ALVA'S
Education Foundation

Alva's Institute of Engineering & Technology

Shobhavana Campus, Mijar, Moodbidri, D.K – 574225

Phone: 08258-262725, Fax: 08258-262726

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course File –Check list	
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course File

Course Name	:	Electromagnetic Waves
Course Code	:	18EC55
Semester / Section	:	V Sem/A- Section
Academic Year	:	2022-23 Odd Semester
Duration	:	Oct 2022 To Jan 2023

	I semester B.E./B.Tech.	I semester B.Arch./B.Plan	I semester B.Sc.	III semester B.E./ B.Tech.	III Semester B.Arch.	III semester B. Plan	III Semester B.Sc.	V Semester B.E./B.Tech.	V Semester B.Arch./ B.Plan.	VII semester B.E./B.Tech.	VII semester B.Plan.	VII semester B.Arch	IX semes B.Arch
Commencement of ODD Semester	# 10.10.2022	# 10.10.2022	10.10.2022 (Tentative)	11.10.2022	31.10.2022	31.10.2022	10.10.2022	10.10.2022	12.09.2022	21.08.2022	21.08.2022	19.09.2022	01.09.20
Internship				11.10.2022 To 30.10.2022						21.08.2022 To 17.09.2022	21.08.2022 To 24.09.2022		
Commencement of Classes				31.10.2022	31.10.2022	31.10.2022	10.10.2022	10.10.2022	12.09.2022	19.09.2022	26.09.2022	19.09.2022	01.09.20
Last Working day of ODD Semester				11.02.2023	11.02.2023	11.02.2023	28.01.2023	27.01.2023	31.12.2022	31.12.2022	07.01.2023	31.12.2022	20.12.20
Practical Examination				13.02.2023 To 21.02.2023	13.02.2023 To 21.02.2023	13.02.2023 To 21.02.2023	01.02.2023 To 09.02.2023	30.01.2023 To 09.02.2023	03.01.2023 To 13.01.2023	03.01.2023 To 13.01.2023	09.01.2023 To 14.01.2023	03.01.2023 To 13.01.2023	21.12.20 To 31.12.20
Theory Examinations				22.02.2023 To 22.03.2023	22.02.2023 To 22.03.2023	22.02.2023 To 22.03.2023	13.02.2023 To 03.03.2023	13.02.2023 To 18.03.2023	16.01.2023 To 15.02.2023	16.01.2023 To 15.02.2023	16.01.2023 To 15.02.2023	16.01.2023 To 15.02.2023	—
Internship			*	26.03.2023 To 16.04.2023	—	—		—	—		—		—
Internship Viva Voce/ Project viva				—	—	—		—	—	—	—		—
Commencement of EVEN Semester				17.04.2023	17.04.2023	17.04.2023	20.03.2023	20.03.2023	20.03.2023	20.02.2023	20.02.2023	20.02.2023	06.01.20

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CALENDAR OF EVENTS (ODD SEMESTER 2022-23) BE & MBA

VISION

Transformative education by pursuing excellence in Engineering and Management through enhancing skills to meet the evolving needs of the community"

MISSION

To bestow quality technical education to imbibe knowledge, creativity and ethos to students community.
To inculcate the best engineering practices through transformative education.
To develop a knowledgeable individual for a dynamic industrial scenario.
To inculcate research, entrepreneurial skills and human values in order to cater the needs of the society.

Week	Month	Days							Activities
		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
1	SEP				1	2	3	4	
2		5	6	7	8	9	10	11	19th : Commencement of VII Semester BE
3		12	13	14	15	16	17	18	22-23 : Student Mentoring
4		19	20	21	22	23	24	25	26 – 30 : Technical Talk/Club and Social Activity
5		26	27	28	29	30			
6	OCT						1	2	
7		3	4	5	6	7	8	9	4th : Maha Navami & 5th : Vijaya Dashami
8		10	11	12	13	14	15	16	10th : Commencement of V Semester BE
9		17	18	19	20	21	22	23	20-21 : Student Mentoring
10		24	25	26	27	28	29	30	24th : Naraka Chaturdashi
11		31							24 – 29 : Technical Talk/Club and Social Activity
									26th : Deepavali
									31st : Commencement of III Semester BE
12	NOV		1	2	3	4	5	6	
13		7	8	9	10	11	12	13	1st : Kannada Rajyothsava
14		14	15	16	17	18	19	20	10th -12th : 1nd IA for VII Semester BE
15		21	22	23	24	25	26	27	24-25 – Student Mentoring
16		28	29	30					20- 25 Technical Talk/Club / Social Activity
									28th : Commencement of 3rd Sem MBA
17	DEC				1	2	3	4	
18		5	6	7	8	9	10	11	8 - 10 : 2nd IA for VII Semester / 1st IA V Semester BE
19		12	13	14	15	16	17	18	15 - 17 : 1st IA for BE III Semester BE
20		19	20	21	22	23	24	25	22-23 : Student Mentoring
21		26	27	28	29	30	31		29 - 31 : 3nd IA for VII Semester BE
									26 - 31 : Technical Talk/Club / Social Activity
									30-31 Second International Conference on Data Analytics & Learning-2022 (DAL'22)
									31 : Last Working Day of VII Semester BE
22	JAN-2023							1	2 - 4 : 2nd IA for V Semester BE / 1st IA for MBA 3rd Sem
23		2	3	4	5	6	7	8	14- Makara Sankranti
24		9	10	11	12	13	14	15	16 -18 : 2nd IA for III Semester BE
25		16	17	18	19	20	21	22	20-21 : Student Mentoring
26		23	24	25	26	27	28	29	23 - 28 : Technical Talk/Club / Social Activity
27		30	31						24th,25th and 27th : 3nd IA for V Sem BE
									26-Republic Day
									27 : Last Working Day of V Semester BE
28	FEB-2023			1	2	3	4	5	
29		6	7	8	9	10	11	12	8 - 10 : 3nd IA for III Semester BE / 2nd IA for MBA 3rd sem
30		13	14	15	16	17	18	19	18- Maha Shivaratri
31		20	21	22	23	24	25	26	11 : Last Working Day of III Semester BE
32		27	28						
33	MAR-2023			1	2	3	4	5	
34		6	7	8	9	10	11	12	9 -11 : 3nd IA for MBA 3rd sem
35		13	14	15	16	17	18	19	18 : Last Working Day of MBA 3rd Sem

Approved by IQAC Chairman

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CALENDAR OF EVENTS (ODD SEMESTER 2022-23) BE

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

tre of Excellence to Empower the Young Minds in the field of Electronics and Communication Engineering with Research s and Skill Development through Transformative Education catering to the needs of the Society."

MISSION

create Learning Environment to enable the Students for Excellence in the field of Electronics d Communication Engineering.

Empower the Students with necessary Skills for Solving the Complex Technological Problems.

Inculcate Research Culture among Teaching-Learning Group by guiding them towards search Activities to bridge the gap between Industry and Academia.

Imbibing the Students with Human Values and Ethics through Transformative Education and ake them Socially Responsible Professionals.

Month	Days							Activities
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
SEP				1	2	3	4	1st – 30th : Boot Camp for 7th sem 22-23 : Student Mentoring 26 – 30 : Technical Talk1
	5	6	7	8	9	10	11	
	12	13	14	15	16	17	18	
	19	20	21	22	23	24	25	
	26	27	28	29	30			
OCT						1	2	4th : Maha Navami & 5th : Vijaya Dashami 1st – 22nd – Training for 5th sem 10th : Commencement of VII Semester BE 20-21 : Student Mentoring 24th : Naraka Chaturdashi & 26th : Deepavali 24 – 29 : Technical Talk/Club and Social Activity 27th - Commencement of V Semester BE 31st : Commencement of III Semester BE
	3	4	5	6	7	8	9	
	10	11	12	13	14	15	16	
	17	18	19	20	21	22	23	
	24	25	26	27	28	29	30	
	31							
NOV		1	2	3	4	5	6	1st : Kannada Rajyothsava 10th -12th : 1nd IA for VII Semester BE 24-25 – Student Mentoring 20– 25 Technical Talk/Club / Social Activity 22nd – 26th SDP 28th – 30th – Industrial visit
	7	8	9	10	11	12	13	
	14	15	16	17	18	19	20	
	21	22	23	24	25	26	27	
	28	29	30					
DEC				1	2	3	4	8 - 10 : 2nd IA for VII Semester / 1st IA V Semester BE 15 - 17 : 1st IA for BE III Semester BE 22-23 : Student Mentoring 29 - 31 : 3nd IA for VII Semester BE 21 - 27 : Cultural fest Jamboori 31 : Last Working Day of VII Semester BE
	5	6	7	8	9	10	11	
	12	13	14	15	16	17	18	
	19	20	21	22	23	24	25	
	26	27	28	29	30	31		
JAN-2023							1	14- Makara Sankranti 16 -18 : 2nd IA for III & V Semester BE 20-21 : Student Mentoring 23 - 28 : Technical Talk/Club / Social Activity 24th,25th and 27th : 3nd IA for V Sem BE 26-Republic Day 27 : Last Working Day of V Semester BE
	2	3	4	5	6	7	8	
	9	10	11	12	13	14	15	
	16	17	18	19	20	21	22	
	23	24	25	26	27	28	29	
	30	31						
FEB-2023			1	2	3	4	5	1st – 20th – training for non-placed students 8 - 10 : 3nd IA for III Semester BE 18- Maha Shivaratri 11 : Last Working Day of III Semester BE 21st -25th -FDP
	6	7	8	9	10	11	12	
	13	14	15	16	17	18	19	
	20	21	22	23	24	25	26	
	27	28						

Approved by IQAC Chairm

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Faculty Personal Time Table

Mrs. Vijetha T S **Designation: Assistant Professor**

Academic Year: 2022-23(ODD)						Effective form: 14/11/22(v3)			
	9.00 To 9.50	9.50 To 10.40	10.40 To 11.00	11.00 To 11.50	11.50 To 12.40	12.40 To 1.40	1.40 To 2.30	2.30 To 3.20	3.30 To 5.00
MON		DSPA-B			EM	LUNCH			
TUE		DSPA-B			EM		DSP LAB		
WED		EM					EM		
THU				EM			DSPA-B		
FRI				DSPA-B			DSP LAB		
SAT		DSPA-B							

WORK LOAD		
THEORY	LAB	TOTAL
20	06	26

ELECTROMAGNETIC WAVES
V Semester (EC/TC)
[As per Choice Based Credit System (CBCS)

Course Code	**18EC55**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

CREDITS – 03

Course objectives: This course will enable students to:

- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart's, Amperes's Law and Stokes 'theorem for different current distributions.
- Infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of Maxwell' equations and applications for Plane waves for their behavior in different media.
- Acquire knowledge of Poynting theorem and its application of power flow.

Module-1	**RBT Level**
Revision of Vector Calculus – **(Text 1: Chapter 1)** **Coulomb's Law, Electric Field Intensity and Flux density**: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**	**L1, L2, L3**
Module -2	
Gauss's law and Divergence: Gauss 'law, Application of Gauss' law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ▼ and divergence theorem, Numerical Problems **(Text: Chapter 3.2 to 3.7).** **Energy, Potential and Conductors**: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and**	**L1, L2, L3**

4.6). Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**	
Module-3	
Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation **(Text: Chapter 7.1 to 7.3)** **Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems. **(Text: Chapter 8.1 to 8.6)**	**L1, L2, L3**
Module -4	
Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).** **Magnetic Materials**: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems **(Text: Chapter 9.6 to 9.7).** Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**	**L1, L2, L3**
Module -5	
Maxwell's equations Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)** **Uniform Plane Wave**: Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (γ, α, β, η) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**	**L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:

- Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
- Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
- Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
- Calculate magnetic force, potential energy and Magnetization with respect to

magnetic materials and voltage induced in electric circuits.

- Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:

W.H. Hayt and J.A. Buck, –Engineering Electromagnetics‖, 8th Edition, Tata McGraw-Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books:

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford university press, 4th Edn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2ndEdn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill. N. Narayana Rao, –Fundamentals of Electromagnetics for Engineering‖, Pearson.

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Department of Electronics and Communication Engineering

SEMESTER--5	**Academic Year: 2022-23**
Code: 18EC55	Course Name: Electromagnetic Waves
Teacher: Mrs. Vijetha T S	

Outcomes: After studying this course, students will be able to,

CO mbers	Course Outcomes	Blooms Level	Target Level
C55.1	Apply differential equations, vector algebra, Integral multivariate calculus and complex calculus to solve for basics electrostatic, magneto static and electromagnetic field problems.	L1	2
C55.2	Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law	L2	2
C55.3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Poisson's equations	L3	2
C55.4	Calculate magnetic field, force, and potential energy with respect to magnetic materials	L4	2
C55.5	Apply Maxwell's equation for time varying fields, EM waves in free space and conductors and also Evaluate power associated with EM waves using Pointing theorem	L3	2

O/PSO Mapping Matrix:

CO mbers	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSOn
C55.1	2													1	
C55.2		2											2		
C55.3		2											2		
C55.4	2												1		
C55.5		2	1				1							2	
UM	4	6	2				1						5	3	
ERAGE	2	2	1				1						2.5	1.5	

O/PSO Mapping Matrix Justification: Students can,

	Justification
8EC55.1	This CO is about fundamentals of mathematics Vector calculation so its mapped moderately. This CO is slightly related to signal processing
8EC55.2	This CO is related to applying mathematics concepts in signalling so it is moderately mapped This gives the basic idea about communication engineering
8EC55.3	This CO is related to applications of mathematics in electromagnetic by using this engineering problems can be analysed This gives the basic idea about communication engineering
8EC55.4	This CO is full calculation of electromagnetic by using fundamentals formulas of mathematics. This gives the basic idea about communication engineering
8EC55.5	The Maxwell equations are having good applications in complex engineering problems. By the help of Maxwell equations communication design can be done. This CO is moderately related to signal processing Brief study of electromagnetic waves are done here it is slightly mapped Here the velocity of light value is derived. this value is help to solve many environmental issues.

Course Teacher
Signature with date

IQAC Member
Signature with date

IQAC Chairman
Signature with date

IQAC
Dept. of Electronics Communication
Alva's Institute of Engg. & Technology
Mijar MOODBIDRI 574 225

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PARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

h SEM ELECTROMAGNETIC WAVES INTERNAL MARKS 22-23(ODD)

#	USN	NAME
1.	4AL20EC001	Aishwarya A P
2.	4AL20EC002	Aishwarya P
3.	4AL20EC004	Akshay
4.	4AL20EC005	Akshay Sonar
5.	4AL20EC006	Aravinda Jogi
6.	4AL20EC007	Bhavana M
7.	4AL20EC008	Chaithrashree M G
8.	4AL20EC010	Chethana.M
9.	4AL20EC011	Darshan Madival
10.	4AL20EC012	Disha H
11.	4AL20EC013	Harshitha D K
12.	4AL20EC014	Jyoti P
13.	4AL20EC015	K.Vijay Bhanu
14.	4AL20EC016	Karthik G Shet
15.	4AL20EC017	Kishan Kumar
16.	4AL20EC018	Krathika
17.	4AL20EC019	Kshama Tc
18.	4AL20EC020	Libina Lal
19.	4AL20EC021	Manjunath Sajjan
20.	4AL20EC023	Mohammed S
21.	4AL20EC024	Mokshith
22.	4AL20EC025	Monika. D. B.
23.	4AL20EC026	Monisha P
24.	4AL20EC027	Nagarjuna GS

25.	4AL20EC028	Padala Sattibabu
26.	4AL20EC029	P V Likhitha
27.	4AL20EC030	Pavan Kh
28.	4AL20EC031	Pooja P
29.	4AL20EC032	Prajaktha Poojary
30.	4AL20EC033	Prajwal R
31.	4AL20EC034	Prashanth VK
32.	4AL20EC035	Pratham Puthran
33.	4AL20EC036	Prathish G Nayak
34.	4AL20EC037	Praveen V
35.	4AL20EC038	Preeti G M
36.	4AL20EC039	Rakesh Sangshetty
37.	4AL20EC040	Rakshitha S
38.	4AL20EC041	Ramya K
39.	4AL20EC042	Ranjitha R
40.	4AL20EC043	Rohan H
41.	4AL20EC045	Sangamesh Biradar
42.	4AL20EC046	Sanjay Gk
43.	4AL20EC048	Santhripti C S
44.	4AL20EC049	Shravan V U
45.	4AL20EC050	Shridevi Rao
46.	4AL20EC051	Shruthi
47.	4AL20EC052	Shubhashri S
48.	4AL20EC053	Shwetha
49.	4AL20EC054	Soumya N

L20EC055	spoorthi salaskar
L20EC056	Srujan
L20EC057	Umesh
L20EC058	Varshini K L
L20EC059	Veena Talawar
L20EC060	Vinod Raj G N
L20EC061	Vinyashree Jain
L20EC062	Vishanth
L20EC063	Vishwanath

VA'S

Department of Electronics & Communication Engineering

Continuous Internal Evaluation Test-I ODD Semester 2022-23

rse Title: **Electromagnetic Waves**		Course Code: 18EC55
e: 12/12/2022	Time: 9.30AM to 11.00AM	Semester: 5th SEM Section
ulty: Mrs. VIJETHA T S		Max. Marks: 30

te: Answer ONE complete question from each Part.

No.		Questions	Marks	COs	BTL
		PART-A			
	a)	Explain the following quantities. i) Unit vector ii) Base vector iii) Cross product iv) Dot product	8	1	L2
	b)	Obtain the expression for electric field at a point on the axis of charged circular Ring.	7	1	L4
		OR			
	a)	Derive an expression for the electric field intensity due to infinite line charge.	8	1	L3
	b)	Point charges of 50nC each are located at A(1,0,0) B(-1,0,0) C(0,1,0) and D(0,-1,0)m, find the total force on the charge at A and also find electric field at A.	7	1	L3
		PART-B			
3	a)	State and prove the Gauss law	5	2	L3
	b)	Infinite number of charges each of QnC are placed along X axis at X= 1,2,4,8,..... ∞. Find the Electric potential and electric field intensity at a point X=0 due to all charges.	5	2	L4
	c)	State and prove the Divergence Theorem.	5	2	L3
		OR			
4	a)	Define the Electric potential and electric field intensity. Obtain the relationship between them.	5	2	L3
	b)	Obtain the expression for electric field at a point due to a Spherical shell of charges.	5	2	L3
		Given $\vec{D} = \frac{10r^3}{4}\hat{r}$ in Cylindrical coordinator, evaluate both sides of divergence theorem for the volume enclosed by the cylinder			

els of Bloom's Taxonomy

o.	L1	L2	L3	L4	L5	L6
vel	Remember	Understand	Apply	Analyze	Evaluate	Create

urse Outcomes

O	Course Outcomes	Target Level
O1	Apply differential equations, vector algebra, Integral multivariate calculus and complex calculus to solve for basics electrostatic, magneto static and electromagnetic field problems.	2
O2	Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law	2
O3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Poisson's equations	2
O4	Calculate magnetic field, force, and potential energy with respect to magnetic materials	2
O5	Apply Maxwell's equation for time varying fields, EM waves in free space and conductors and also Evaluate power associated with EM waves using Pointing theorem	2

6/12/22

H.O.D.
Dept. Of Electronics & Communication
Govt. Institute of Engg. & Technology,
Wayanad, MOOLADKA - 673 577

I.Q.A.C

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY, MOODBIDRI

Department of Electronics and Communication Engineering

Semester	5th	Internal Assessment	1

SCEHEME OF EVALUATION

12th December 2022

Electromagnetic Waves – 18EC55

Note: Answer any TWO full questions.

Q. NO.	Scheme of Evaluation	Marks	CO's
1a	i) Unit vector ii) Base vector iii) Cross product iv) Dot product	2+2+2+2	1
1b	FIGURE and Explanation * If we consider an element of the ring at a point diametrically opposite to A. Then its dE_y components points upwards & hence cancels with that due to the element at A. dE_x components due to both the element add up. $\Rightarrow \int dE_y = 0$ The total field at P is the sum of the fields due to all the elements of the ring. $E = \int dE = \int dE_x + \int dE_y = \int dE_x$ $E = \int dE_x = \frac{S_L \cdot x}{4\pi\epsilon_0 r^3}\int_0^{2\pi R} dl$ $= \frac{S_L \cdot x}{4\pi\epsilon_0 r^3}(2\pi R)$ where $r = (R^2+x^2)^{1/2}$ $\Rightarrow E = \frac{2\pi R S_L \cdot x}{4\pi\epsilon_0 (R^2+x^2)^{3/2}}$ If $\hat{a}_x$ is the unit vector along the axis. The field at P is $\vec{E} = \left[\frac{S_L \cdot R x}{2\epsilon_0 (R^2+x^2)^{3/2}}\right]\hat{a}_x$	2+5	
2a	FIGURE and Explanation	2+5	

	Note that R is perpendicular to the distance of P from the line charge $dE_z = dE \cos\theta = \frac{dq}{4\pi\epsilon_0 r^2} \cdot \cos\theta$ $E_z = \frac{-\rho_L}{4\pi\epsilon_0 R} \int_{(\pi-\theta_1)}^{\theta_1} \cos\theta \cdot d\theta$ $E_z = \frac{-\rho_L}{4\pi\epsilon_0 R} [\sin\theta_1 - \sin\theta_2]$ $\vec{E_z} = \frac{-\rho_L}{4\pi\epsilon_0 R} [\sin\theta_1 - \sin\theta_2] (-\hat{a}_z) \rightarrow (5)$ ∴ The total electric field is $\vec{E} = \vec{E_y} + \vec{E_z}$ $\boxed{\vec{E} = \frac{\rho_L}{4\pi\epsilon_0 R} [(\cos\theta_2 + \cos\theta_1)\hat{a}_y + (\sin\theta_1 - \sin\theta_2)\hat{a}_z]} \rightarrow (6)$		
2b	Force at A =21.5micro ax Electric field intensity 430 ax	4+3	1
3a	Gauss law statement Proof law Three cases	2+3	2
3b	V = 18Q E =11.98Q	2+3	2
3c	Divergence theorem statement Proof	2+3	2
4a	Definition of electric field intensity Electric potential derivation	2+3	2
4b	Figure and explanation derivation	2+3	2
4c	Divergence equation 800π	2+3	2

ALVA'S

Institute of Engineering & Technology

Department of Electronics & Communication Engineering

Continuous Internal Evaluation Test-II ODD Semester 2022-23

Course Title: **Electromagnetic Waves**		Course Code: 18EC55
Date: 04/01/2023	Time: 9.30AM to 11.00AM	Semester: 5th SEM Section
Faculty: Mrs. VIJETHA T S		Max. Marks: 30

Note: Answer ONE complete question from each Part.

