor in the form of regular polygon of n sides inscribed in a circle of radius R. Show that the expression for magnetic flux density B is given				10	CO3	2015

Copyright ©2017. cAAS. All rights reserved.

		by B=(μ_0I/2R)tan(/n) at the centre where I is the current. Show also when n is indefinitely increased then the expression reduces to B= (μ_0I/2R). A circuit carrying a direct current of 5 A forms a regular hexagon inscribed in a circle of radius 1m. Calculate the magnetic flux density at the centre of the current hexagon. Assume the medium to be free space.			
4	1	A Solenoid with air core has 2000 turns and a length of 500mm. Core radius is 40mm. Find its inductance.	10	CO4	2010
	2	Calculate the vector current density at a point P(1.5, 90°, 0.5) if H=(2/^) cos0.2 ₂ₙ a^.	10	CO4	2012
	3	With usual notations derive the equation for the magnetic force between two differential current elements.	10	CO4	2014
	4	State and prove Uniqueness theorem	10	CO4	2014
	5	Show that V satisfies Laplace equation in spherical coordinate system	10	CO4	2013
5	1	Derive Maxwell's equation for time varying fields.	10	CO5	2016
	2	Given E = Em sin(ωt-βz) a_y^ in free space. Find D, B, H.	10	CO5	2014
	3	The dry earth has conductivity =10^{-8} (S/m) and relative permittivity $_r$=4. Find the frequency range on which the conduction current dominates the displacement current.	10	CO5	2011
	4	State and explain the conditions of Faraday's law	10	CO5	2011
	5	Derive and obtain the solution of 3-D wave equation for all the vector fields, In free space.	10	CO5	2010

Copyright ©2017. cAAS. All rights reserved.

Course Outcome Computation

Academic Year:

Odd / Even semester

INTERNAL TEST					**T1**						**T2**	
Course Outcome	**CO1**		**CO2**		**CO3**		**CO4**		**CO5**		**CO6**	
QUESTION NO	**Q1**	**LV**	**Q2**	**LV**	**Q3**	**LV**	**Q1**	**LV**	**Q2**	**LV**	**Q3**	**LV**
MAX MARKS	10	-	10	-	10	-	10	-	10	-	10	-
USN-1	5	2	10				10	3	9	3	4	1
USN-2	5	2	8	3								
USN-3	7	3	7	3	10	3	8	3	8	3	5	2
USN-4					4	1	10	3	8	3	6	2
USN-5	8	3	6	2	9	3	10	3	8	3		
USN-6							10	3	9	3	4	1
Average CO Attainment		2.5		2.75		2.33		3		3		1.5

LV Threshold : 3:>60%, 2:>=50% and <=60%, 1: <=49%
CO1 Computation :(2+2+2+3)/4 = 10/4=2.5

PO Computation

Program Outcome	PO1		PO3		PO3		PO1		PO12		PO12	
Weight of CO - PO	3		1		3		2		2		3	
Course Outcome	CO1		CO2		CO3		CO4		CO5		CO6	
Test/Quiz/Lab	T1						T2					
QUESTION NO	Q1	LV	Q2	LV	Q3	LV	Q1	LV	Q2	LV	Q3	LV
MAX MARKS	10	-	10	-	10	-	10	-	10	-	10	-
USN-1	5	2	10	3			10	3	9	3	4	1
USN-2	5	2	8	3								
USN-3	7	3	7	3	10	3	8	3	8	3	5	2
USN-4					4	1	10	3	8	3	6	2
USN-5	8	3	6	2	9	3	10	3	8	3		
USN-6							10	3	9	3	4	1
Average CO Attainment		2.5		2.75		2.33		3		3		1.5

Copyright ©2017. cAAS. All rights reserved.