Q.No.		Questions	Marks	COs	BTL
		PART-A			
1	a)	State and prove the stroke's theorem.	8	3	L2
	b)	State and prove the Ampere's Circuital Law	7	3	L4
		OR			
2	a)	Sate and prove Uniqueness theorem.	8	3	L3
	b)	Explain the scalar and vector magnetic potential.	7	3	L3
		PART-B			
3	a)	Derive the expression for force on a differential current element in a magnetic field and also obtain the equation for force on straight current carrying conductor.	8	4	L3
	b)	Derive the Expression for a Torque on a rectangular current loop in a uniform magnetic field.	7	4	L4
		OR			
4	a)	Derive the magnetic boundary conditions at the interface between two different magnetic materials.	8	4	L3
	b)	Verify the Stokes' Theorem for the field $\vec{H}$ = 6xy $\widehat{a_x}$ -3y^2 $\widehat{a_y}$ A/m and the rectangular path around the region 2≤x≤5, -1≤y≤2 and Z=0,	7	4	L3

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

Course Outcomes

CO	Course Outcomes	Target Level
CO1	Apply differential equations, vector algebra, Integral multivariate calculus and complex calculus to solve for basics electrostatic, magneto static and electromagnetic field problems.	2
CO2	Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law	2
CO3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Poisson's equations	2
CO4	Calculate magnetic field, force, and potential energy with respect to magnetic materials	2
CO5	Apply Maxwell's equation for time varying fields, EM waves in free space and conductors and also Evaluate power associated with EM waves using Pointing theorem	2

I.Q.A.C

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Stokes theorem

Stokes theorem provides a way of relating a line integral to the surface integral in cases, where curl of a vector exists in a vector field.

It is given by

$$\int (\nabla \times \vec{F}) \cdot d\vec{s} = \oint \vec{F} \cdot d\vec{l}$$

This means, if we consider the curl of a vector $\vec{F}$ at each point in a vector field and sum up all those curl within any chosen surface then, the sum will be equal to Circulation of $\vec{F}$ around the boundary of chosen surface

2+2+2+2 | 1

Proof:-

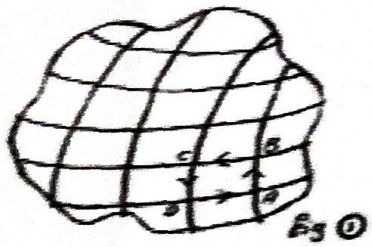

Fig ①

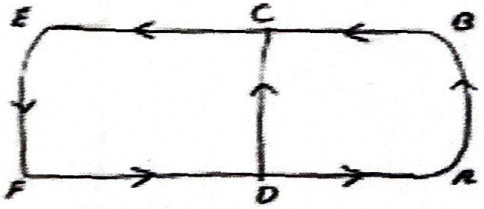

Fig ②

Now Consider fig ① surface in the vector field where there is Circulation of $\vec{F}$

We can divide the surface into a number of elementary areas

Consider one such element of area ds, with parameters ABCD

Proof with figure

Ampere's Circuital law

The ampere's law states that "The line integral of $\vec{H}$ along any closed path is equal to the current enclosed by the path." It is represented as

$$\oint \vec{H} \cdot d\vec{l} = I \quad \text{or} \quad \oint \vec{B} \cdot d\vec{l} = \mu I$$

2+5

	Proof with figure		
2a	Theorem statement Proof conclusion	2+5	
2b	Explanation of Scalar Magnetic Potential Explanation of vector Magnetic Potential	3+4	1
3a	Equation for force on a differential current element in a magnetic field Modified equation for Straight current carrying conductor	2+3	2
3b	Torque on a conductor definition Explanation derivation	2+3	2
4a	Tangential Component Explanation Normal Component Explanation	4+4	2
4b	Stokes' Theorem in terms of H LHS answer 126 RHS answer 126	1+3+3	2

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USN | | | | | | | | | | |

Alva's Institute of Engineering &Technology, Moodbidri

Department of Electronics & Communication Engineering

Continuous Internal Evaluation Test-III ODD Semester 2022-23

Course Title: **Electromagnetic Waves**		Course Code: 18EC55
Date: 25/01/2023	Time: 9.30AM to 11.00AM	Semester: 5th SEM Section
Faculty: Mrs. VIJETHA T S		Max. Marks: 30

Note: Answer ONE complete question from each Part.

Q.No.		Questions	Marks	COs	BTL
		PART-A			
1	a)	Define the Electric potential and electric field intensity. Obtain the relationship between them.	8	2	L2
	b)	Determine the potential difference between two points due to a point charge 'Q' at the origin	7	2	L4
		OR			
2	a)	Explain the Divergence, and also derive the Maxwell's first point form of equation.	8	2	L3
	b)	Derive an expression for the electric field intensity due to infinite line charge(using Gauss's Law)	7	2	L3
		PART-B			
3	a)	Obtain the expression for faraday's law differential form and also explain the Maxwell's integral form of equations.	8	5	L3
	b)	Explain the Pointing Vector Theorem.	7	5	L4
		OR			
4	a)	Starting from Maxwell's equations, derive wave equations in terms of E and H for a uniform plane travelling in free space.	8	5	L3
	b)	The electric field in free space is given by $E= 800\cos(10^8 t-\beta y)a_z$ V/m Find i)β ii)λ and iii)H at point p(1,1.5,0.4) at t=8ns.	7	5	L3

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
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4	Calculate magnetic field, force, and potential energy with respect to magnetic materials	2
5	Apply Maxwell's equation for time varying fields, EM waves in free space and conductors and also Evaluate power associated with EM waves using Pointing theorem	2

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

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Affiliated to VTU Belagavi and Approved by AICTE, New Delhi, Recognized by Govt. of Karnataka

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

VISION

"Centre of Excellence to Empower the young minds in the field of Electronics and Communication Engineering with research focus and skill development through Transformative Education catering to the needs of the Society"

MISSION

M1: To create Learning Environment to enable the Students for Excellence in the field of Electronics and Communication Engineering.

M2: To Empower the Students with necessary Skills for Solving the Complex Technological Problems.

M3: To Inculcate Research Culture among Teaching-Learning Group by guiding them towards Research Activities to bridge the gap between Industry and Academia.

M4: By Imbibing the Students with Human Values and Ethics through Transformative Education and make them Socially Responsible Professionals

PROGRAM EDUCATIONAL OBJECTIVEs (PEOs)

The graduates will be able to

PEO1: Apply Mathematical, Scientific and Engineering skills for solving problems in the area of Electronics and communication engineering.

PEO2: Expose to Emerging Technologies and excel in Industries/Higher studies/Research.

PEO3: Apply analytical skills in the area of Electronics and [illegible] Engineering to become competent and Employable.

PEO4: Inculcate Professional ethics, human values, team [illegible] engineering problems and contribute to societal needs.

PROGRAM SPECIFIC OUTCOMEs (PSOs)

The graduates will be able to

PSO1: Understand and apply the principles of Electronics and Communication Engineering in various domains of Analog and Digital Systems.

PSO2: Design and implement systems using the concepts of Electronics, Signal processing, Embedded systems and Semiconductor Technology.

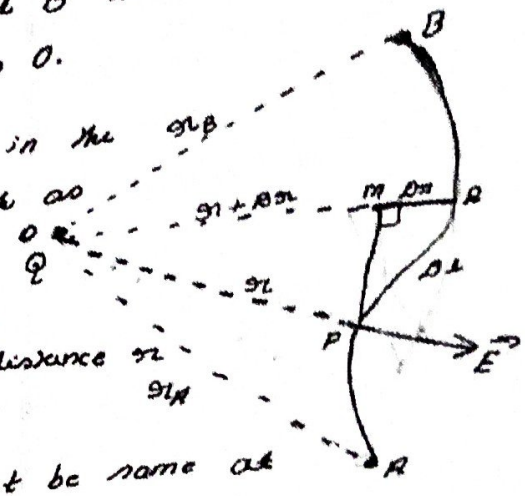
PSO3: Apply modern hardware and software tools to analyse and solve engineering problems.

Scheme		
Definition OF E and V Relationship between E and V	2+5	

Potential field of a Point Charge :-

Consider a point charge Q at O. It establishes a radially outward field in its vicinity whose strength decreases with distance.

Consider two points A and B in the field. which are at distance r_A & r_B respectively from O.



let a unit positive charge be moved in the field from A to B. along an arbitrary path as shown in figure.

let us consider the unit charge at the position P on the path, which is at a distance r from O.

let $\vec{E}$ be the field at P ($\vec{E}$ need not be same at all points on the path)

The work done in moving the charge from P through a small length PR (Δl) along the path AB is

$$\Delta W = -\vec{E}\cdot\Delta\vec{l}$$

$$= -E\cdot\Delta l\cos\theta$$

$$\Delta W = \frac{-Q}{4\pi\varepsilon_0 r^2}\cdot\Delta l\cos\theta$$

$\therefore$ $\boxed{\text{Force}} = QE$ i.e. $\boxed{\text{Force}} = F$ & $F_R = E\sin\theta$

$F_R = F_N = E\sin\theta$

$$dW = -\frac{Q}{4\pi\epsilon_0 r^2}\, dr$$

The work done = dW & $F_N = dr$

$$dW = -\frac{Q}{4\pi\epsilon_0 r^2}\, dr$$

$\therefore$ The total work done in moving the charge from A to B is

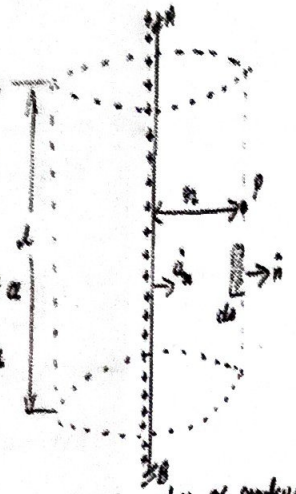
$$W = \int dW = \int_A^B -\frac{Q}{4\pi\epsilon_0 r^2}\, dr$$

$$W = \frac{Q}{4\pi\epsilon}\left[\frac{1}{r}\right]_A^B$$

$$W = \frac{Q}{4\pi\epsilon_0}\left[\frac{1}{r_B} - \frac{1}{r_A}\right]$$

$\therefore$ Let V_{AB} be the difference b/w potentials at points B & A respectively

$$V_{AB} = \frac{Q}{4\pi\epsilon_0}\left[\frac{1}{r_B} - \frac{1}{r_A}\right]$$

2a	1. Find at a point due to an infinite line charge of uniform line charge density. Consider an infinite line charge along AB. Let it have a uniform linear charge density ρ_L. It is required to find the field at a point P. Located at a normal distance r from the line charge.  Consider a hollow right circular cylindrical surface of radius r, open both the end closed. $\therefore$ The electric flux through an elementary area ds is $d\psi = \vec{D}\cdot d\vec{S} \rightarrow (1)$ Let $\hat{s}$ and $\hat{n}$ be the unit vectors along $\vec{D}$ and normal to ds respectively eq (1) $\therefore$ $d\psi = D\cdot dS\ \hat{s}\cdot\hat{n} \Rightarrow (2)$ From the figure, it is clear that $\hat{s}$ & $\hat{n}$ are parallel. $\hat{s}\cdot\hat{n} = \lvert\hat{s}\rvert\lvert\hat{n}\rvert\cos 0 = 1$ eq (2) becomes $d\psi = D\cdot dS$ $\therefore$ The total flux over the entire curved area is $\psi_1 = \int d\psi = \int D\cdot dS$ $\psi_1 = D\int dS \Rightarrow (3)$ $\therefore$ D is constant over the curved surface.	2+5

Dividing both sides by Δv, we will get

$$\frac{\oint \vec{D}\cdot d\vec{s}}{\Delta v} = \frac{\Delta q}{\Delta v}$$

Applying the limits $\Delta v \to 0$ on both sides

$$\lim_{\Delta v \to 0} \frac{\oint \vec{D}\cdot d\vec{s}}{\Delta v} = \lim_{\Delta v \to 0}\left(\frac{\Delta q}{\Delta v}\right)$$

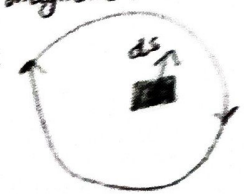
WKT

$$\lim_{\Delta v \to 0}\left(\frac{\Delta q}{\Delta v}\right) = \frac{dq}{dv} = \rho_v \text{ : volume charge density at } P$$

Again from the definition of divergence

$$\lim_{\Delta v \to 0}\left(\frac{\oint \vec{D}\cdot d\vec{s}}{\Delta v}\right) = \nabla\cdot\vec{D}$$

$\Rightarrow$ $\boxed{\nabla\cdot\vec{D} = \rho_v}$ It is also called as Gauss' law in its differential form

3a	Integral and Point (or differential) forms of Faraday's Law Consider a loop of a conducting material which is stationary Let it be subjected to a change in the magnetic flux linkage As per Faraday's law, the induced current in the loop obeys the law $e = -\frac{d\phi}{dt}$  Where 'e' is the induced emf and ϕ is the magnetic flux linkage But the induced emf in a loop is given by $e = \oint \vec{E}\cdot d\vec{l}$ $\oint \vec{E}\cdot d\vec{l} = -\frac{d\phi}{dt}$	2+3	5

[illegible]	Poynting vector theorem :-	2+3	5

"The energy transported in a given volume free of any source is equal to the sum of, the rate at which the decrease in electric and magnetic energies stored in the volume takes place and the rate at which energy is flow across through the surface"

Poynting vector represents the rate at which energy is transported per unit area at a point on the path of an EM wave § is given by the cross product $\vec{E} \times \vec{H}$ at the same point.

Proof:-

from Maxwell's equation

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} = -\mu \frac{\partial H}{\partial t} \rightarrow (1)$$

$$\nabla \times \vec{H} = \vec{J} + \frac{\partial D}{\partial t} = \vec{J} + \varepsilon \frac{\partial \vec{E}}{\partial t} \rightarrow (2)$$

$$\nabla(\vec{E}\times\vec{H}) = \vec{H}\left(-\mu\frac{\partial\vec{H}}{\partial t}\right) - \vec{E}\left(\vec{J} + \epsilon\frac{\partial\vec{E}}{\partial t}\right)$$

$$\nabla(\vec{E}\times\vec{H}) = -\mu\left(\vec{H}\cdot\frac{\partial\vec{H}}{\partial t}\right) - \vec{E}\cdot\vec{J} - \epsilon\vec{E}\cdot\frac{\partial\vec{E}}{\partial t} \rightarrow (4)$$

$$\Rightarrow \vec{H}\cdot\frac{\partial\vec{H}}{\partial t} = \frac{1}{2}\frac{\partial H^2}{\partial t}$$

$$\vec{H}\cdot\frac{\partial\vec{H}}{\partial t} = \frac{1}{2}\left(\mu\times\frac{\partial H^2}{\partial t}\right)$$

$$\vec{E}\cdot\frac{\partial\vec{E}}{\partial t} = \frac{1}{2}\frac{\partial E^2}{\partial t}$$

(4) becomes

$$\nabla(\vec{E}\times\vec{H}) = -\frac{\partial}{\partial t}\left(\frac{\mu H^2}{2}\right) - \frac{\partial}{\partial t}\left(\frac{\epsilon E^2}{2}\right) - \vec{E}\cdot\vec{J}$$

Taking Volume Integral on both

$$\int_V \nabla(\vec{E}\times\vec{H})\,dv = -\int_V\left[\frac{\partial}{\partial t}\left(\frac{\mu H^2}{2} + \frac{\epsilon E^2}{2}\right)\right]dv - \int_V \vec{E}\cdot\vec{J}\,dv \Rightarrow (5)$$

Gauss Divergence Theorem

$$\int_V \nabla(\vec{E}\times\vec{H})\,dv = \oint(\vec{E}\times\vec{H})\,d\vec{S}$$

(5) becomes

$$\int_V\left[\frac{\partial}{\partial t}\left(\frac{\mu H^2}{2} + \frac{\epsilon E^2}{2}\right)\right]dv$$

$\frac{\mu H^2}{2}$ & $\frac{\epsilon E^2}{2}$ are stored magnetic & electric field energies

$\frac{\partial}{\partial t}\frac{\mu H^2}{2}$ & $\frac{\partial}{\partial t}\frac{\epsilon E^2}{2}$ represents the rate of increase of the magnetic field energy

$-\int_V\left[\frac{\partial}{\partial t}\left(\frac{\mu H^2}{2} + \frac{\epsilon E^2}{2}\right)\right]dv$ = The rate at which the stored field energy is decreasing in a volume V, which the integration is carried out

$\int_V \vec{E}\cdot\vec{J}\,dv$ is the Joule heating

The rate which energy is dissipated in a volume

$\frac{1}{2}\epsilon E^2$ represents the stored field energy in the volume V

$$\oint(\vec{E}\times\vec{H})\,d\vec{S}$$

Uniform Plane Wave

When propagation in free space

From Maxwell equations

$$\nabla\times\vec{E} = -\frac{\partial\vec{B}}{\partial t} \rightarrow (1)$$

$$\nabla\times\vec{H} = \frac{\partial\vec{D}}{\partial t} \rightarrow (2)$$

$$\nabla\cdot\vec{B} = 0 \rightarrow (3)$$

$$\nabla\cdot\vec{D} = 0 \rightarrow (4)$$

(1) has space in the area where $\sigma = 0$ & $\rho = 0$ so there are no free charges and there are no sources currents

Wave Equations in terms of Electric & Magnetic fields

Consider the Curl equations in Maxwell

$$\nabla\times\vec{E} = -\mu\frac{\partial\vec{H}}{\partial t}$$

$$\nabla\times\vec{H} = \epsilon\frac{\partial\vec{E}}{\partial t}$$

$\because \vec{B} = \mu\vec{H}$, $\vec{D} = \epsilon\vec{E}$

$$\nabla\times\vec{E} = -\mu\frac{\partial\vec{H}}{\partial t} \rightarrow (1)$$

$$\nabla\times\vec{H} = \epsilon\frac{\partial\vec{E}}{\partial t} \rightarrow (2)$$

Taking Curl on both sides of equation (2)

$$\nabla\times\nabla\times\vec{H} = \epsilon\frac{\partial}{\partial t}(\nabla\times\vec{E}) \rightarrow (3)$$

We know that

$$\nabla\times\nabla\times\vec{H} = \nabla(\nabla\cdot\vec{H}) - \nabla^2\vec{H}$$

$$= \nabla\left(\frac{\rho}{\epsilon}\right) - \nabla^2\vec{H} \rightarrow (4)$$

($\because$ we know Maxwell equation $\nabla\cdot\vec{D} = \rho$, so $\nabla\cdot\vec{D} = \frac{\rho}{\epsilon}$)

Eq (3) & (4)

$$\nabla\left(\frac{\rho}{\epsilon}\right) - \nabla^2\vec{H} = -\mu\frac{\partial}{\partial t}(\nabla\times\vec{E})$$

Using eq (1)

$$\nabla\left(\frac{\rho}{\epsilon}\right) - \nabla^2\vec{H} = -\mu\frac{\partial}{\partial t}\left(-\mu\frac{\partial\vec{H}}{\partial t}\right)$$

$$\nabla^2\vec{H} - \mu\epsilon\frac{\partial^2\vec{H}}{\partial t^2} = \mu\frac{\partial}{\partial t}\left(\frac{\rho}{\epsilon}\right) \rightarrow (5)$$

Consider eq (1) as a component of complex vectors

Taking curl on (1) eq (1)

$$\nabla\times\nabla\times\vec{E} = \nabla\times\vec{H} = \epsilon\frac{\partial}{\partial t}(\nabla\times\vec{E})$$

Expanding the LHS substituting for $\nabla\times\vec{H}$ from eq (1)

$$\nabla(\nabla\cdot\vec{E}) - \nabla^2\vec{E} = \nabla\times\vec{H} = -\mu\epsilon\frac{\partial^2\vec{E}}{\partial t^2}$$

We know Maxwell equation

$$\nabla\cdot\vec{E} = \frac{\rho}{\epsilon} \quad \nabla\times\vec{H} = \epsilon(\nabla\times\vec{E}) = 0$$

$$\nabla^2 H - \mu\varepsilon \frac{\partial^2 H}{\partial t^2} = -\nabla \times \vec{J} \rightarrow (6)$$

The above equation represents the wave equation in $\vec{H}$ for a medium with constant μ & ε

If we consider a space where there are no charge or current or even it be a non-conducting medium but with no free charges. Then $\rho_v = 0$ & $\vec{J} = 0$

eq (5) & (6) becomes

$$\nabla^2 \vec{E} - \mu\varepsilon \frac{\partial^2 \vec{E}}{\partial t^2} = 0 \rightarrow (7)$$

$$\nabla^2 \vec{H} - \mu\varepsilon \frac{\partial^2 \vec{H}}{\partial t^2} = 0 \rightarrow (8)$$

The another wave equation is $\nabla^2 \vec{F} - \frac{1}{v^2}\frac{\partial^2 \vec{F}}{\partial t^2} = 0 \rightarrow (9)$

This equation represents a wave travelling with a velocity v

Comparing eq (9) with eq (8) & (7)

$$v = \frac{1}{\sqrt{\mu\varepsilon}}$$

for free space $\mu_0 = 4\pi \times 10^{-7}$ & $\varepsilon_0 = 8.854 \times 10^{-12}$

$$\therefore v = 3 \times 10^8 \text{ ms}^{-1}$$

Solution:- $\vec{E} = 800 \cos(10^8 t - \beta y)\,\hat{a}_x \rightarrow (1)$ wkt $\vec{E} = E \cos(\omega t - \beta y)\,\hat{a}_x \rightarrow (4)$ Basic eq $E_y(z) = C_1 e^{\alpha z} e^{j(\omega t - \beta z)}$ Comparing eq (1) & (4) $\omega = 10^8$ for free space $v = 3\times10^8$ ms^{-1} $\beta = \frac{\omega}{v} = \frac{10^8}{3\times10^8} = 0.333$ rad/m $\lambda = \frac{2\pi}{\beta} = 18.85$ m wave in y direction $\eta = \frac{E_x}{H_z}$ $\vec{H_z} = \frac{E_x}{\eta}$ $= \frac{800 \cos(10^8 t - \beta y)\,\hat{a}_x}{377}$ $= 2.12 \cos(10^8 t - \beta y)\,\hat{a}_x$ at $P(1, 1.5, 0.4)$ $y = 1$ & $t = 8$ns $\Rightarrow \vec{H_z} = 2.09\,\hat{a}_x$ A/m	1+3+3	5

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

3rd SEM ELECTROMAGNETIC WAVES INTERNAL MARKS 22-23(ODD)

	USN	NAME	AVG	IA-1	IA-2	IA-3	SIGNATURE
1.	4AL20EC001	Aishwarya A P	27	16	12	21	
2.	4AL20EC002	Aishwarya P	28	12	21	19	
3.	4AL20EC004	Akshay	31	20	22	20	
4.	4AL20EC005	Akshay Sonar	25	16	17	11	
5.	4AL20EC006	Aravinda Jogi	29	17	24	15	
6.	4AL20EC007	Bhavana M	22	12	11	13	
7.	4AL20EC008	Chaithrashree M G	25	12	12	19	
8.	4AL20EC010	Chethana.M	32	21	14	30	
9.	4AL20EC011	Darshan Madival	27	14	21	15	
10.	4AL20EC012	Disha H	25	11	14	20	
11.	4AL20EC013	Harshitha D K	30	14	21	25	
12.	4AL20EC014	Jyoti P	29	18	13	26	
13.	4AL20EC015	K.Vijay Bhanu	28	16	15	21	
14.	4AL20EC016	Karthik G Shet	29	28	15	14	
15.	4AL20EC017	Kishan Kumar	34	21	27	23	
16.	4AL20EC018	Krathika	25	12	16	15	
17.	4AL20EC019	Kshama Tc	27	14	15	22	
18.	4AL20EC020	Libina Lal	33	20	25	23	
19.	4AL20EC021	Manjunath Sajjan	32	21	26	18	
20.	4AL20EC023	Mohammed S	38	27	30	26	
21.	4AL20EC024	Mokshith	33	24	24	20	
22.	4AL20EC025	Monika. D. B.	21	11	7	13	D.B. Monika
23.	4AL20EC026	Monisha P	21	11	13	12	
24.	4AL20EC027	Nagarjuna GS	24	15	11	15	

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

5th SEM ELECTROMAGNETIC WAVES INTERNAL MARKS 22-23(ODD)

25.	4AL20EC028	Padala Sattibabu	20				
26.	4AL20EC029	P V Likhitha	37	30	26	23	
27.	4AL20EC030	Pavan Kh	27	23	11	16	
28.	4AL20EC031	Pooja P	28	23	18	12	
29.	4AL20EC032	Prajaktha Poojary	33	18	27	24	
30.	4AL20EC033	Prajwal R	24	13	13	15	
31.	4AL20EC034	Prashanth VK	28	16	16	20	
32.	4AL20EC035	Pratham Puthran	31	17	20	24	
33.	4AL20EC036	Prathish G Nayak	32	26	16	22	
34.	4AL20EC037	Praveen V	30	25	24	11	
35.	4AL20EC038	Preeti G M	35	26	23	24	
36.	4AL20EC039	Rakesh Sangshetty	23	12	14	13	
37.	4AL20EC040	Rakshitha S	25	14	13	17	
38.	4AL20EC041	Ramya K	37	22	30	28	
39.	4AL20EC042	Ranjitha R	35	20	24	30	
40.	4AL20EC043	Rohan H	26	19	15	12	
41.	4AL20EC045	Sangamesh Biradar	24	15	6	21	
42.	4AL20EC046	Sanjay Gk	24	15	15	12	
43.	4AL20EC048	Santhripti C S	30	15	22	23	
44.	4AL20EC049	Shravan V U	24	15	13	14	
45.	4AL20EC050	Shridevi Rao	28	15	15	22	
46.	4AL20EC051	Shruthi	34	22	23	27	Shruthi
47.	4AL20EC052	Shubhashri S	35	25	27	22	
48.	4AL20EC053	Shwetha	35	22	23	28	Shwetha
49.	4AL20EC054	Soumya N	34	21	28	23	

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEEI

5th SEM ELECTROMAGNETIC WAVES INTERNAL MARKS 22-23(ODD)

50.	4AL20EC055	spoorthi salaskar	**34**	24	21	25	
51.	4AL20EC056	Srujan	**27**	15	17	18	
52.	4AL20EC057	Umesh	**32**	22	21	23	
53.	4AL20EC058	Varshini K L	**30**	20	26	12	
54.	4AL20EC059	Veena Talawar	**36**	27	23	26	
55.	4AL20EC060	Vinod Raj G N	**26**	18	14	15	
56.	4AL20EC061	Vinyashree Jain	**31**	20	23	20	
57.	4AL20EC062	Vishanth	**24**	15	15	11	
58.	4AL20EC063	Vishwanath	**27**	18	15	16	

Course Coordinator

Alva's Institute of Engineering &Technology, Moodbidri

Department of Electronics & Communication Engineering

ASSIGNMENT - ODD Semester 2022-23

Course Title: **Electromagnetic Waves**	Course Code: 18EC55
Semester: 5th SEM 'A' Section	Faculty: Mrs. VIJETHA T S

Q.No.	**Assignment 1** Date :16/11/2022	Marks	COs
a)	Sate and Explain the Coulomb's Law	10	1
b)	Obtain the Expression for Electric field intensity due to a line charge		
c)	Obtain the Expression for Electric field intensity due a sheet of charge		
d)	With the help of equations explain the charge densities		
e)	Obtain the expression for Electric field intensity due to a many charges		
	Assignment 2 Date :23/11/2022	**Marks**	**COs**
a)	State and prove the Gauss's Law	10	2
b)	Sate and Prove the Divergence Theorem		
c)	Explain the Divergence of a vector and obtain the point form of Gauss Law		
d)	Obtain the Electric field due to a line charges		
e)	Obtain the Electric field due to a volume charges		
	Assignment 3 Date :14/12/2022	**Marks**	**COs**
a)	State and prove the Biot- Savart Law	10	3
b)	State and Prove Ampere's Circuital Law		
c)	State and prove the stoke's Theorem		
d)	Explain the Scalar and vector magnetic potentials		
e)	Obtain the expression for Magnetic field intensity of a toroidal coil		
	Assignment 4 Date :11/01/2023	**Marks**	**COs**
a)	Explain the Lorentz force equations	10	4
b)	Obtain the expression for Magnetic field intensity for a straight current carrying conductor		
c)	Obtain the expression for Torque		
	Assignment 5 Date :14/01/2023	**Marks**	**COs**
a)	Seminar on advancement in **Electromagnetic Waves**	10	5

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

5TH SEM ELECTROMAGNETIC WAVES ASSIGNMENT MARKS-22-23(ODD)

#	USN	NAME	ASG-1	ASG-2	ASG-3	ASG-4	ASG-5	TOTAL
1.	4AL20EC001	Aishwarya A P	10	10	10	10	10	10
2.	4AL20EC002	Aishwarya Panchagavi	10	10	10	10	10	10
3.	4AL20EC004	Akshay	10	10	10	10	10	10
4.	4AL20EC005	Akshay Sonar	10	10	10	10	10	10
5.	4AL20EC006	Aravinda Jogi	10	10	10	10	10	10
6.	4AL20EC007	Bhavana M	10	10	10	10	10	10
7.	4AL20EC008	Chaithrashree M G	10	10	10	10	10	10
8.	4AL20EC010	Chethana.M	10	10	10	10	10	10
9.	4AL20EC011	Darshan Madival	10	10	10	10	10	10
10.	4AL20EC012	Disha H	10	10	10	10	10	10
11.	4AL20EC013	Harshitha D K	10	10	10	10	10	10
12.	4AL20EC014	Jyoti Phakkirannanavar	10	10	10	10	10	10
13.	4AL20EC015	K.Vijay Bhanu	10	10	10	10	10	10
14.	4AL20EC016	Karthik G Shet	10	10	10	10	10	10
15.	4AL20EC017	Kishan Kumar	10	10	10	10	10	10
16.	4AL20EC018	Krathika	10	10	10	10	10	10
17.	4AL20EC019	Kshama Tc	10	10	10	10	10	10
18.	4AL20EC020	Libina Lal	10	10	10	10	10	10
19.	4AL20EC021	Manjunath Sajjan	10	10	10	10	10	10
20.	4AL20EC023	Mohammed Sharfuddin	10	10	10	10	10	10
21.	4AL20EC024	Mokshith	10	10	10	10	10	10
22.	4AL20EC025	Monika. D. B.	10	10	10	10	10	10
23.	4AL20EC026	Monisha P	10	10	10	10	10	10
24.	4AL20EC027	Nagarjuna GS	10	10	10	10	10	10
25.	4AL20EC028	Padala Sattibabu	10	10	10	10	10	10

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

5TH SEM ELECTROMAGNETIC WAVES ASSIGNMENT MARKS-22-23(ODD)

.	4AL20EC029	P V Likhitha	10	10	10	10	10	10
.	4AL20EC030	Pavan Kh	10	10	10	10	10	10
.	4AL20EC031	Pooja P	10	10	10	10	10	10
.	4AL20EC032	Prajaktha Poojary	10	10	10	10	10	10
.	4AL20EC033	Prajwal R	10	10	10	10	10	10
.	4AL20EC034	Prashanth VK	10	10	10	10	10	10
2.	4AL20EC035	Pratham Puthran	10	10	10	10	10	10
3.	4AL20EC036	Prathish G Nayak	10	10	10	10	10	10
4.	4AL20EC037	Praveen Vishwakarma	10	10	10	10	10	10
5.	4AL20EC038	Preeti G M	10	10	10	10	10	10
6.	4AL20EC039	Rakesh Sangshetty	10	10	10	10	10	10
7.	4AL20EC040	Rakshitha S	10	10	10	10	10	10
8.	4AL20EC041	Ramya K	10	10	10	10	10	10
9.	4AL20EC042	Ranjitha R	10	10	10	10	10	10
0.	4AL20EC043	Rohan H	10	10	10	10	10	10
41.	4AL20EC045	Sangamesh Biradar	10	10	10	10	10	10
42.	4AL20EC046	Sanjay Gk	10	10	10	10	10	10
43.	4AL20EC048	Santhripti C S	10	10	10	10	10	10
44.	4AL20EC049	Shravan V U	10	10	10	10	10	10
45.	4AL20EC050	Shridevi Rao	10	10	10	10	10	10
46.	4AL20EC051	Shruthi	10	10	10	10	10	10
47.	4AL20EC052	Shubhashri S	10	10	10	10	10	10
48.	4AL20EC053	Shwetha	10	10	10	10	10	10
49.	4AL20EC054	Soumya N	10	10	10	10	10	10
50.	4AL20EC055	spoorthi salaskar	10	10	10	10	10	10

51.	4AL20EC056	Srujan	10	10	10	10	10	10
52.	4AL20EC057	Umesh	10	10	10	10	10	10
53.	4AL20EC058	Varshini K L	10	10	10	10	10	10
54.	4AL20EC059	Veena Talawar	10	10	10	10	10	10
55.	4AL20EC060	Vinod Raj G N	10	10	10	10	10	10
56.	4AL20EC061	Vinyashree Jain	10	10	10	10	10	10
57.	4AL20EC062	Vishanth	10	10	10	10	10	10
58.	4AL20EC063	Vishwanath	10	10	10	10	10	10

Course Coordinator

Delivery details of the content beyond the syllabus for the attainment of POs and PSOs

2022-2023(ODD SEMESTER)						
5th semester						
Sl. No	**Gap**	**Action taken**	**DD-MM-YY**	**Resource Person with Designation**	**%ofstudents**	**Relevanceto PO's, PSO's**
1.	**Electromagnetic Waves** **" Application of EM Waves"**	Seminar on **Application of EM Waves**	Jan-2023	**Prof. Vijetha T S** **Asst. Prof** **Dept. of. ECE, AIET**	100%	PO4,PO6,PO10,PO11

BATCH.No	USN	NAME	TOPIC	REPORT	Presentation	Total
B1	4AL20EC001	Aishwarya A P	APPLICATION OF EM IN AGRICULTURE	5	5	10
	4AL20EC025	Monika. D. B.		5	5	10
	4AL20EC040	Rakshitha S		5	5	10
B2	4AL20EC010	Chethana.M	ELECTROMAGNETIC WAVE IN AGRICULTURE	5	5	10
	4AL20EC014	Jyoti P		5	5	10
	4AL20EC058	Varshini K L		5	5	10
	4AL20EC059	Veena Talawar		5	5	10
B3	4AL20EC002	Aishwarya P	EM WAVES AND HUMAN HEALTH	5	5	10
	4AL20EC007	Bhavana M		5	5	10
	4AL20EC013	Harshitha D K		5	5	10
	4AL20EC019	Kshama Tc		5	5	10
B4	4AL20EC006	Aravinda Jogi	EM WAVES IN 5G TECHNOLOGY	5	5	10
	4AL20EC004	Akshay		5	5	10
	4AL20EC011	Darshan Madival		5	5	10

	4AL20EC057	Umesh		5	5	10
B5	4AL20EC005	Akshay Sonar	APPLICATION OF EM FIELDS IN MEDICINES	5	5	10
	4AL20EC021	Manjunath Sajjan		5	5	10
	4AL20EC023	Mohammed S		5	5	10
	4AL20EC039	Rakesh Sangshetty		5	5	10
B6	4AL20EC012	Disha H	ELECTROMAGNETIC SPECTRUM	5	5	10
	4AL20EC050	Shridevi Rao		5	5	10
	4AL20EC051	Shruthi		5	5	10
	4AL20EC053	Shwetha		5	5	10
B7	4AL20EC015	K.Vijay Bhanu	MEDICINES IN EM WAVES	5	5	10
	4AL20EC035	Pratham Puthran		5	5	10
	4AL20EC034	Prashanth VK		5	5	10
	4AL20EC030	Pavan Kh		5	5	10
B8	4AL20EC029	P V Likhitha	APPLICATION OF EM	5	5	10

	4AL20EC041	Ramya K	FIELDS IN MEDICINES	5	5	10
	4AL20EC054	Soumya N		5	5	10
	4AL20EC052	Shubhashri S		5	5	10
B9	4AL20EC028	Padala Sattibabu	ELECTROMAGNETIC BIO-DEVICES	5	5	10
	4AL20EC027	Nagarjuna GS		5	5	10
	4AL20EC043	Rohan H		5	5	10
	4AL20EC046	Sanjay Gk		5	5	10
B10	4AL20EC018	Krathika	MAGNETIC SENSOR	5	5	10
	4AL20EC020	Libina Lal		5	5	10
	4AL20EC038	Preeti G M		5	5	10
	4AL20EC042	Ranjitha R		5	5	10
B11	4AL20EC016	Karthik G Shet	ARMY ELECTROMAGNETIC SPECTRUM OPERATION	5	5	10
	4AL20EC033	Prajwal R		5	5	10
	4AL20EC060	Vinod Raj G N		5	5	10

	4AL20EC063	Vishwanath		5	5	10
B12	4AL20EC008	Chaithrashree M G	SATELITE COMMUNICATION	5	5	10
	4AL20EC031	Pooja P		5	5	10
	4AL20EC048	Santhripti C S		5	5	10
	4AL20EC061	Vinyashree Jain		5	5	10
B13	4AL20EC017	Kishan Kumar	SATELLITE COMMUNICATION USING EM WAVES	5	5	10
	4AL20EC037	Praveen V		5	5	10
	4AL20EC045	Sangamesh Biradar		5	5	10
	4AL20EC056	Srujan		5	5	10
B14	4AL20EC024	Mokshith	SATELLITE COMMUNICATION USING EM WAVES	5	5	10
	4AL20EC036	Prathish G Nayak		5	5	10
	4AL20EC049	Shravan V U		5	5	10
	4AL20EC062	Vishanth		5	5	10

B15	4AL20EC026	Monisha P	**EM WAVES IN T IMAGIN**
	4AL20EC032	Prajaktha Poojary	
	4AL20EC055	spoorthi salaskar	
	4AL20EC026	Monisha P	

CONTINUOUS INTERNAL EVALUATION - 1																						
Subject:		ELECTROMAGNETIC WAVES		BITWISE MARK ENTRY																Sem: 5		Sec: 'A'
																				Subject Code:		18EC55
Sl. No.	USN	Name	AB	Q.No. 1				Q.No. 2				Q.No. 3				Q.No. 4				Out of 30
				a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	
1	4AL20EC001	Aishwarya A P						2	3			3		3						16
2	4AL20EC002	Aishwarya Panchagavi							2			5		5						12
3	4AL20EC004	Akshay						8	4							3		5		20
4	4AL20EC005	Akshay Sonar		3	5							5	3							16
5	4AL20EC006	Aravinda Jogi		4	3				7			5	5							17
6	4AL20EC007	Bhavana M		3	3												4	2		12
7	4AL20EC008	Chaithrashree M G						6	6											12
8	4AL20EC010	Chethana.M		3	6											5	3	5		21
9	4AL20EC011	Darshan Madival						4				5		5						14
10	4AL20EC012	Disha H							4			6				1				11
11	4AL20EC013	Harshitha D K						3	1			5		5						14
12	4AL20EC014	Jyoti Phakkirannanavar		2	5			6	2			5		5						18
13	4AL20EC015	K.Vijay Bhanu						8								3	5			16
14	4AL20EC016	Karthik G Shet						8	7			5	3	5						28
15	4AL20EC017	Kishan Kumar							8			3		5			5			21
16	4AL20EC018	Krathika							6			2		3		1				12
17	4AL20EC019	Kshama Tc							7			1	6							14
18	4AL20EC020	Libina Lal						8	3			4		5						20
19	4AL20EC021	Manjunath Sajjan		8	7							6	5							21
20	4AL20EC023	Mohammed Sharfuddin						8	7							5	5	5		27
21	4AL20EC024	Mokshith		6	7							5	1	5						24
22	4AL20EC025	Monika. D. B.		1	2							5		3						11
23	4AL20EC026	Monisha P			2							4		5						11
24	4AL20EC027	Nagarjuna GS		2	3							5		5						15
25	4AL20EC028	Padala Sattibabu			5							3		5						18
26	4AL20EC029	P V Likhitha						8	7							5	5	5		30
27	4AL20EC030	Pavan Kh						8	5			5	5							23
28	4AL20EC031	Pooja P						8	5			5		5						23
29	4AL20EC032	Prajaktha Poojary						8	4			2	1	3						18
30	4AL20EC033	Prajwal R						3				1		5						13
31	4AL20EC034	Prashanth VK						6				5		5						16
32	4AL20EC035	Pratham Puthran						6	1			5		5						17
33	4AL20EC036	Prathish G Nayak						8	7			5	1	5						26
34	4AL20EC037	Praveen Vishwakarma						8	7			5		5						25
35	4AL20EC038	Preeti G M						8	7			5	1	5						26
36	4AL20EC039	Rakesh Sangshetty						4	1			5		2						12
37	4AL20EC040	Rakshitha S		2	1			6	2			1		5						14
38	4AL20EC041	Ramya K						6	6			3	2	5						22
39	4AL20EC042	Ranjitha R						8	2							5	5			20
40	4AL20EC043	Rohan H						8	5			2	2	2						19
41	4AL20EC045	Sangamesh Biradar			5							5		5						15
42	4AL20EC046	Sanjay Gk		6	3							1		5						15
43	4AL20EC048	Santhripti C S						4	8							3				15
44	4AL20EC049	Shravan V Upadhyaya						8	2			5								15
45	4AL20EC050	Shridevi Rao		6	4											6	6			15
46	4AL20EC051	Shruthi		6	4											6	6			22
47	4AL20EC052	Shubhashri S						8	6			1	5	5						25
48	4AL20EC053	Shwetha		4	6							6	6							22
49	4AL20EC054	Soumya N						8	3			5		5						21
50	4AL20EC055	spoorthi salaskar						8	7			5		4						24
51	4AL20EC056	Srujan		8												4	3			15
52	4AL20EC057	Umesh		3	6									5		5	3			22
53	4AL20EC058	Varshini K L		8	2							5		5						20
54	4AL20EC059	Veena Talawar						7	7			5	3	5						27
55	4AL20EC060	Vinod Raj G N						8	2			5		3						18
56	4AL20EC061	Vinyashree Jain						8	2			5		5						20
57	4AL20EC062	Vishanth		1	5							5		4						15
58	4AL20EC063	Vishwanath						4	3					1		5	5			18

CONTINUOUS INTERNAL EVALUATION - 2

Subject:	ELECTROMAGNETIC WAVES	BITWISE MARK ENTRY	Sem: 5	Sec: 'A'
		Subject Code:	18EC55	

Sl. No.	Dept.	Name	AB	Q.No. 1				Q.No. 2				Q.No. 3				Q.No. 4				Out of 30
				a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	
1	4AL20EC001	Aishwarya A P						7				3	2							12
2	4AL20EC002	Aishwarya Panchagavi		6	7							8								21
3	4AL20EC004	Akshay			7							8	7							22
4	4AL20EC005	Akshay Sonar		7	7											3				17
5	4AL20EC006	Aravinda Jogi		6	3							8	7							24
6	4AL20EC007	Bhavana M						6	2							3				11
7	4AL20EC008	Chaithrashree M G		6	2											4				12
8	4AL20EC010	Chethana.M		4								3	7							14
9	4AL20EC011	Darshan Madival		8	7							6								21
10	4AL20EC012	Disha H		4	6							4								14
11	4AL20EC013	Harshitha D K		5	7							3	6							21
12	4AL20EC014	Jyoti Phakkirannanavar		5	5												3			13
13	4AL20EC015	K.Vijay Bhanu		8	7															15
14	4AL20EC016	Karthik G Shet		4	6							5								15
15	4AL20EC017	Kishan Kumar		6	7											8	6			27
16	4AL20EC018	Krathika		4	3							5	4							16
17	4AL20EC019	Kshama Tc						4	5			6								15
18	4AL20EC020	Libina Lal		8	6							4	7							25
19	4AL20EC021	Manjunath Sajjan						5	7			4	5							26
20	4AL20EC023	Mohammed Sharfuddin		8	5											8	6			30
21	4AL20EC024	Mokshith		6	7							6	5							24
22	4AL20EC025	Monika. D. B.						6				1								7
23	4AL20EC026	Monisha P		8	1								4							13
24	4AL20EC027	Nagarjuna GS										4	7							11
25	4AL20EC028	Padala Sattibabu		4																4
26	4AL20EC029	P V Likhitha		6	7											8	5			26
27	4AL20EC030	Pavan Kh			2											6	3			11
28	4AL20EC031	Pooja P						8	3							3	4			18
29	4AL20EC032	Prajaktha Poojary		8	5							8	6							27
30	4AL20EC033	Prajwal R		4								3	6							13
31	4AL20EC034	Prashanth VK		6	7											3				16
32	4AL20EC035	Pratham Puthran																		20
33	4AL20EC036	Prathish G Nayak						5				8	7							16
34	4AL20EC037	Praveen Vishwakarma		7	7								2							24
35	4AL20EC038	Preeti G M		5	7							5	7							23
36	4AL20EC039	Rakesh Sangshetty		6	7											8	2			14
37	4AL20EC040	Rakshitha S		7	7															13
38	4AL20EC041	Ramya K						8	7							8	7			30
39	4AL20EC042	Ranjitha R		6	7											8	3			24
40	4AL20EC043	Rohan H		4	1							4	6							15
41	4AL20EC045	Sangamesh Biradar			6															6
42	4AL20EC046	Sanjay Gk						6	3			6								15
43	4AL20EC048	Santhripti C S		8	7							7								22
44	4AL20EC049	Shravan V Upadhyaya		6												7				13
45	4AL20EC050	Shridevi Rao		8	7											8				15
46	4AL20EC051	Shruthi		8	7											8				23
47	4AL20EC052	Shubhashri S		6	6			3								6	6			27
48	4AL20EC053	Shwetha		8	7											6	7			23
49	4AL20EC054	Soumya N		8	7							6	7							28
50	4AL20EC055	spoorthi salaskar		5	5							4	7							21
51	4AL20EC056	Srujan			3							8	6							17
52	4AL20EC057	Umesh		4	7											3	7			21
53	4AL20EC058	Varshini K L		8	7							4	7							26
54	4AL20EC059	Veena Talawar						8	7							7	1			23
55	4AL20EC060	Vinod Raj G N		8	5											1				14
56	4AL20EC061	Vinyashree Jain		8	7											8				23
57	4AL20EC062	Vishanth		5	7							3								15
58	4AL20EC063	Vishwanath						8	6			1								15

INTERNAL EVALUATION - 3

Subject: ELECTROMAGNETIC WAVES

BITWISE MARK ENTRY

Sem: 5 | Sec: 'A'

Subject Code: 18EC55

No.	Dept.	Name	AB	Q.No. 1				Q.No. 2				Q.No. 3				Q.No. 4				Out of 30
				a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	
1	4AL20EC001	Aishwarya A P		6	7							8								21
2	4AL20EC002	Aishwarya Panchagavi		8	3							1	7							19
3	4AL20EC004	Akshay						3	7			8	2							20
4	4AL20EC005	Akshay Sonar						3					7			8				11
5	4AL20EC006	Aravinda Jogi		8								8	7							15
6	4AL20EC007	Bhavana M		4	7							5								13
7	4AL20EC008	Chaithrashree M G		8	7							4				8				19
8	4AL20EC010	Chethana.M										8	7							30
9	4AL20EC011	Darshan Madival		8	7							8	7							15
10	4AL20EC012	Disha H		8	4								5							20
11	4AL20EC013	Harshitha D K		8	7											8	5			25
12	4AL20EC014	Jyoti Phakkirannanavar		7	7							4	7							26
13	4AL20EC015	K.Vijay Bhanu							7				7							21
14	4AL20EC016	Karthik G Shet		8	7								7							14
15	4AL20EC017	Kishan Kumar						4				4	7			8				23
16	4AL20EC018	Krathika		6	7							2	7							15
17	4AL20EC019	Kshama Tc						8	7			4				8				22
18	4AL20EC020	Libina Lal						7	7							2	2			23
19	4AL20EC021	Manjunath Sajjan		8	7											7	4			18
20	4AL20EC023	Mohammed Sharfuddin							7			6	7							26
21	4AL20EC024	Mokshith						5	7							1				20
22	4AL20EC025	Monika. D. B.										5	5							13
23	4AL20EC026	Monisha P		8												6	6			
24	4AL20EC027	Nagarjuna GS						1	7							8	7			15
25	4AL20EC028	Padala Sattibabu		4	7							8	5			8				23
26	4AL20EC029	P V Likhitha		4	7							8	5							16
27	4AL20EC030	Pavan Kh						2	3			4	7							12
28	4AL20EC031	Pooja P		7	6								7							24
29	4AL20EC032	Prajaktha Poojary		8	3							6	7							15
30	4AL20EC033	Prajwal R						6	7			2	7							20
31	4AL20EC034	Prashanth VK							3							8				24
32	4AL20EC035	Pratham Puthran		6	7							4	7							22
33	4AL20EC036	Prathish G Nayak		8								5								11
34	4AL20EC037	Praveen Vishwakarma						8	6			3								24
35	4AL20EC038	Preeti G M		8	7			3					7	6		8				13
36	4AL20EC039	Rakesh Sangshetty		8	7							8	7							17
37	4AL20EC040	Rakshitha S		5								8	7			8	4			28
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48	4AL20EC053	Shwetha						1	7			8	7							23
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50	4AL20EC055	spoorthi salaskar						8	7				3							18
51	4AL20EC056	Srujan		8	6							4	5							23
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53	4AL20EC058	Varshini K L		8	7							4	7							26
54	4AL20EC059	Veena Talawar		5	3							7								15
55	4AL20EC060	Vinod Raj G N		8												8	4			20
56	4AL20EC061	Vinyashree Jain							3			4	4							11
57	4AL20EC062	Vishanth						2	7				7							
58	4AL20EC063	Vishwanath																		

CBCS Scheme

USN | | | | | | | | | | |

15EC36

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Point charges of 50 nano-coulomb each are located at A(1, 0, 0), B(–1, 0, 0), C(0, 1, 0) and D(0, –1, 0) in free space. Find the total force on the charge at A. **(08 Marks)**

b. Define electric field intensity and electric flux density. **(04 Marks)**

c. A uniform line charge of infinite length with $\rho_L = 40$ nc/m lies along z axis. Find $\bar{E}$ at (–2, 2, 8) in air. **(04 Marks)**

OR

2 a. Derive the expression for electric field intensity due to infinite line charge. **(08 Marks)**

b. Two particles having charges 2nano-coulomb and 5nano-coulomb are spaced 80 cm apart. Determine the electric field intensity at point "A" situated at a distance of 0.5 m from each of the two particles. Assume dielectric constant of 5. **(08 Marks)**

Module-2

3 a. Evaluate both sides of the divergence theorem for the field $\bar{D} = 2xy\,\hat{a}x + x^2\,\hat{a}y\ c/m^2$ and the rectangular parallel piped formed by the planes x = 0 and 1, y = 0 and 2, and z = 0 and 3. **(08 Marks)**

b. Derive the expression for equation of continuity. **(06 Marks)**

c. Give the vector density $J = 10\rho^2 z\,\hat{a}\rho - 4\rho\cos^2\phi\,\hat{a}\rho$ mA/m^2. Determine the total current flowing outward through the circular band. $\rho = 3$, $0 < \phi < 2\pi$, $2 < z < 2.8$. **(02 Marks)**

OR

4 a. State and explain Gauss law in point form. **(05 Marks)**

b. Given the electric field $\bar{E} = 2x\,\hat{a}_x - 4y\,\hat{a}_y$ v/m. Find the work done in moving a point charge +2C from (2, 0, 0,) to (0, 0, 0) and then form (0, 0, 0) to (0, 2, 0). **(05 Marks)**

c. A potential field in free space is expressed as $V = \frac{60\sin\theta}{r^2}$ v. Find the electric flux density at the point (3, 60°, 25°) in spherical co-ordinates. **(06 Marks)**

Module-3

5 a. State and explain uniqueness theorem. **(08 Marks)**

b. Determine the magnetic field intensity $\bar{H}$ at point P(0.4, 0.3, 0), if the 8A current in a conductor inward from infinity to origin on the x axis and outward to infinity along y axis.

Time: ... Note: ... choosing ONE full ...

Module-1

1 a. Point charges of 50 nano-coulomb each are located at A(1, 0, 0), B(−1, 0, 0), C(0, 1, 0) and D(0, −1, 0) in free space. Find the total force on the charge at A. **(08 Marks)**

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c. A uniform line charge of infinite length with $\rho_L = 40$ nc/m lies along z axis. Find $\bar{E}$ at (−2, 2, 8) in air. **(04 Marks)**

OR

2 a. Derive the expression for electric field intensity due to infinite line charge. **(08 Marks)**

b. Two particles having charges 2nano-coulomb and 5nano-coulomb are spaced 80 cm apart. Determine the electric field intensity at point "A" situated at a distance of 0.5 m from each of the two particles. Assume dielectric constant of 5. **(08 Marks)**

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3 a. Evaluate both sides of the divergence theorem for the field $\bar{D} = 2xy\,\hat{a}x + x^2\,\hat{a}y\ c/m^2$ and the rectangular parallel piped formed by the planes x = 0 and 1, y = 0 and 2, and z = 0 and 3. **(08 Marks)**

b. Derive the expression for equation of continuity. **(06 Marks)**

c. Give the vector density $J = 10\rho^2 z\,\hat{a}\rho - 4\rho\cos^2\phi\,\hat{a}\rho$ mA/m^2. Determine the total current flowing outward through the circular band. $\rho = 3$, $0 < \phi < 2\pi$, $2 < z < 2.8$. **(02 Marks)**

OR

4 a. State and explain Gauss law in point form. **(05 Marks)**

b. Given the electric field $\bar{E} = 2x\,\hat{a}_x - 4y\,\hat{a}_y$ v/m. Find the work done in moving a point charge +2C from (2, 0, 0,) to (0, 0, 0) and then form (0, 0, 0) to (0, 2, 0). **(05 Marks)**

c. A potential field in free space is expressed as $V = \frac{60\sin\theta}{r^2}$ v. Find the electric flux density at the point (3, 60°, 25°) in spherical co-ordinates. **(06 Marks)**

Module-3

5 a. State and explain uniqueness theorem. **(08 Marks)**

b. Determine the magnetic field intensity $\bar{H}$ at point P(0.4, 0.3, 0), if the 8A current in a ... infinity to origin on the x axis and outward to infinity along y axis. **(08 Marks)**

... will be treated as malpractice.

OR

3 a. Find the expression for force on differential current element moving in a steady magnetic field. Deduce the result to a straight conductor in a uniform magnetic field. **(08 Marks)**

b. For region 1, $\mu_1 = 4\mu H/m$ and for region 2, $\mu_2 = 6\mu$ H/m. The regions are separated by $z = 0$ plane. The surface current density at the boundary is $\overline{K} = 100\overline{ax}$ A/m. Find $\overline{B}_2$ if $\overline{B}_1 = 2\hat{a}x - 3\hat{a}y + \hat{a}z$ militesla for $z > 0$. **(08 Marks)**

Module-5

4 a. For the given medium $\varepsilon = 4 \times 10^{-9}$ F/m and $\sigma = 0$. Find 'K' so that the following pair of fields satisfy Maxwell's equation :

$\overline{E} = (20y - kt)\overline{ax}$ v/m

$\overline{H} = (y + 2 \times 10^6 t)\overline{az}$ A/m **(08 Marks)**

b. A plane wave of 16 GHz frequency and E = 10 v/m propagates through the body of salt water having constants $\varepsilon = 100$, $\mu_r = 1$ and $\sigma = 100$ S/m. Determine attenuation constant, phase shift, phase velocity and intrinsic impedance of the medium and depth of penetration. **(08 Marks)**

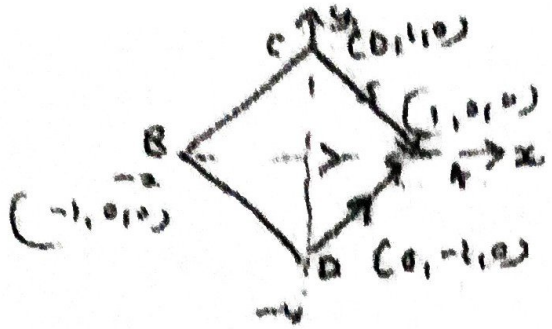
OR

5 a. State and explain Poynthing theorem. **(08 Marks)**

b. Find the amplitude of displacement current density in the free space within a large power distribution transformer where $\overline{H} = 10^6 \cos(377t + 1.2566 \times 10^{-6} z)\hat{ay}$ A/m. **(05 Marks)**

c. The depth of penetration in a conducting medium is 0.1m and the frequency of the electromagnetic wave is 1 MHz. Find the conductivity of the conducting medium. **(03 Marks)**

1 a)



$$\bar{F}_B = \frac{Q^2}{4\pi\epsilon_0 r_B^2}\bar{a}_{rB} \quad -(1)$$

$$r_B = 2$$

$$\bar{F}_C = \frac{Q^2}{4\pi\epsilon_0 r_C^2}\bar{a}_{rC} = \frac{Q^2}{4\pi\epsilon_0}\left[\frac{\bar{a}_x - \bar{a}_y}{2\sqrt{2}}\right]$$ 2

$$\bar{F}_D = \frac{Q^2}{4\pi\epsilon_0 r_D^2}\bar{a}_{rD} = \frac{Q^2}{4\pi\epsilon_0}\left[\frac{\bar{a}_x + \bar{a}_y}{2\sqrt{2}}\right]$$ 2

$$\bar{F} = \bar{F}_B + \bar{F}_C + \bar{F}_D = \underline{21.5\times10^{-6}\,\bar{a}_x\ N}$$ 2

b) Electric field intensity is the vector force on unit positive test charge 2

$$\bar{E} = \frac{F_t}{q_t}\ V/m.$$

Electric flux Density $\bar{D} = \frac{\psi}{S}$ C/m² The number of flux lines which pass unit area of a surface held normal to the direction of the flux lines. 2

c)

$$\bar{E} = \frac{Q_L}{2\pi\epsilon_0 r}\bar{a}_r \qquad \bar{R} = \sqrt{(-2-0)^2 + (2-0)^2 + (8-0)^2}$$

$$R = \sqrt{8}$$ 2

$$\bar{a}_R = \frac{\bar{R}}{R} = \frac{-2\bar{a}_x + 2\bar{a}_y}{\sqrt{8}}$$

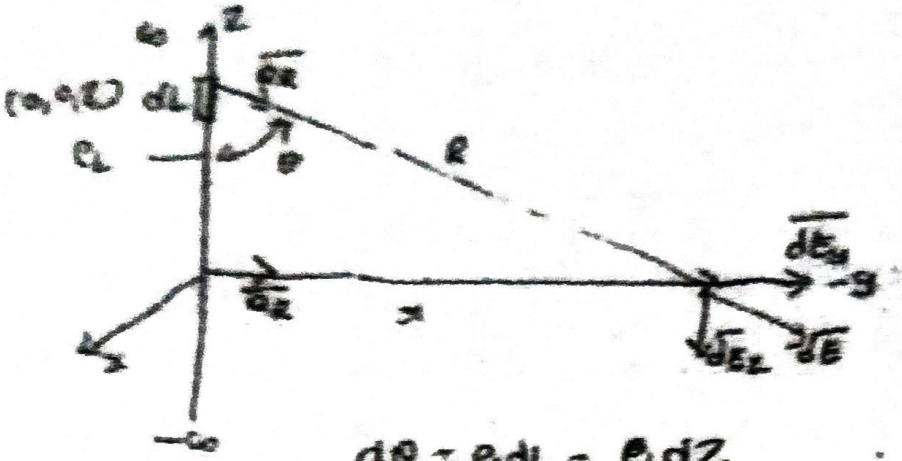
$$\bar{E} = \frac{40\times10^{-9}}{2\pi\times8.854\times10^{-12}\times\sqrt{8}}\left[\frac{-2\bar{a}_x + 2\bar{a}_y}{\sqrt{8}}\right]$$ 2

$$= -180\,\vec{a}_x + 180\,\vec{a}_y\ V/m$$

Approved

Prof. J. RAVI
Coordinator & Member – BOE [EC/TC]
VTU, Belgaum
Professor/ECE
Technology, Bangalore-56...38

Approved



$$dQ = \rho_L dl = \rho_L dz$$

$$\bar{R} = r\bar{a}_r - z\bar{a}_z \quad , \quad |\bar{R}| = \sqrt{r^2+z^2}.$$

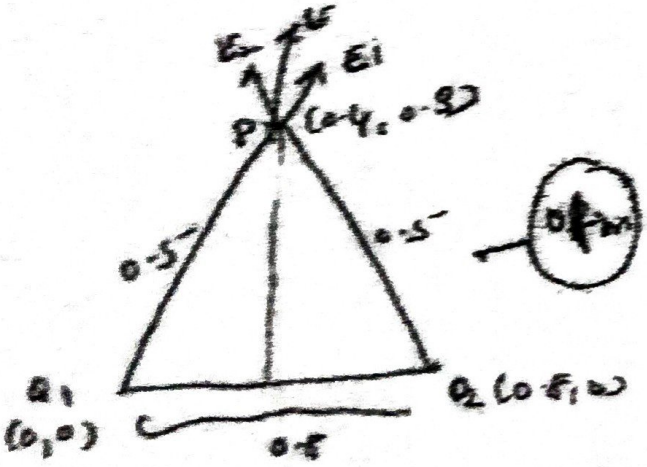
$$\overline{dE} = \frac{dQ}{4\pi\epsilon_0 R^2}\bar{a}_R = \frac{\rho_L dz}{4\pi\epsilon_0 (\sqrt{r^2+z^2})^2}\left[\frac{r\bar{a}_r - z\bar{a}_z}{\sqrt{r^2+z^2}}\right]$$

$$\overline{dE} = \frac{\rho_L dz}{4\pi\epsilon_0 (\sqrt{r^2+z^2})^2}\frac{r\bar{a}_r}{\sqrt{r^2+z^2}}$$

Finally E. After integration

$$\bar{E} = \frac{\rho_L}{2\pi\epsilon_0 r}\bar{a}_r \text{ V/m}$$

2M



0.5M

$$\bar{E}_1 = \frac{Q_1}{4\pi\epsilon_0 (R_{1P})^2}\bar{a}_{1P}$$

0.5M

$$\bar{a}_{1P} = \frac{0.4\bar{a}_x + 0.3\bar{a}_y}{0.5}$$

1M

$$\bar{E}_1 = \frac{2\times10^{-9}}{4\pi\times8.854\times10^{-12}\times5(0.5)^2}\left[\frac{0.4\bar{a}_x + 0.3\bar{a}_y}{0.5}\right]$$

0.5

$$\bar{E}_1 = 28.76\left[0.4\bar{a}_x + 0.3\bar{a}_y\right]$$

$$= 11.50\bar{a}_x + 8.62\bar{a}_y \text{ V/m}$$

Similarly $\bar{E}_2 = \dfrac{5\times10^{-9}}{4\pi\times5\times8.854\times10^{-12}(0.5)^2}\dfrac{(-0.4\bar{a}_x + 0.3\bar{a}_y)}{0.5}$

0.5M

$$= -28.76\bar{a}_x + 21.5\bar{a}_y$$

$$\bar{E} = \bar{E}_1 + \bar{E}_2 = \left[-17.26\bar{a}_x + 30.12\bar{a}_y\right]$$

0.5M

Question Number	Solution	Allotted
3 a)	$\vec{D} = 2xy\,\vec{a_x} + x^2\,\vec{a_y}\ C/m^2$ $\quad \oint \vec{D}\cdot d\vec{s} = \int_v \vec{\nabla}\cdot\vec{D}\,dv$	2
	$\oint_s \vec{D}\cdot d\vec{s} = \int_0^3\int_0^2 \underset{x=0}{\vec{D}\cdot(-dy\,dz\,\vec{a_x})} + \int_0^3\int_0^2 \underset{x=1}{\vec{D}\cdot(dy\,dz\,\vec{a_x})}$	
	$+ \int_0^3\int_0^1 \underset{y=0}{\vec{D}\cdot(-dx\,dz\,\vec{a_y})} + \int_0^3\int_0^1 \underset{y=2}{\vec{D}\cdot dx\,dz\,\vec{a_y}}$	
	$= -\int_0^3\int_0^2 \underset{x=0}{D_x\,dy\,dz} + \int_0^3\int_0^2 \underset{x=1}{D_x\,dy\,dz} - \int_0^3\int_0^1 \underset{y=0}{D_y\,dx\,dz}$	
	$+ \int_0^3\int_0^1 \underset{y=2}{D_y\,dx\,dz}$	3
	D_x at $x=0 = 0$ and D_y at $y=0 = D_y$ at $y=2$ needs to be evaluated	
	$\oint_s \vec{D}\cdot d\vec{s} = \int_0^3\int_0^2 \underset{x=1}{D_x\,dy\,dz} = \int_0^3\int_0^2 2y\,dy\,dz$	
	$= \int_0^3 4\,dz = 12 \quad -(1)$	
	$\vec{\nabla}\cdot\vec{D} = \frac{\partial}{\partial x}(2xy) + \frac{\partial}{\partial y}(x^2) = 2y$	
	volume integral is:	3
	$\int_v (\vec{\nabla}\cdot\vec{D})\,dv = \int_0^3\int_0^2\int_0^4 2y\,dx\,dy\,dz = \int_0^3\int_0^2 2y\,dy\,dz$	
	$= \int_0^3 4\,dz = 12 \quad -(2)$	
	from (1) and (2) divergence theorem is verified.	

Question Number	Solution

3a) Given $\vec{D} = 2xy\,\hat{i} + x^2\,\hat{j}$ C/m²

$\oint_S D\,ds = \int_V (\nabla\cdot D)\,dv$

$\oint \vec{J}\,ds = -\frac{\partial Q}{\partial t}$

$\int_{vol} (\nabla\cdot J)\,dv = \frac{\partial Q}{\partial t}$

L.H.S = R.H.S

b) Equation of Continuity.

The current through closed surface is $I = \oint_S J\cdot ds$ — (1)

outward flow must be balanced by decrease of positive charge $I = \oint_S J\cdot ds = -\frac{dQ_c}{dt}$ — (2)

Apply divergence theorem

$\int_S J\cdot ds = \int_{vol} (\nabla\cdot J)\,dv$ — (3)

$\int_{vol} (\nabla\cdot J)\,dv = -\frac{d}{dt}\int_{vol} \rho_v\,dv$ — (4)

$\int_{vol} (\nabla\cdot J)\,dv = -\int_{vol} \frac{\partial}{\partial t}\rho_v\,dv$ — (5)

$(\nabla\cdot J)\,dv = -\frac{\partial \rho_v}{\partial t}\,dv$ — (6)

$\nabla\cdot J = -\frac{\partial \rho_v}{\partial t}$ — (7)

c) $I = \int_S \vec{J}\cdot\vec{ds} = \int_0^{2\pi}\int_2^{2.8} 10e^{-3z}\,d\phi\,dz \times 10^{-3} = 3.26\,A$

4a) Gauss law in point form: The divergence of electric displacement density in a medium at a point is equal to the charge/unit volume at the same point

By gauss law $\oint \vec{D}\cdot\vec{ds} = \Delta Q$

$\therefore \frac{\oint \vec{D}\,ds}{\Delta v} = \frac{\Delta Q}{\Delta v}$

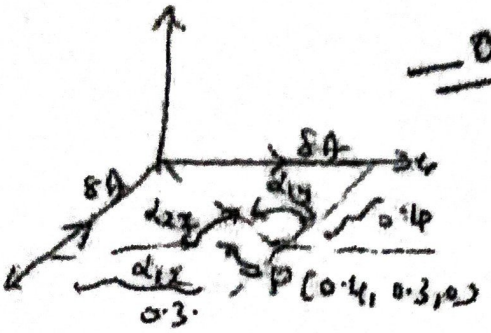
$\Delta v \to 0$ $\frac{\oint \vec{D}\cdot\vec{ds}}{\Delta v} = \lim_{\Delta v\to 0}\left(\frac{\Delta Q}{\Delta v}\right)$

$\nabla\cdot D = \rho_v$ or $\vec{\nabla}\cdot\vec{D} = \rho_v$

Solution	Marks Allocated
5/12	

uniqueness theorem Under the given boundary condition, laplace equation has one and only one solution. The same holds good for poisson's equation also 2

$V_1 = V_2$ proof — — — 6



— 02 marks

Consider current along x axis for which $\alpha_{1x} = -90°$

$\alpha_{2x} = \tan^{-1}\frac{0.4}{0.3}$

$= 53.12°$

r = radial distance measured from x axis $= 0.3$.

$\bar{H} = \frac{I}{4\pi r}[\sin\alpha_2 - \sin\alpha_1]\bar{a_\phi}$

$\bar{H_x} = \frac{8}{4\pi \times 0.3}[\sin\alpha_{2x} - \sin\alpha_{1x}]\bar{a_\phi}$

$= 3.819\bar{a_\phi}$

unit vector $\bar{a_\phi}$ referred to x axis is $-\bar{a_z}$

$\bar{H_x} = -3.819\bar{a_z}$ A/m

02 mks

Similarly on the y axis $\alpha_{1y} = -\tan^{-1}\left(\frac{0.3}{0.4}\right)$

$\alpha_{1y} = -36.86°$ $\alpha_{2y} = 90°$ where $r = 0.4$

$\bar{H_y} = \frac{8}{4\pi \times 0.4}\left[\sin 90 - \sin(-36.86)\right]$

$= 2.54\bar{a_\phi}$

unit vector $\bar{a_\phi}$ referred to y axis is $-\bar{a_z}$

$\bar{H_y} = -2.54\bar{a_z}$ A/m

$\bar{H} = \bar{H_x} + \bar{H_y} = -6.36\bar{a_z}$ A/m

4

for P $x = 0.5,\ y = 1.5,\ z = 1$

in cylindrical system $\phi = \tan^{-1}(y/x)$

$= 71.56$

$r = \sqrt{x^2+y^2}$ (2)

$P(1.58,\ \phi = 71.56,\ z = 1)$ $= 1.5811$

ϕ in radian $= \frac{\pi \times 71.56}{180} = 1.249$ rad

$V = 6 \times 1.5811 \times 1.249 \times 1 = 11.84\,V$ (1)

$E = -\nabla V$

$= -\left(\frac{\partial V}{\partial r}\bar{a_r} + \frac{1}{r}\frac{\partial V}{\partial \phi}\bar{a_\phi} + \frac{\partial V}{\partial z}\bar{a_z}\right)$ (1)

$= -6\phi z\,\bar{a_r} - 6z\,\bar{a_\phi} - 6r\phi\,\bar{a_z}$ (1)

$D = \epsilon_0 \bar{E}$

$\rho_v = \nabla \cdot D = \frac{1}{r}\frac{\partial}{\partial r}(rD_r) + \frac{1}{r}\frac{\partial D_\phi}{\partial \phi} + \frac{\partial D_z}{\partial z}$ (1)

$= \frac{1}{r} \times (-6\phi z \epsilon_0) + \frac{1}{r} \times 0 + 0$

$= \frac{-6\phi z \epsilon_0}{r}$ (1)

$\rho_v = \frac{-6 \times 1.249 \times 1 \times 8.854 \times 10^{-12}}{1.5811}$ (1)

$= -41.96\,pC/m^3$

(b) Scalar magnetic potential

V_m is scalar magnetic potential.

$\nabla \times \nabla V_m = 0$

$H = -\nabla V_m$

$\therefore \nabla(-\bar{H}) = 0$ $\nabla \times H = 0$ (4)

But $\nabla \times \bar{H} = J$ i.e. $J = 0$

Scalar magnetic potential V_m can be defined for source free region where current density is

vector magnetic potential

It is denoted by $\overline{A}$

$\nabla \cdot (\nabla \times \overline{A}) = 0$, $\nabla \cdot B = 0$

$\overline{B} = \nabla \times \overline{A}$.

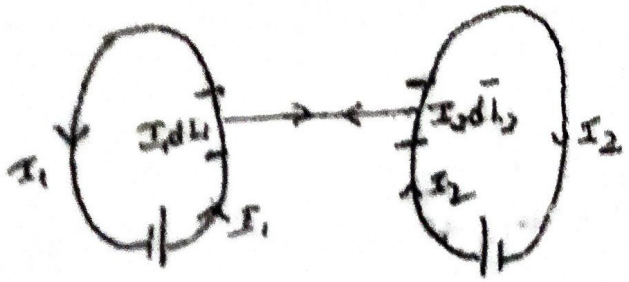
WKT $\nabla \times H = J$, $\nabla \times \frac{B}{\mu_0} = J$, $\nabla \times \overline{B} = \mu_0 \overline{J}$

$\nabla \times \nabla \times \overline{A} = \mu_0 \overline{J}$ (4)

using vector identity $\nabla(\nabla \cdot \overline{A}) - \nabla^2 A = \mu_0 J$

$$J = \frac{1}{\mu_0}(\nabla \times \nabla \times \overline{A}) = \frac{1}{\mu_0}\left[\nabla(\nabla \cdot \overline{A}) - \nabla^2 \overline{A}\right]$$

Force between Differential current Elements



$d(dF_1) = I_1 dL_1 \times d\overline{B_2}$

$d\overline{B_2} = \mu_0 \, d\overline{H_2}$

$= \mu_0 \left[\frac{I_2 \, dL_2 \times a_{R_{21}}}{4\pi R_{21}^2}\right]$

1 mark

$$d[dF_1] = \frac{\mu_0 I \, d\overline{L_1} \times (I_2 dL_2 \times \overline{a_{R_{21}}})}{4\pi R_{21}^2}$$

2 mark

$$F_1 = \frac{\mu_0 I_1 I_2}{4\pi} \oint_{L_1} \oint_{L_2} \frac{d\overline{L_1} \times (d\overline{L_2} \times \overline{a_{R_{21}}})}{R_{21}^2}$$

3.

$$\overline{F_2} = \frac{\mu_0 I_1 I_2}{4\pi} \oint_{L_2} \oint_{L_1} \frac{d\overline{L_2} \times (d\overline{L_1} \times \overline{a_{R_{12}}})}{R_{12}^2}$$

(i) $\mu = 1.8 \times 10^{-5}$ & $H = 120$ A/m

$M = (\mu_r - 1)H = \left(\frac{\mu}{\mu_0} - 1\right)H = 1599$ A/m (2)

(ii) $M = (8.3 \times 10^{28})(4.5 \times 10^{-27})$ (2)

$= 373.5$ A/m

$dW_y = -Q[E_y \cdot dy]$

$E_y = -4x\bar{a}_x$ (2M)

$dW_y = -Q[-4x\bar{a}_x \cdot dy\bar{a}_y]$

$= 8y\,dy$

$dW_z = 0$ Cos z Component

$W = \int dW_x + \int dW_y + \int dW_z$ (1)

$W = -\int_2^0 4x\,dx + \int_0^2 8y\,dy + 0 = \underline{\underline{24\,J}}$

(c) $V = \dfrac{60\sin\theta}{r^2}$

$\vec{E} = -\left[\dfrac{\partial V}{\partial r}\bar{a}_r + \dfrac{1}{r}\dfrac{\partial V}{\partial \theta}\bar{a}_\theta + \dfrac{1}{r\sin\theta}\dfrac{\partial V}{\partial \phi}\bar{a}_\phi\right]$ 1

$\vec{E} = -\left[-\dfrac{120\sin\theta}{r^2}\bar{a}_r + \dfrac{60\cos\theta}{r^3}\bar{a}_\theta + 0\right]$ 2

$\vec{D} = \epsilon_0\vec{E} = \dfrac{60\epsilon_0}{r^3}\left[2\sin\theta\,\bar{a}_r + \cos\theta\,\bar{a}_\theta\right]$ 1

$\vec{D} = \cancel{+1.622\times10^{-11}\,\bar{a}_r + 2.95\times10^{-11}\,\bar{a}_\theta}$ 1

$\boxed{\text{OR}}$

$\vec{D} = 34.86\,\vec{a}_r - 9.835\,\vec{a}_\theta \ \text{pC/m}^2$

(iii) $B = 200 \times 10^{-6}\ T$ $\quad \chi_m = 15$

$B = \mu_0 \mu_r H$

$\chi_m = M/H \Rightarrow H = \frac{M}{\chi_m}$

$B = \frac{\mu_0 \mu_r M}{\chi_m}$ (2)

$M = \frac{(200 \times 10^{-6}) \times 15}{4\pi \times 10^{-7} \times (15+1)} = 224.6\ A/m$

(b) $\bar{F} = I\,\bar{dL} \times \bar{B}$ (2)

$I = 10A,\ \bar{dL} = 4\bar{a}_z \quad \bar{B} = 0.05\bar{a}_x$

$\bar{F} = [10(4\bar{a}_z) \times 0.05\bar{a}_x]$ (2)

$= 2(-\bar{a}_y)\ N$ $\quad$ 0.2 $\hat{a}_y$ N

8a) Consider a differential element of length dL of the conductor. If ρ_v is the charge/unit volume in the conductor, then the charge dQ in the differential element is ← 0.2 mark

$dQ =$ charge density $\times$ volume

$dQ = \rho_v dv$ (2)

$dv = A \cdot dL$ (A is the area of conductor)

$dQ = \rho_v A\, dL$ ← 0.3 m

I be the current flowing in the conductor

$\bar{dF} = dQ(\vec{v} \times \vec{B}) = dL \rho_v A (\vec{v} \times \vec{B})$

$\bar{dF} = \rho_v v A (\bar{dL} \times \vec{B})$

But $\rho_v v A = I$ current flow.

$\therefore \bar{dF} = I(\bar{dL} \times \vec{B})$ ← 0.3 mark

$\bar{dF} = I\,dL\,B \sin\theta$

$\bar{F} = IL\bar{B}\sin\theta$

The normal component $\bar{B}_{n1} = (\bar{B}_1 \cdot \bar{a}_{n12})\bar{a}_{n12}$

$z \geq 0$, there is medium 2 and above $z > 0$ there is medium 1. The field vector travels from medium 1 to medium 2

$\bar{a}_{n12} = -\bar{a}_z$

$\bar{B}_{n1} = [(2\bar{a}_x - 3\bar{a}_y + \bar{a}_z) \cdot (-\bar{a}_z)] \cdot (-\bar{a}_z)$

$= \bar{a}_z$ mT

Tangential component of $\bar{B}_1$ is

$\bar{B}_{tan1} = \bar{B}_1 - \bar{B}_{n1}$

$= (2\bar{a}_x - 3\bar{a}_y + \bar{a}_z - \bar{a}_z) \times 10^{-3}$

$= 2\bar{a}_x - 3\bar{a}_y$ mT

using B.C $\bar{B}_{n2} = \bar{B}_{n1} = \bar{a}_z$ mT

$\bar{H}_{tan1} - \bar{H}_{tan2} = \bar{a}_{n12} \times \bar{K}$

$\bar{H}_{tan1} = \dfrac{\bar{B}_{tan1}}{\mu_0 \mu_{r1}}$

$= 500\bar{a}_x - 750\bar{a}_y$ A/m

putting value of $\bar{H}_{tan1}$ in above expression,

$[(500\bar{a}_x - 750\bar{a}_y) - \bar{H}_{tan2}] = (-\bar{a}_z) \times (100\bar{a}_x)$

$\bar{H}_{tan2} = 500\bar{a}_x - 650\bar{a}_y$ A/m

$\bar{B}_{tan2} = \mu_2 \bar{H}_{tan2} = (6 \times 10^{-6})(500\bar{a}_x - 650\bar{a}_y)$

$\bar{B}_{tan2} = (3\bar{a}_x - 3.9\bar{a}_y)$ mT

$B_2 = \bar{B}_{tan2} + \bar{B}_{n2}$

$= (3\bar{a}_x - 3.9\bar{a}_y + \bar{a}_z)$ mT

11/12

$$\nabla \times \bar{E} = \frac{\partial \bar{B}}{\partial t} = \varepsilon \frac{\partial \bar{E}}{\partial t}$$

$$\begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 0 & 0 & 4+2\times10^6 t \end{vmatrix}$$

$\bar{a}_z$ (4)

$$\frac{\partial}{\partial t}\bar{E} = \varepsilon \frac{\partial}{\partial t}\left[2y - kt\right]\bar{a}_z$$

$$= \varepsilon \frac{\partial}{\partial t}(-kt)\bar{a}_z$$

$$\text{RHS} = -k\varepsilon\bar{a}_z$$

$$\varepsilon\bar{a}_z = \bar{a}_z$$

$$= -1/\varepsilon = -\frac{1}{4\times10^{-9}} = -2.5\times10^{8}$$ (4)

$$\frac{\sigma}{\omega\varepsilon} = \frac{\sigma}{2\pi f \varepsilon_0 \varepsilon_r} = 1.12$$

So it is a Conductor (2)

$$\beta = \sqrt{\frac{\omega\mu\sigma}{2}} = \sqrt{\frac{2\pi f\mu\sigma}{2}} = 2513$$

$$= \sqrt{\frac{\omega\mu}{\sigma}}\angle 45^\circ = 35.5\angle 45^\circ$$ (2)

$$u = \frac{\omega}{\beta} = \frac{2\pi\times16\times10^{6}}{2513} = 4\times10^{7}\,\text{m/s}$$ (1)

$$\delta = \frac{1}{\sqrt{\pi f \mu \sigma}} =$$ (1)

Prof. — (6)

(b) using Ampere circuital law

$$\nabla \times \bar{H} = \frac{\partial \bar{D}}{\partial t} = J_D \quad (1)$$

$$\nabla \times \bar{H} = \begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 0 & 10^{-6}\cos(377t + 1.25\times10^{-6} z) & 0 \end{vmatrix} \quad (1)$$

$$= 1.25\sin(377t + 1.256\times10^{-6} z)\,\bar{a}_x \quad (1)$$

$$J_D = \frac{\partial \bar{D}}{\partial t} = \nabla \times \bar{H} \quad \text{for free space} \quad (1)$$

$$J_D = 1.256\sin(377t + 1.25\times10^{-6} z)\,\bar{a}_x \ \text{A/m}^2$$

Approved

Prof. J. RAVI Kumar
Coordinator & Member - BOE [ECITC]
VTU, Belgaum
Professor ECE
Dayananda Sagar College of Engineering, Bangalore-560 078

Amplitude is $1.256\ \text{A/m}^2$ (1)

(c) $\delta = \frac{1}{\sqrt{\pi f \mu \sigma}} = \frac{1}{\sqrt{\pi f (4\pi\times10^{-7})\sigma}}$ (1)

Approved

$\sqrt{\sigma} = 5.03292\ \text{S/m}$, $\sigma = 25.3302\ \text{S/m}$ (2)

Registrar (Evaluation)
Visveswaraiah Technological University
Belgaum 590 014

Third Semester B.E. Degree Examination, June/July 2013

Field Theory

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer FIVE full questions, selecting at least TWO questions from each part.*
2. Assume any missing data suitably.

PART – A

1 a. State and explain Coulomb's law in vector form. (05 Marks)

b. Two point charges $Q_1 = 100\ \mu c$ and $Q_2 = 10\ \mu c$ are located at points $(-1, 1, -3)$m, $(3, 1, 0)$m respectively. Find the x, y and z components of the force on Q_1. What is the magnitude of the total force? (08 Marks)

c. State and prove Gauss divergence theorem. (07 Marks)

2 a. Show that the electric field at any point is given by the negative of the gradient of potential at the point. (06 Marks)

b. Find the potential, electric field intensity and volume charge density at a point $P(-4, 3, 6)$ provided the potential field $V = 2x^2y - 5z$. (08 Marks)

c. Discuss the boundary conditions between two perfect dielectrics. (06 Marks)

3 a. State uniqueness theorem and prove two solutions V_1 and V_2 are equal using Laplace's equation. (08 Marks)

b. Starting with point form of Gauss law, deduce Poisson's & Laplace equations. (05 Marks)

c. Given vector $\vec{E} = (12yx^2 - 6z^2x)\hat{a}_x + (4x^3 + 18zy^2)\hat{a}_y + (6y^3 - 6zx^2)\hat{a}_z$. Check whether it represents a possible electric field. (07 Marks)

4 a. List the applications of Biot-Savarts law. Explain any one with necessary mathematical representations. (06 Marks)

b. Explain the concept of curl with suitable derivation of curl $\vec{F}$. (06 Marks)

c. A solenoid of 10 cm diameter and 30 cm length is wound with 150 turns and carries a current of 5 A. Find the magnetic flux density at a point on the axis at a distance of 10 cm from the midpoint of the solenoid. (08 Marks)

PART – B

5 a. State and prove the Lorentz force equation. (04 Marks)

b. Find the force per meter length between two long parallel wires separated by 10 cm in air and carrying a current of 10 A in the same direction. (08 Marks)

c. Consider two different media placed adjacently in a region where there is a magnetic field. Explain with suitable mathematical steps the magnetic boundary conditions. (08 Marks)

a. With suitable mathematical steps, p
uniform plane wave. (10 Mar

b. For silver the conductivity is $\sigma = 3.0\times10^4$ s/m. At what frequency will the depth
penetration be 1 mm? (04 Mar

c. State and prove Poynting theorem. (06 Mar

a. Explain the reflection of plane waves at the surface of a perfect conductor at norma
incidence. (10 Mar

b. What is SWR? With necessary expression, explain in detail SWR. (10 Mar

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06ES36

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Field Theory

Time: 3 hrs. Max. Marks:100

Note : 1. *Answer any FIVE full questions.*
2. *Assume any missing data suitably.*

1 a. State and explain Gauss Law. Find out the relation between D and E. (06 Marks)

b. Charge is distributed uniformly along an infinite straight line with constant density ρ_l. Develop the expression for E at the general point P. (06 Marks)

c. A vector field is given by, $A(r,\phi,z) = 30e^{-r}a_r - 2za_z$. Verify the divergence theorem for the volume enclosed by, $r = 2$, $z = 5$. (08 Marks)

2 a. If $E = -8xya_x - 4x^2a_y + a_z (V/m)$. Find the work done in carrying a 6 coulomb charge from A(1, 8, 5) to B(2, 18, 6) along the path $y = 3x+2$, $z = x+4$. (08 Marks)

b. A potential function is $v = 2x+4y$ volts, is in free space. Find the stored energy in free space in the 1 m^3 volume centered at origin. (06 Marks)

c. Starting with principle of charge conservation, obtain point form of continuity equation. (06 Marks)

3 a. Obtain the conditions on the tangential and normal components of electric field intensity and electric flux density at the boundary between two dielectric media. (08 Marks)

b. Derive Poisson's and Laplace's equations starting from point form of Gauss law. (06 Marks)

c. State and explain uniqueness theorem. (06 Marks)

4 a. Find H at the centre of a square current loop of side 4 meters, if a current of 5 amp is passing through it. (08 Marks)

b. State and explain Ampere's circuit law. (06 Marks)

c. Given $A = (y\cos ax)a_x + (y+e^x)a_z$, find $\nabla \times A$ at the origin. (06 Marks)

5 a. Derive Lorentz force equation and mention the application of its solution. (06 Marks)

b. Define torque. Find the torque about the z-axis for a conductor located at $x = 0.4$ m, $y = 0$ and $0 < z < 2$m, which carries a current of 5A in the a_z direction, along the length of the conductor. $B = 2.5a_z$ Tesla. (06 Marks)

c. Derive the expression for the inductance of a toroidial ring with N turns and carrying current I amp. Assume the radius of the toroid be 'R' m and area of cross section of toroidial ring be 'A' m^2. (08 Marks)

6 a. State and explain Faraday's law for EMF when a closed conductor single loop circuit is placed in time varying magnetic field and hence show that $\nabla \times E = -\partial B/\partial t$. (07 Marks)

b. Write Maxwell's equations for free space in point and integral forms. (08 Marks)

c. Write a short note on retarded potentials. (05 Marks)

7 a. What is uniform plane wave? Explain its propagation in free space with necessary equations. (08 Marks)

b. What is loss tangent? Explain its practical importance. (06 Marks)

c. Find the skin depth δ at a frequency of 1.6 MHz in aluminium, where σ = 38.2 MS/m and $\mu_r = 1$. Also find γ, λ and V_p. (06 Marks)

8 a. Define the terms i) Reflection co-efficient and ii) Transmission co-efficient. Also bring out the relation between them. (08 Marks)

b. Write a short note on SWR. (05 Marks)

c. A 50 MHz uniform plane wave has electric field amplitude 10 V/m. The medium is lossless, having $\epsilon_r = 9$ and $\mu_r = 1$. The wave propagates in the x, y plane at a 30° angle to ... linearly polarized along z. Write down the phasor expression for the ... and V_{pz}. (07 Marks)

c. Determine electric flux density D in Cartesian co-ordinates [illegible] by

i) A point charge of 30 mC at origin

ii) An infinite line charge with $\rho_l = 40\mu C/m$ on $x = 0$; $y = 0$

iii) A surface charge with $\rho_s = 57.2\mu C/m^2$ on the plane $z = 9$ m. (10 Marks)

2 a. Show that $E = -\nabla V$. (06 Marks)

b. A total charge of 40 nC is uniformly distributed around a ring of radius 2m, with it's center located at origin (0, 0, 0) and lying in the plane $z = 0$. Determine electric potential at (0, 0, 5) m. Also determine the potential at (0, 0, 5), if all charge of 40 nC were to be concentrated at origin. (07 Marks)

c. Determine work done in carrying a charge of –2 C from (2, 1, –1) to (8, 2, –1) in the electric field $E = y\, a_x + x\, a_y$ v/m, (in Cartesian co-ordinates) considering the path along the parabola $x = 2y^2$. (07 Marks)

3 a. Using Laplace equation derive an expression for capacitance for concentric spherical capacitor. (08 Marks)

b. Find stored energy in a system of four identical charges of 4 nC, at the corners of a square of side 1m. Also determine energy density at the center of the square. (06 Marks)

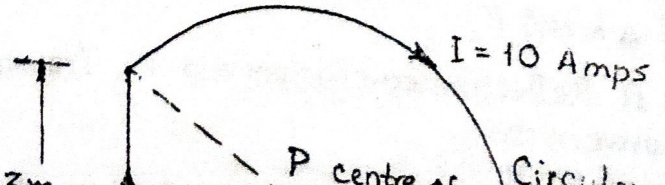
c. With usual notation derive the expression $\nabla . J = -\frac{\partial \rho_v}{\partial t}$. (06 Marks)

4 a. Discuss the boundary conditions at the interface between two dielectrics of different permittivities. (08 Marks)

b. State and prove uniqueness theorem. (06 Marks)

c. The region $z < 0$ is composed of a uniform dielectric material with $\varepsilon_r = 3.2$ and the region $z > 0$ is characterized by $\varepsilon_r = 2$. If $D_1 = (-30a_x + 50a_y + 70a_z)\, nC/m^2$, determine i) D_2 ii) θ_1 iii) θ_2

5 a. Using Biot Savert's law, determine magnetic flux density at 'P', for the current loop shown in Fig.5(a) (06 Marks)



b. Clearly differentiate between scalar magnetic potential and vector magnetic potential. (05 Marks)

c. Given $H = 20r^2 a_\phi$ A/m i) Determine the current density J ii) Also determine the total current that crosses the surface r = 1m, $0 < \phi < 2\pi$ and z = 0 (in cylindrical coordinates). (07 Marks)

6 a. Explain Faraday's laws applied to
i) Stationary path, changing field and
ii) Steady field moving circuit.
Derive necessary relationships. (10 Marks)

b. For the Faraday disc generator shown in Fig.6(b), determine open circuit voltage. The circular disc is of radius 'a', rotates at a constant angular velocity 'ω' rad/sec in a magnetic field of $B_z = \omega b / \pi r^2$. Two brushes are put, at the axis and rim of the disc.

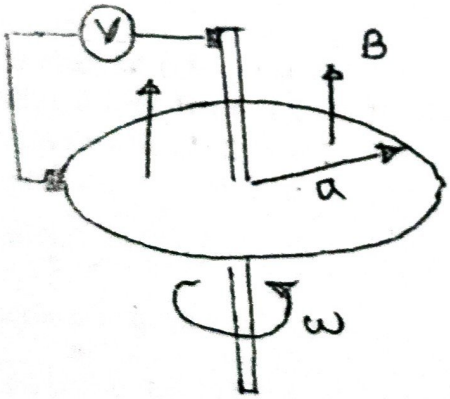


Fig.6(b) (05 Marks)

c. Determine inductance of a solenoid carrying N turns on a magnetic core of axial length 'l' meters and cross sectional area of 'A' m^2. (05 Marks)

7 a. List Maxwell's equations in differential form for both steady fields and time varying fields (08 Marks)

b. State and prove Poynting theorem. (06 Marks)

c. Derive electromagnetic wave equation for a homogeneous medium. (06 Marks)

8 a. What do you mean by depth of penetration? (05 Marks)

b. Explain electromagnetic waves propagation in perfect dielectric. (07 Marks)

c. Wet marshy soil is characterized by $\sigma = 10^{-2}$ s/m, $\varepsilon_r = 15$ and $\mu_r = 1$. At frequencies 60 Hz, 1 MHz, 100 MHz and 10 GHz, indicate whether soil be considered a conductor, or a dielectric. (08 Marks)

06ES36

Third Semester B.E. Degree Examination, Dec.08/Jan.09
Field Theory

e: 3 hrs. Max. Marks:100

Note : 1. *Answer any FIVE full questions by choosing at least Two from each part*
2. *Any missing data can be assumed.*
3. *Draw neat diagram wherever necessary.*

PART - A

a. State Coulomb's law of force between any two point charges and indicate the units of the quantities involved. (06 Marks)

b. Volume charge density, $\rho_v = 0$ for $\rho < 0.01(m)$ and also for $\rho > 0.03(m)$. In the region, $0.01 < \rho < 0.03(m)$, $\rho_v = 10^{-8}\cos(50\pi\rho)$ (c/m^3), find electric flux density $\vec{D}$ everywhere. (07 Marks)

c. Evaluate both sides of gauss – divergence theorem for the field $\vec{D}\ 2xyz\vec{a}_x + 3y^2z\vec{a}_y + x\vec{a}_z(c/m^2)$. the region is defined by $-1 \le x, y, z \le 1(m)$. (07 Marks)

a. Define electric scalar potential. With usual notations, establish the relationship between electric field intensity and electric scalar potential. (06 Marks)

b. A metallic sphere of radius 0.1(m) has a surface change density of $10(nc/m^2)$. Calculate electric energy stored in the system. Derive the formula employed. (07 Marks)

c. A capacitor has square plates each of side 'a'(m). The plates make an angle θ with each other. Show that for small θ, the capacitance is $C = \frac{\epsilon_o a^2}{d}\left(1 - \frac{a\theta}{2d}\right)(F)$. (07 Marks)

a. Derive Poisson's and Laplace's equations. Write laplace's equation in CCS and SCS. (06 Marks)

b. Using laplace's equation, prove that the potential distribution at any point in the region between two concentric cylinders of radii A and B as $V = V_o\frac{\ln\left(\rho/B\right)}{\ln\left(A/B\right)}$(Volts) (07 Marks)

c. It is known that V = XY is a solution of laplace's equation, where X is a function of x alone and Y is a function y alone. Determine which of the following potential functions are also solutions of laplace's equation i) V = 100X, ii) V = 80XY, iii) V = 3XY + x – by. (07 Marks)

a. State and explain Biot – savart law. Using this, find the magnetic flux density at the centre of a circular current loop of radius 'a'(m) (07 Marks)

b. Magnetic field intensity in free space is $\vec{H} = 10\rho^2\vec{a}_\phi\left(A/m\right)$ Determine

i) $\vec{J}$

ii) Integrate $\vec{J}$ over the circular surface ρ = 1(m), all ϕ and z = 0. (06 Marks)

c. Verify the stoke's theorem for the field $\vec{H}\ 6xy\vec{a}x - 3y2\vec{a}y\left(A/B\right)$ and the rectangular path around the region, $2 \le x \le 5$, $-1 \le y \le 1$, Z = 0. Let the positive direction of $\vec{da}$ be $\vec{a}_z$

PART B

a. Obtain the expression of magnetic force between two current elements and hence for current loops. (06 Marks)

b. Find the magnetization in a magnetic material where:

i) $\mu = 1.8 \times 10^{-5}$ (H/m) and H = 120 (A/m).

ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m^3 and each atom has a dipole moment of 4.5×10^{-27} (A/m^2) and

iii) B = 300 (μT) and $\chi_m = 15$. (06 Marks)

c. Define self inductance. Find the same of a solenoid with air core has 2000 turns and a length of 500(mm) core with radius 40 (mm). (08 Marks)

a. Explain transformer and motional induced emfs. (06 Marks)

b. Show that an emf induced in a Faraday's disc generator is $e = -\frac{WBa^2}{2}$ (Volts), where 'W' is the angular velocity in rad/sec, B is the magnetic flux density in Tesla and 'a' is the radius of the disc in metre. (06 Marks)

c. Write the Maxwell's equations in point form for static fields and in integral form for time varying fields. (08 Marks)

a. Discuss the uniform plane wave propagation in a good conducting medium. (06 Marks)

b. The magnetic field intensity of uniform plane wave in air is 20 (A/m) in $\vec{a}_y$ direction. The wave is propagating in the $\vec{a}_z$ direction at an angular frequency of 2×10^8 (rad/sec)

Find: i) Phase shift constant; ii) Wavelength;

iii) Intrinsic η; and iv) Amplitude of electric field intensity (06 Marks)

c. A circular wire having a conductivity σ and radius 'a' carrying a direct current I(Amperes). Using Poynting's theorem, determine the net power entering the wire of length l(m). (08 Marks)

a. Derive the expressions for transmission co-efficient and reflection co-efficient. (08 Marks)

b. Define Standing Wave Ratio(S). What value of S results when reflection coefficient = ± ½? (04 Marks)

c. Given T = 0.5, η_1=100 (Ω), η_2=300 (Ω), E^i_{x1}=100 (v/m). Calculate values for the incident, reflected and transmitted waves. Also show that the average power is conserved.

06ES36

Third Semester B.E. Degree Examination, June-July 2009

Field Theory

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, selecting at least Two full questions from each part.*

PART – A

a. State and prove Divergence theorem. (06 Marks)

b. Define: i) Electric field intensity; ii) Electric flux density; iii) Volume charge density (06 Marks)

c. Let $\vec{D} = 5r^2 \hat{a}r$ mc/m^2 for $r \le 0.08$m and $\vec{D} = \frac{.205}{r^2}\hat{a}r$ μc/m^2 for $r \ge 0.08$m. Find ρ_v for i) r = 0.06m; ii) r = 0.1m. (08 Marks)

a. Derive the expression for the energy stored in Electrostatic field using electric field intensity $\vec{E}$. (06 Marks)

b. A 15-nc point charge is at the origin in free space. Calculate V, if point P is located at (2, -3, -1). Also calculate V_1 at P if V = 0 at (6, 5, 4). (08 Marks)

c. Derive point form of continuity equation. (06 Marks)

a. Derive Laplace's equations. (05 Marks)

b. Using Laplace equations, derive the expression for the capacitance of a co-oxial cable. (10 Marks)

c. Calculate the numerical values for V and ρ_v in free space of $V = \frac{4yz}{x^2+1}$ at p: (1, 2, 3) (05 Marks)

a. Derive the expression for field at a point P due to an infinitely long filament carrying direct current I. (08 Marks)

b. Explain scaler and vector Magnetic Potential. (08 Marks)

c. Calculate the value of vector current density in cylindrical co-ordinates at P: (1.5, 90°, 0.5) if $\vec{H} = \frac{2}{\rho}\cos 0.2\phi a_\rho$. (04 Marks)

PART – B

a. Define: i) Magnetization; ii) Permeability; iii) Torque. (06 Marks)

b. Obtain the boundary conditions at interface between two magnetic materials. (06 Marks)

c. Find Magnetization in magnetic material, where: (08 Marks)
i) $\mu = 1.8 \times 10^{-5}$ H/m and H = 120 A/m; ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m^3 and each atoms has a dipole moment of 4.5×10^{-27} A – m^2; iii) B = 300 μT and $X_m = 15$.

a. List Maxwell's equations in point form and integral form. (08 Marks)

b. Let $\mu = 10^{-5}$ H/m, $\epsilon = 4 \times 10^{-9}$ F/m, $\sigma = 0$ and $\rho_v = 0$. Find K so that each of he following pair of fields satisfies Maxwell's equation.
i) $\vec{D} = \left(6\hat{a}_x - 2y\hat{a}_y + 2z\hat{a}_z \text{ nc/m}^2\right)$, $\vec{H} = \left(kx\hat{a}_x + 10y\hat{a}_y - 25z\hat{a}_z\right)$ A/m.
ii) $\vec{E} = (20y - kt)\hat{a}x$ v/m, $\vec{H} = \left(y + 2\times10^{6}t\right)\hat{a}_z$ A/m. (06 Marks)

c. Write a note on Retarded Potential. (06 Marks)

a. State and prove Poynting's theorem. (10 Marks)

b. Discuss the behaviour of good conductor when uniform plane wave propagates through it. (10 Marks)

a. Discuss the problem of wave reflections from multiple interfaces. (08 Marks)

b. Define: i) Reflection coefficient; ii) Standing wave Ratios. (04 Marks)

c. Consider a 50 MHz uniform plane wave having Electric field amplitude 10 v/m. The medium is loss less having $\epsilon_r = \epsilon_{rl} = 9.0$ and $\mu r = 1.0$. The wave propagates in xy plane at 30° angle to x axis and is linearly polarized along z. Write the phasor expression for the electric field. (08 Marks)

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USN

06ES36

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Field Theory

Time: 3 hrs.

Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define electric field intensity due to a point charge in vector form. With usual notations, derive the expression for field at a point due to many charges. **(07 Marks)**

b. State and prove divergence theorem. **(05 Marks)**

c. Calculate the divergence of vector D at the points specified using cartesian, cylindrical and spherical coordinates:

i) $D = \frac{1}{z^2}[10xyz.a_x + 5x^2za_y + (2z^3 - 5x^2y)a_z]$ c/m^2 at point P(2, 3, 5)

ii) $D = 5z^2.a_\rho + 10\rho z\,.\,a_z$ at $\rho(3, -45°, 5)$

(08 Marks)

2 a. Define electric field and electric potential. With usual notations establish the relationship between electric field intensity and electric potential. **(10 Marks)**

b. With usual notations, derive the boundary conditions for perfect dielectric materials of permitivities ϵ_1 and ϵ_2. **(05 Marks)**

c. Given the potential field $V = 50x^2yz + 20y^2$ volts in free space, find

i) Potential V at P(1, 2, 3)

ii) $|E_p|$ (Magnitude of electric potential)

iii) $\hat{a}_r$ at P.

(05 Marks)

3 a. With usual notations, deduce the Poisson's equation and Laplace equation from Maxwell's first equation. Express $\nabla^2 V$ in different co-ordinate systems. **(10 Marks)**

b. Given $V = A\ln\left[B\frac{(1-\cos\theta)}{1+\cos\theta}\right]$ volts

i) Show that V satisfies Laplace equation in spherical coordinates.

ii) Find A and B so that V = 100V, |E| = 500 V/m at r = 5mt, $\theta = 90°$ and $\phi = 60°$.

(10 Marks)

4 a. State and prove the Stroke's theorem. **(06 Marks)**

b. If the vector magnetic potential at a point in a space is given as $A = 100\,\rho^{1.5}a_z$ wb/mt, find the following: i) H ii) J and show that $\oint H.dl = I$ for the circular path with $\rho = 1$. **(06 Marks)**

c. In cylindrical coordinates, a magnetic field is given as $H = [4\rho - 2\rho^2]a_\phi$ A/m, $0 \le \rho \le 1$.

i) Find the current density or a function of ρ within cylinder.

ii) Find the total current that passes through the surface Z = 0 and $0 \le \rho \le 1$ mt in the a-

ie equation for magnetic force between two differential current

(06 Marks)

uare loop having corners (-2, -2, 0), (2, -2, 0), (2, 2, 0) and
by $B = 0.4a_x T$ ii) About the origin by $B = 0.6a_x - 0.4a_y T$.

(06 Marks)

nce between conducting loop and a very long straight wire

(08 Marks)

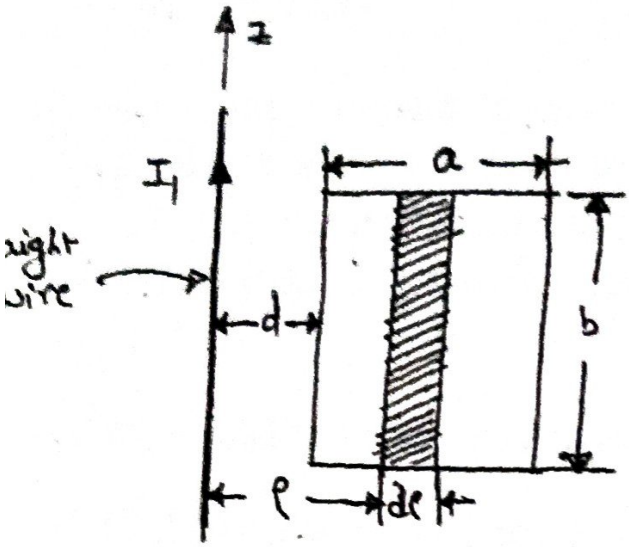

Fig.5(c)

Maxwell's equation in point form as derived from Faraday's
field $E = 2x^3a_x + 4x^4a_y$ v/m can not arise from a static

(08 Marks)

differential form of continuity equation from the Maxwell's

(04 Marks)

n free space is given as $B = \begin{cases} 4\sin\omega t a_z & \rho \le \rho_0 \\ 0 & \rho > 0 \end{cases}$

. Verify the same using Maxwell's equations. (08 Marks)

em.

(04 Marks)

xpression for intrinsic impendence for lossy media.

(06 Marks)

00 MHz uniform plane wave in free space is given by
1. Find

z = 10 cm iii) What is $|H|_{max}$? (10 Marks)

e ratio (SWR).

(04 Marks)

eral expression for a traveling plane wave. (06 Marks)

ee space (region-1) are normally incident on the interface
) with $\epsilon_r = 3.0$. Compare the magnitude of the incident

USN

06ES36

Third Semester B.E. Degree Examination, May/June 2010
Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the term 'Electric field intensity' and derive the expression for field due to an infinite line of charge. **(12 Marks)**

b. Given $\vec{D} = 5r\hat{a}_r$ c/m^2, prove divergence theorem for a shell region enclosed by spherical surfaces at r = a and r = b (b>a) and centered at the origin. **(08 Marks)**

2 a. Prove that the energy density in an electrostatic field is given by $\frac{1}{2}\epsilon\vec{E}^2$ J/m^3. **(08 Marks)**

b. Given $V = 2x^2y - 5z$ at point P(-4, 3, 6). Find the potential, electric field intensity and volume charge density. **(08 Marks)**

c. Derive the boundary conditions for $\vec{E}$ and $\vec{D}$ between two dielectrics. **(04 Marks)**

3 a. State and prove uniqueness theorem. **(10 Marks)**

b. Derive the expression for capacitance of a coaxial cable using Laplace's equation. **(10 Marks)**

4 a. State and explain Biot-Savart law for a small differential current element. **(04 Marks)**

b. Derive the expression for magnetic flux density on the axis of a circular loop of radius 'a' carrying current I using Biot Savart law. **(07 Marks)**

c. Vector magnetic potential in free space is given by $\vec{A} = 100e^{1.5}\hat{a}_z$ Wb/m. Find the magnetic field intensity and current density and hence prove Ampere's circuital law for $\rho = 1$. **(09 Marks)**

PART – B

5 a. Deduce the expression for inductance of a toroidal coil having N turns and carrying a current of I amps. **(06 Marks)**

b. A point charge Q = 18 nC has a velocity of 5×10^6 m/s in the direction $\hat{a} = 0.6\hat{a}_x + 0.75\hat{a}_y + 0.3\hat{a}_z$. Calculate the magnitude of the force exerted on the charge by the field $\vec{B} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ mT. **(06 Marks)**

c. A sq. loop carrying 2 mA current is placed in the field of an infinite filament carrying current of 15 Amp as shown, fig. Q5 (c). Find the force exerted on the sq.loop. **(08 Marks)**

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06ES36

Third Semester B.E. Degree Examination, December 2010
Field Theory

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. Assume any missing data suitably.

PART – A

1 a. Show that the electric field intensity at a point, due to 'n' number of point charges, is given by $\overline{E} = \frac{1}{4\pi\epsilon_0}\sum_{i=1}^{n}\frac{Q_i}{R_i^2}\hat{a}_{R_i}\ v/m$. **(05 Marks)**

b. A uniform line charge of infinite length with $\rho_L = 40$ nc/m, lies along the z-axis. Find $\overline{E}$ at (-2, 2, 8) in air. **(05 Marks)**

c. State and prove the Gauss's law. **(06 Marks)**

d. Determine the volume charge density, if the field is $\overline{D} = \frac{10\cos\theta\sin\phi}{r}\hat{a}_r\ c/m^2$. **(04 Marks)**

2 a. Derive an equation for the potential at a point, due to an infinite line charge. **(06 Marks)**

b. If the potential field $V = 3x^2 + 3y^2 + 2z^3$ volts, find
i) V ii) $\overline{E}$ iii) $\overline{D}$ at P(-4, 5, 4) **(06 Marks)**

c. Deduce an equation for the capacitance of a coaxial cable of length 'L', radius of inner conductor 'a' and out conductor 'b'. **(08 Marks)**

3 a. State and prove the uniqueness theorem. **(06 Marks)**

b. Find the capacitance between the two concentric spheres of radii r = b and r = a, such that b > a, if the potential V = 0 at r = b, using the Laplace's equation. **(10 Marks)**

c. Determine whether or not the potential equations i) $V = 2x^2 - 4y^2 + z^2$ and ii) $V = r^2\cos\phi + \theta$ satisfy the Laplace's equation. **(04 Marks)**

4 a. State and prove the Stoke's theorem. **(04 Marks)**

b. If the magnetic field intensity in a region is $\overline{H} = (3y-2)\hat{a}_z + 2x\hat{a}_y$, find the current density at the origin. **(06 Marks)**

c. A co-axial cable with radius of inner conductor a, inner radius of outer conductor b and outer radius c carries a current I at inner conductor and –I in the outer conductor. Determine and sketch variation of $\overline{H}$ against r for i) r < a ii) a < r < b iii) b < r < c iv) r > c

(06 Marks)

b. Derive the magnetic boundary conditions at the interface between the two different magnetic materials. Discuss the conditions. (08 Marks)

c. Calculate the inductance of a solenoid of 400 turns wound on a cylindrical tube of 10 cm diameter and 50 cm length. Assume the solenoid is in air. (06 Marks)

6 a. Using the Faraday's law, deduce the Maxwell's equation, to relate time varying electric and magnetic fields. (08 Marks)

b. Derive the Maxwell's equations in the point form of the Gauss's law for time varying fields. (06 Marks)

c. Given $\overline{E} = E_m \sin(\omega t - \beta z)\hat{a}_y$ in free space. Find $\overline{D}$, $\overline{B}$ and $\overline{H}$. (06 Marks)

$\frac{E_x}{H_y} = -\sqrt{\frac{\mu}{\varepsilon}} = \frac{E_y}{H_z} = -\sqrt{\frac{\mu}{\varepsilon}}$ $B = \mu H$ $D = \varepsilon E$

7 a. Obtain the solution of wave equation for uniform plane wave in free space. (10 Marks)

b. State and explain the Poynting's theorem. (04 Marks)

c. For a wave traveling in air, the electric field is given by $\overline{E} = 6\cos(\omega t - \beta t)\hat{a}_z$ at f = 10 MHz. Calculate the average Poynting vector. (06 Marks)

8 a. Explain the reflection of uniform plane waves, with normal incidence at a plane dielectric boundary. (10 Marks)

b. Write short notes on:

i) Standing wave ratio.

ii) Skin effect in conductors

USN 4AL11EC039

10ES36

Third Semester B.E. Degree Examination, January 2013
Field Theory

Time: 3 hrs. Max. Marks: 100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define 'Electric field intensity'. Derive an expression for electric field intensity' $(\vec{E})$ at a point due to many charges. **(07 Marks)**

b. Point charges of 50 nc each are located at A(1, 0, 0) B(-1, 0, 0) C(0, 10) and D(0, -1, 0)m. find the total force on the charge at A and also find $\vec{E}$ at A. **(05 Marks)**

c. Given $\vec{D} = 5\vec{ar}$ c/m^2, prove divergence theorem for a shell region enclosed by spherical surfaces at r = a and r = b (b > a) and centred at the origin. **(08 Marks)**

2 a. Find the electric field intensity at point x(1, 2, -1) given the potential $V = 3x^2y + 2y^2z + 3xyz$. **(05 Marks)**

b. Derive boundary conditions between conductor and free space if different 'ε'. **(08 Marks)**

c. Show that capacitance of co-axial cable is $C = \frac{2\pi \in L}{\ell_n[b/a]}$ F with usual notations. **(07 Marks)**

3 a. With usual representations derive Poisson's equation. **(05 Marks)**

b. Verify that the potential field given below satisfies the Laplace's equation $V = 2x^2 - 3y^2 + z^2$. **(05 Marks)**

c. A large spherical cloud of radius 'b' has a uniform volume charge distribution of ρ_v c/m^3, find the potential distribution and electric field intensity at any point in space using Laplace. **(10 Marks)**

4 a. State and explain Biot – Savart law. **(06 Marks)**

b. Calculate the value of vector current density in cylindrical co –ordinates at p(1.5, 90°, 0.5) if $\vec{H} = \frac{2}{\rho}\cos 0.2\phi \ \vec{a\phi}$. **(06 Marks)**

c. Given $\vec{H} = 20r^2 \ \vec{a\phi}$ A/m, determine the current density J also determine the total current that crosses the surface r = 1 m, $0 < \phi < 2\pi$ and z = 0 in cylindrical co-ordinate. **(08 Marks)**

PART – B

5 a. Derive lorentz force equation. **(05 Marks)**

b. Find the force per meter length between two long parallel wires separated by 10 cm in air and carrying a current of 10A in the same direction. **(05 Marks)**

c. Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6 cm diameter. The length of the tube is 60 cm, the solenoid is in air. Derive the equation for

e :

constant

nt

dance. (05 Marks)

Poynting theorem. (05 Marks)

n co-efficient and reflection co-efficient deduce the relationship between (06 Marks)

in the free space of amplitude 100 v/m strikes a perfect dielectric as (10 Marks)

Determine E_t.

free space

06CE42

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014

10ES36

Time: 3 hrs.

Field Theory

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

Max. Marks 100

PART – A

1 a. State and explain the Coulomb's law of force between the two point charges. (05 Marks)

b. Four 10nc positive charges are located in the Z = 0 plane at the corners of a square of side 8cm. A fifth 10nc positive charge is located at a point 8cm distant from the other charges. Calculate the magnitude of the force on the fifth charge in free space. (07 Marks)

c. A 100nc point charge is located at A(-1, 1, 3) in free space.

i) Find the locus of all points P(x, y, z) at which $E_x = 500$ V/m.

ii) Find y_1 if P(-2, y_1, 3) lies on that locus. (08 Marks)

2 a. Determine the work done in carrying a charge of 2C from B(1, 0, 1) to A(0.8, 0.6, 1) in an-electric field $\vec{E} = y\vec{a}_x + x\vec{a}_y + 2\vec{a}_z$ V/mt along the short arc of circle $x^2 + y^2 = 1$, Z = 1. (06 Marks)

b. Show that electric field intensity is a negative potential gradient. (04 Marks)

c. Derive an expression for continuity equation in point form. (04 Marks)

c. The Z = 0 defines the boundary between free space and dielectric medium with dielectric constant 20. The electric field intensity in free space is $\vec{E} = 10\vec{a}_x + 20\vec{a}_y + 40\vec{a}_z$ V/mt. Determine the electric field intensity in the dielectric medium. (06 Marks)

3 a. Derive Poisson's and Laplace's equation. (06 Marks)

b. In free space the volume charge density $\rho_v = \frac{200\epsilon_0}{r^{2/3}}$ C/m³, use Poisson's equation to find the potential V(r). (08 Marks)

c. Using Laplace's equation derive an expression for capacitance of parallel plate capacitor. (06 Marks)

4 a. State and explain Biot-Savart law. (06 Marks)

b. Prove that Ampere's circular law $\vec{\nabla} \times \vec{H} = \vec{J}$. (07 Marks)

c. Determine the magnetic field intensity $\vec{H}$ at point P(0.4, 0.3, 0). If the 8A current in a conductor inward from ∞ to origin on the x-axis and outward to ∞ along y-axis. (07 Marks)

PART – B

5 a. Deduce the expression for force between the differential current elements. (08 Marks)

b. A loop has a dimension of 1mt × 2mt and lies in the uniform magnetic field $\vec{B} = -0.6\vec{a}_x + 0.8\vec{a}_y$ T. The loop current is 4mA. Calculate the torque on the loop. (08 Marks)

e an expression for ... conductor pla
field. (04 Ma

dia the relative permittivity $\epsilon_r = 5$, conductivity $\sigma = 0$,
y $\vec{J}_d = 20\cos(1.5 \times 10^8 t - bx)\hat{a}y$ $\mu A/m^2$. Determine the ele
d intensity. (06 Ma

e conduction current density is equal to displacement curr
e of $v(t) = v_0 \cos wt$. (10 Ma

ive an expression for uniform plane wave in free space.
(08 Ma

pagation constant, intrinsic impedance and phase velocity
niform plane wave is propagating. (06 Ma

ven by $\vec{H}(x,t) = 10\cos(10^8 t - \beta x)\hat{a}y$ A/mt. Find β, λ a
= 1ns. (06 Ma

ion and transmission coefficient if the uniform plane wa
y with different dielectric. (10 Ma

eorem. (10 Ma

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USN

06ES36

Third Semester B.E. Degree Examination, June/July 2014
Field Theory

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define 'electric field intensity' and derive the expression for field due to an infinite line of charge. **(12 Marks)**

b. Sheet of charge with $\rho_s = -40\ \mu c/m^2$ located at $z = -0.5m$, line of charge with $\rho_L = -6\mu c/m$ line along y-axis, what is the net flux crosses the surface of a cube of 2m on an edge of centered at origin. **(04 Marks)**

c. Calculate $\vec{D}$ in rectangular co-ordinates at P(2, -3, 6) produced by a point charge Q = 55mc located at (-2, 3, 6). **(04 Marks)**

2 a. Show that $\vec{E}$ is a negative potential gradient of the potential V. **(05 Marks)**

b. Given potential field $V = 2x^2y - 5z$ and at a point P(-4, 3, 6), obtain

i) V, ii) $\vec{E}$, iii) Direction of $\vec{E}$. **(05 Marks)**

c. Find the capacitance of coaxial cable of inner radius 'a' and outer radius 'b'. **(05 Marks)**

d. A special capacitor of 54pF of two concentric sphere differing in radii 4cm with air as dielectric medium, find their radii and also find energy stored in the capacitor for V = 100V. **(05 Marks)**

3 a. Derive Poisson's and Laplace's equations and write Laplace's equation in cylindrical and polar coordinates. **(06 Marks)**

b. Determine whether the following potential fields satisfies Laplace's equation or not:

i) $V = x^2 + y^2 + z^2$; ii) $V = \rho\cos\phi + z$. **(06 Marks)**

c. Using Laplace's equation, find capacitance of metallic parallel plates. **(08 Marks)**

4 a. Derive an expression for H at a point in the axis of solenoid. **(06 Marks)**

b. A circuit carrying current 5A, from rectangular hexagon inscribed in a circle of radius 1m, calculate B at the centre of hexagon. **(04 Marks)**

c. Show that $\int H.dl = \int_S \nabla X H dS = I$, with definition of the same. **(10 Marks)**

PART – B

5 a. Obtain the expression for magnetic force on moving point charge and magnetic force on differential current element. **(10 Marks)**

b. Obtain the expression for inductance of coaxial cable. **(06 Marks)**

c. Calculate the inductance of solenoid of 200 turns, wound tightly on a cylindrical tube of 6cm dia, length of cable (solenoid) is 60cm in air for $\rho = 3 \times 10^{-2}m$. **(04 Marks)**

6 a. Explain Faraday's law and Lenz's law. (06 Marks)

b. Write Maxwell's equations in differential form and integral form. (08 Marks)

c. A circular cross section conductor of radius 1.5mm carries a current $i = 5.5\sin(4 \times 10^{10}t)\mu A$. Find amplitude of the displacement current density if $\sigma = 35\mho/m$, $\epsilon_r = 10$. (06 Marks)

7 a. Derive an equation for wave propagation in free-space. (10 Marks)

b. State and prove Poyntings theorem. (06 Marks)

c. A plane wave traveling in positive x-direction in a lossless unbounded medium having permeability 4.5 times that of free space and a permittivity twice that of the wave.

i) Find phase velocity of the wave.

ii) If E has only y-component with a amplitude 20 V/m, find the amplitude and direction of H. (04 Marks)

8 a. Derive the expression for transmission coefficient and reflection coefficient. (08 Marks)

b. Show that $SWR = \frac{1+\Gamma}{1-\Gamma}$. (06 Marks)

c. Given, $\Gamma = 0.5$, $\eta_1 = 300\Omega$, $\eta_2 = 300\Omega$, E_xi, = 100 V/m. Calculate incident, reflected and transmitted waves also find average power is conserved. (06 Marks)

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Field Theory

Time: 3 hrs. Max. Marks: 100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. State and prove Gauss law. **(04 Marks)**

b. Find the volume charge density at $(4m, 45^\circ, 60^\circ)$. If the electric flux density is given by, $\vec{D} = (r\hat{a}_r + \sin\theta\hat{a}_\theta + \sin\theta\cos\phi\hat{a}_\phi)$ C/m². **(06 Marks)**

$\rho_v = \nabla \cdot D$

c. Given $\vec{D} = \frac{10r^3}{4}\hat{a}_r$ in cylindrical co-ordinates, evaluate both sides of the divergence theorem for the volume enclosed by the cylinder with r = 2 m, z = 0 to 10 m. **(10 Marks)**

2 a. With usual notations, prove point form of continuity equation, $\nabla \cdot J = \frac{\partial \rho_v}{\partial t}$. **(05 Marks)**

b. Find the amount of energy required to move a 6 coulomb of point charge from the origin to P(3, 1, -1) m in the field $\vec{E} = (2x\hat{a}_x - 3y^2\hat{a}_y + 4\hat{a}_z)$ V/m along the straight line path, x = -3z, y = x+ 2z **(05 Marks)**

c. A parallel plate capacitor is filled with a dielectric of 0.03 power factor and $\varepsilon_r = 10$. The plates have an area of 250 mm² and the distance between them is 10 mm. If 5000 V (rms) at 1 MHz is applied to the capacitor find the power dissipated as heat. **(10 Marks)**

3 a. Find V and the volume charge density in free space, if $V = \frac{2\cos\phi}{r^2}$ at P(0.5, 45°, 60°). **(07 Marks)**

b. Find the electric field at P(3, 1, 2) for the field of two radial conducting planes V= 50 V at $\phi = 10^\circ$ and V = 20 V at $\phi = 30^\circ$ **(08 Marks)**

c. State and prove uniqueness theorem. **(05 Marks)**

4 a. State and prove Ampere's law. **(04 Marks)**

b. Calculate the magnetic field intensity at point P due to 10 A current flowing in the anticlockwise direction in the metallic block shown in Fig. Q4 (b). **(06 Marks)**

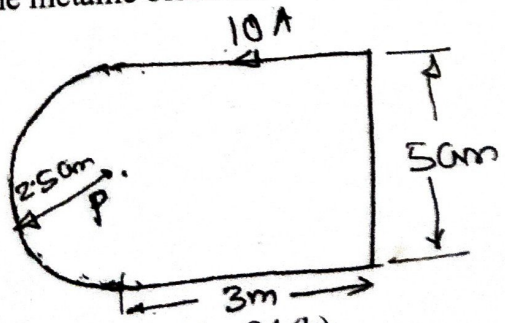


Fig. Q4 (b)

c. Verify stokes theorem for a field having $\vec{H} = 2\rho^2(\tau+1)\sin\phi\hat{a}_\phi$ for the portion of a cylindrical surface defined by $\rho = 2$, $\frac{\pi}{4} \le \phi \le \frac{\pi}{2}$, $1 \le \tau \le 1.5$ and for its perimeter. **(10 Marks)**

c. Two homogeneous, linear, isotropic material have interface at X = 0, in which there is a surface current $K = 200\hat{a}_z$ A/m. In region 2 for X > 0, find i) H_2 ii) $|B_1|$ iii) $|B_2|$ iv) α_1 v) α_2. If $H_1 = (150\hat{a}_x - 400\hat{a}_y + 250\hat{a}_z)$ A/m. **(10 Marks)**

6 a. State Maxwell's equations for a good conductor and for perfect dielectrics. **(08 Marks)**

b. Define phase velocity, wavelength and propagation constant. **(06 Marks)**

c. A uniform plane wave traveling in +z direction in air has $H = 20\hat{a}_y$ A/m the frequency of the signal is $\frac{1}{\pi} \times 10^9$ Hz. Find λ, T and E. **(06 Marks)**

7 a. Derive the expression for α, β, γ and V for low loss dielectric. **(06 Marks)**

b. For a uniform plane wave, $E_y = 10.4e^{(-j\beta x + 2\pi \times 10^9 t)}$ V / m. Find

i) The direction of propagation.

ii) Phase constant β

iii) Expression for H. **(05 Marks)**

c. A material is characterized by $\varepsilon_r = 2.5$, $\mu_r = 1$ and $\sigma = 4 \times 10^{-5}$ ℧/m at f = 1 MHz. Determine the value of the loss tangent, attenuation constant and phase constant. **(09 Marks)**

USN 4AL12EC044

10ES36

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define electric field intensity ($\vec{E}$). Find an expression for electric field intensity due to N different point charges. **(04 Marks)**

b. Derive Maxwell's first equation in electrostatics. **(04 Marks)**

c. Given $\vec{D} = z\sin\phi\,\vec{a_\rho} + \rho\sin\phi\,\vec{a_z}$ c/m^2 compute the volume charge density at (1, 30° 2). **(04 Marks)**

d. Verify both sides of Gauss Divergence theorem if $\vec{D} = 2xy\,\vec{a_x} + x^2\,\vec{a_y}$ c/m^2 present in the region bounded by $0 \le x \le 1$, $0 \le y \le 2$, $0 \le z \le 3$ **(08 Marks)**

2 a. Derive an equation for potential due to infinite line charge. **(04 Marks)**

b. If $U = \dfrac{60\sin\theta}{r^2}$ V find V and $\vec{E}$ at P (3,60,25) **(05 Marks)**

c. Derive an equitation for energy stored in terms of $\vec{E}$ and $\vec{D}$ **(05 Marks)**

d. Derive Boundary conditions for conductor and Dielectric interface. **(06 Marks)**

3 a. Expand ∇^2 operation in different co-ordinate system. **(03 Marks)**

b. Verify that the potential field given below satisfies the Laplace equation
$V = 2x^2 - 3y^2 + z^2$
$V = [Ar^4 + Br^{-4}]\sin 4P$ **(08 Marks)**

c. 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 = Vo at r = a. **(09 Marks)**

4 a. Derive expression for $\vec{H}$ due to straight conductor of finite length. **(08 Marks)**

b. State and explain the following
i) Ampere circuit law
ii) Stokes theorem. **(08 Marks)**

c. Given the vector magnetic potential
$\vec{A} = x^2\vec{a_x} + 2yz\vec{a_y} + (-x^2)\vec{a_z}$
Find magnetic flux density. **(04 Marks)**

PART – B

5 a. Derive expression for force on a differential current element **(06 Marks)**

b. A current element $I_1\,\Delta L_1 = 10^{-5}\,\vec{a_z}$ A.m is located at $P_1(1, 0, 0)$ while second element $I_2\,\Delta L_2 = 10^{-5}\,(0.6\,-\vec{a_x}\;2\vec{a_y} + 3\vec{a_z})$ A.m is at P_2 (-1, 0,0) both in free space find the vector force exerted on $I_2\,\Delta L_2$ by $I_1\,\Delta L_1$ **(08 Marks)**

c. Derive an equation of inductance of Toroid. **(06 Marks)**

equations for time varying fields.

b. $\vec{E} = Em \sin(wt - Bz)\ \vec{ay}$ in free space find $\vec{D}, \vec{B}, \vec{H}$ **(08 Marks)**

c. Define displacement current density. **(05 Marks)**

d. Derive continuity equation from Maxwell's equation. **(02 Marks)**

a. Derive General wave equation **(05 Marks)**

b. The uniform plane wave travelling in free space is given by **(08 Marks)**

$Ey = 10.4\ e^{j(2\pi\times10^{9}t-\beta x)}\ \mu v/m$

Find:

i) Direction of wave propagation.

ii) Phase velocity

iii) Phase constant

iv) Equation for magnetic field **(08 Marks)**

c. For $E = E_m e^{-\alpha z} \cos(wt - \beta z)\ \vec{ax}$ find average power density. Assume free space. **(04 Marks)**

a. Derive expression for transmission co-efficient and Reflection co-efficient for uniform waves at normal incidence. **(08 Marks)**

b. For $n_1 = 100\Omega$, $n_2 = 100\Omega$ and $Ex_1 = 100v/m$ calculate amplitude of incident, reflected and transmitted waves. Also show that average power is conserved. **(10 Marks)**

c. Define SWR. **(02 Marks)**

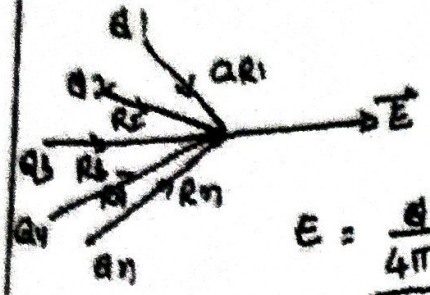
* * * * *

Scheme & Solutions

Signature of Scrutinizer

Subject Title: Field Theory Subject Code: 10EC36

Question Number	Solution	Marks Allocated
1(a)	$\vec{E} = F/Q$ N/C or V/m	



$$\vec{E} = \vec{E}_1 + \vec{E}_2 + \vec{E}_3 + \dots E_n$$

$$E = \frac{Q_1}{4\pi\epsilon_0 R_1^2}\vec{a_{R_1}} + \frac{Q_2}{4\pi\epsilon_0 R_2^2}\vec{a_{R_2}} + \dots \frac{Q_n}{4\pi\epsilon_0 R_n^2}\vec{a_{R_n}}$$

$$\boxed{\vec{E} = \frac{1}{4\pi\epsilon_0}\sum_{i=1}^{n}\frac{Q_i}{R_i^2}\vec{a_{R_i}}}$$

1 + 3 (4)

(b) $$\text{Div}\,\vec{D} = \lim_{\Delta V \to 0}\frac{\oint \vec{D}\cdot d\vec{s}}{\Delta V} = \frac{\partial D_x}{\partial x} + \frac{\partial D_y}{\partial y} + \frac{\partial D_z}{\partial z} \quad -①$$

As per Gauss law

$$\psi = Q = \oint \vec{D}\cdot d\vec{s} \quad -②$$

$$\frac{Q}{\Delta V} = \frac{\oint \vec{D}\cdot d\vec{s}}{\Delta V}$$

$\Delta V \to 0$ volume shrinks to zero

$$\underbrace{\lim_{\Delta V \to 0}\frac{Q}{\Delta V}}_{\rho_v} = \lim_{\Delta V \to 0}\frac{\oint \vec{D}\cdot d\vec{s}}{\Delta V}$$

$$\boxed{\nabla\cdot\vec{D} = \rho_v}$$

4 (4)

(c) $$\vec{D} = z\sin\phi\,\vec{a_\rho} + \rho\sin\phi\,\vec{a_z}$$

$$\nabla\cdot\vec{D} = \rho_v$$

$$\nabla\cdot\vec{D} = \frac{1}{\rho}\frac{\partial}{\partial\rho}(\rho D_\rho) + \frac{1}{\rho}\frac{\partial D_\phi}{\partial\phi} + \frac{\partial D_z}{\partial z}$$

$$= \frac{1}{\rho}\frac{\partial}{\partial\rho}(\rho z\sin\phi) + 0 + \frac{\partial}{\partial z}\rho\sin\phi$$

$$= \frac{1}{\rho}\times 2\sin\phi + 0 \times = \frac{1}{\rho}\times 2\sin\phi = 1$$

$$= 1 \times 2 \times \sin 30 \quad (4)$$

$$\rho_v(1, 30, 2) = 1$$

(4)

$$\int_V (\nabla \cdot \vec{D})\, dv$$

$$\nabla \cdot \vec{D} = \frac{\partial}{\partial x} D_x + \frac{\partial}{\partial y} D_y + \frac{\partial}{\partial z} D_z$$

$$\int_{x=0}^{1} \int_{y=0}^{2} \int_{0}^{3} (\nabla \cdot \vec{D})\, dv \qquad 2y + 0$$

$$\int_{x=0}^{1} \int_{y=0}^{2} \int_{0}^{3} 2y \, dx\, dy\, dz$$

RHS $\boxed{= 12C}$ —— (1) —— 4

front $-\int_{y=0}^{2} \int_{z=0}^{3} 2xy \big|_{x=0} dy\, dz = 0$

back $+\int_{y=0}^{2} \int_{z=0}^{3} -2xy \, dy\, dz = 12C$ —— (2) } 2

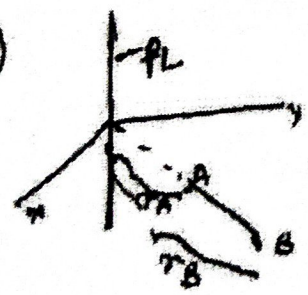
Right $-\int_{z=0}^{1} \int_{z=0}^{3} z^2 \, dx\, dz = -1C$ —— (3) } 2

Left $= \int_{z=0}^{1} \int_{z=0}^{3} z^2 \, dx\, dz = 1C$ —— (4)

Top + Bottom $= 0$ $\qquad 12 - 1 + 1 = 12$ —— (5)

$\boxed{RHS = LHS}$ $\qquad 4+2+2 = 8$

2 (a)



$$V_{AB} = -\int_B^A \vec{E} \cdot dL = -\int_{r_B}^{r_A} \frac{\rho_L}{2\pi\epsilon_0 r} \vec{a_r} \cdot dr\, \vec{a_r}$$

$$= \boxed{\frac{\rho_L}{2\pi\epsilon_0} \ln\left(\frac{r_B}{r_A}\right) V}$$

(04)

$r = 3,\ \theta = 60^\circ\ \phi = 25^\circ$

(b) $V = \dfrac{60 \sin 60}{3^2} = 5.77\,V.$ —— (1)

$$\vec{E} = -\nabla V$$
$$= -\left(\frac{\partial}{\partial r} \vec{a_r} + \frac{1}{r}\frac{\partial V}{\partial \theta} \vec{a_\theta} + \frac{1}{r \sin\theta}\frac{\partial V}{\partial \phi} \vec{a_\phi}\right)$$

(2)

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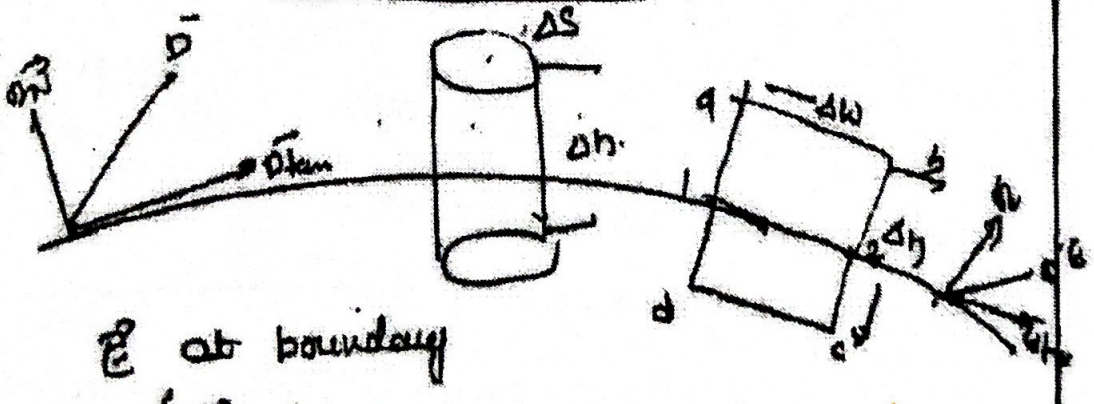
Question Number	Solution	Marks Allocated
	$\vec{E} = -\left[-\frac{120\sin\theta}{r^3} + \frac{1}{r}\frac{60}{r^2}\cos\theta\,\vec{a_\theta}\right]$ — 2	
	$\vec{E}_{(3,60,25)} = \underline{3.849\,\vec{a_r} - 1.111\,\vec{a_\theta}}$ V/m — 1	(4)
(c)	$W_E = \frac{1}{2}\int_V \rho_v V\,dv$ $\quad 1+2+1 =$	(4)
	$\rho_v = \nabla\cdot\vec{D}$	
	$W_E = \frac{1}{2}\int_V (\nabla\cdot\vec{D})V\,dv$	
	$W_E = \frac{1}{2}\int_V (\nabla\cdot V\vec{D} - \vec{D}\cdot\nabla V)\,dv$	
	$W_E = \frac{1}{2}\int_V \nabla\cdot VD - \int_V (\vec{D}\cdot\nabla V)\,dv$ — 2	
	$\frac{1}{2}\int_V (\nabla\cdot V\vec{D})\,dv = \frac{1}{2}\oint (V\vec{D})\cdot d\vec{s}$	
	$W_E = \frac{1}{2}\oint (VD)\cdot ds - \frac{1}{2}\int_V \vec{D}\cdot\nabla V\,dv$	
	$V \propto 1/r \quad D \propto 1/r^2$ first term vanishes	
	$\therefore W_E = -\frac{1}{2}\int_V \vec{D}\cdot\nabla V\,dv$ — (3)	
	$\vec{E} = -\nabla V$	
	$\boxed{\therefore W_E = \frac{1}{2}\int_V \epsilon_0 E^2}\,V$ — 2+3 =	(5)
(d)		
	$\vec{E}$ at boundary	
	$\oint \vec{E}\cdot dL = 0$	
	$E_{tan} = 0$ — (3)	
	$\vec{D}$ at boundary.	
	$\oint_S \vec{D}\cdot ds = 0$	$E_{tan} = D_{tan} = 0$
	$D_N = \rho_s$	$D_N = \rho_s$
	$E_N = \frac{\rho_s}{\epsilon_0}$ — (3)	$E_N = \frac{\rho_s}{\epsilon} = \frac{\rho_s}{\epsilon_0\epsilon_r}$
	3 P.B	(8)

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

A Unit of Alva's Education Foundation (R)
(Affiliated to Visvesvaraya Technological University, Belgaum,
Approved by AICTE, New Delhi & Recognised by Government of Karnataka)
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Email : principalaiet08@gmail.com, Web:www.aiet.org.in

Date : 08/12/2015

To,

The Principal

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Respected Sir,

Sub: - National Level Workshop on "Challenges in Cyber Security & Forensics"

We are pleased to inform you that ***Department Computer Science & ineering, Alva's Institute of Engineering & Technology, Moodbidri,*** has organized a **National Level Workshop** on **"Challenges in Cyber urity & Forensics"** during **18th & 19th, January 2016.**

Main objective of this workshop is to providing an introduction to ting Basics and Routing Protocols used in security systems. Challenges in er Security, Implementation issues of Network Security will be discussed hands-on experience during this workshop.

We request you to encourage PG students and Faculty members of your nization to actively participate in this National Level Workshop.

Thanking You

With regards

[Prof. Manjunath Kotari]

H.O.D.

Dept. Of Computer Science & Engineering
Alva's Institute of Engg. & Technology
Mijar, MOODBIDRI - 574 225

Date 08/12/2015

To,

The Principal

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10ES36

3 (a)

$$\nabla^2 V = \frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2}$$

$$\nabla^2 V = \frac{1}{\rho}\frac{\partial}{\partial \rho}\left(\rho \frac{\partial V}{\partial \rho}\right) + \frac{1}{\rho^2}\left(\frac{\partial^2 V}{\partial \phi^2}\right) + \frac{\partial^2 V}{\partial z^2}$$

$$\nabla^2 V = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 \frac{\partial V}{\partial r}\right) + \frac{1}{r^2 \sin\theta}\frac{\partial}{\partial \theta}\left(\sin\theta \frac{\partial V}{\partial \theta}\right) + \frac{1}{r^2 \sin^2\theta}\frac{\partial^2 V}{\partial \phi^2}$$

(b)

$$\nabla^2 V = \frac{\partial^2}{\partial x^2}(2x^2 - 2y^2 + z^2) + \frac{\partial^2}{\partial y^2}(2x^2 - 2y^2 + z^2) + \frac{\partial^2}{\partial z^2}(2x^2 - 2y^2 + z^2)$$ (2)

$$= \frac{\partial}{\partial x}(4x) + \frac{\partial}{\partial y}(-4y) + \frac{\partial}{\partial z}(2z)$$

$$4 - 4 + 2 = 0$$

$\nabla^2 V = 0$ — Satisfies Laplace Eqn — 4

Step

1. $\nabla^2 V = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r \frac{\partial V}{\partial r}\right) + \frac{1}{r^2}\left(\frac{\partial^2 V}{\partial \phi^2}\right) + \frac{\partial^2 V}{\partial z^2}$
2. $\frac{\partial V}{\partial r} = \sin 4\phi\,[4Ar^3 - 4Br^5]$
3. $r\frac{\partial V}{\partial r} = \sin 4\phi\,[4Ar^4 - 4Br^6]$
4. $\frac{1}{r^2}\frac{\partial}{\partial r}\left[r \frac{\partial V}{\partial r}\right] = \sin 4\phi\,[16Ar^2 + 16Br^4]$
5. $\frac{\partial V}{\partial \phi} = [Ar^4 + Br^6]\,4\cos 4\phi$
6. $\frac{\partial^2 V}{\partial \phi^2} = [Ar^4 + Br^6]\,16[-\sin 4\phi]$
7. $\frac{1}{r^2}\frac{\partial^2 V}{\partial \phi^2} = -\sin 4\phi\,[16Ar^2 + 16Br^4]$

$$\frac{\partial^2 V}{\partial z^2} = 0$$

In question $\sin 4\phi$ is printed instead of $\sin 4\phi$. Hence, full marks to be given if 4 steps are done.

$\nabla^2 V = 0$ Proved Laplace Eqn. — 4

4 + 4 = (8)

(4)

Full marks to be given if 4 steps are correct.

4/1

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A Unit of Alva's Education Foundation (R)
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Date : 08/12/2015

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The Principal

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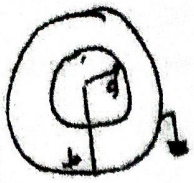
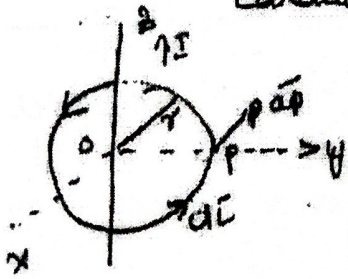
Question Number	Solution	Marks Allocated
(c)	 at $r=b$ $V=0$ outer potential $\nabla^2 V = 0$ $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 \frac{\partial V}{\partial r}\right) = 0$ $1/r^2 \neq 0$ $\partial/\partial r \left(r^2 \frac{\partial V}{\partial r}\right) = 0$. integrate $r^2 \frac{\partial V}{\partial r} = \int 0 + C_1$ $r^2 \frac{\partial V}{\partial r} = C_1$. $\frac{\partial V}{\partial r} = C_1 r^{-2}$ again integrate $V = \frac{-C_1}{r} + C_2$ $\therefore V = \frac{-V_0}{r\left[\frac{1}{b} - \frac{1}{a}\right]} + \frac{V_0}{b\left[\frac{1}{b} - 1/a\right]}$ — (5) $E = -\nabla V$ $C = Q/V$ — (4) $C = \frac{4\pi\epsilon}{\left[\frac{1}{a} - 1/b\right]}$. $5 + 4 =$	(9)
4 (a)	$\vec{H}$ due to infinitely long straight conductor  $H = H_\phi \vec{a_\phi}$ $dL = r\,d\phi\, \vec{a_\phi}$ $\vec{H} \cdot d\vec{L} = H_\phi r\, d\phi$ $\oint \vec{H} \cdot d\vec{L} = I$. $\int_0^{2\pi} H_\phi r\, d\phi = I$. $H_\phi = \frac{I}{2\pi r} \vec{a_\phi}$ A/m (other method is also allowed) (8)	2 2 2 2 2 (8)

5

$\oint \vec{H} \cdot d\vec{L} = I$

Explanation (4) (4)

(2) Stokes theorem.

$\oint_L \vec{H} \cdot d\vec{L} = \int_S (\nabla \times \vec{H}) \, d\vec{S}$

Explanation. (4) (4)

4+4=2

(c) $\vec{A} = x^2 \vec{a_x} + 2yz \, \vec{a_y} + (-x^2) \vec{a_z}$

$B = \nabla \times \vec{A}$

$$\begin{vmatrix} \vec{a_x} & \vec{a_y} & \vec{a_z} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ A_x & A_y & A_z \end{vmatrix} \quad \text{—(2)}$$

$\vec{B} = -2y \, \vec{a_x} + 2x \, \vec{a_y}$ wb/m² —(2)

2+2 = (4)

PART-B

5(a) Derivation

force Exerted on differential Element of charge moving in steady magnetic field

$dF = dq \, \vec{v} \times \vec{B}$ N (1)

$J = \rho_v \vec{v}$

$dq = \rho_v dv$

apply in eqn (1) $dF = \rho dv \, \vec{v} \times \vec{B}$

$dF = J \times B \, dv$ —(3)

$J dv = I dL$

force Exerted on surface current density

$dF = \vec{K} \times \vec{B} \, ds$

with $dF = (I dL \times \vec{B})$

$\boxed{F = \oint I dL \times \vec{B}}$ —(3)

3+3 = 6.

(1)

6/12

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Registrar (Evaluation)
Visvesvaraya Technological University
BELGAUM - 14

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RNSIT, Bengaluru-98

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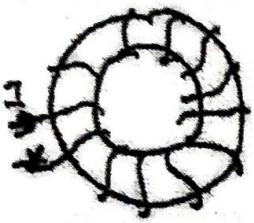
Question Number	Solution	Marks Allocated
(b)	$dH_1 = \frac{I_1 \Delta L_1 \times a_{R12}}{4\pi (R_{12})^2}$	
	$R_{12} = (-1-1)a_z = -2\vec{a_z}$	
	$\lvert R_{12} \rvert = 2, \quad a_{R12} = -\vec{a_z}$	
	$dH_1 = -10^{-5}/16\pi \, a_y$ A/m.	
	flux density at P, — (4)	
	$dB_1 = \mu_0 dH_1$	
	$= -0.25 \times 10^{-12} a_y$ T	
	force Exerted on $I_2 \Delta L_2$ due to $I_1 \Delta L_1$	
	$F_2 = I_2 \Delta L_2 \times dB_1$	
	$= (4.5 a_z - 1.5 \vec{a_z}) 10^{-18}$ N. — (4)	
	4+4 =	(8)
(c)		
	$B = \frac{\mu N I}{2\pi r}$.	
	Total flux linkage = Nφ.	
	Total flux linkage N(B)(A)	
	$= N\left(\frac{\mu N I}{2\pi R}\right)(A)$	
	$= \frac{\mu N^2 I A}{2\pi R}$.	
	$L = \frac{\mu N^2 A}{2\pi R}$ $\quad A = \pi r^2 \, m^2$ — (2)	(2)
(6) (a)	maxwell's Equation from faraday law	
	$\int_S (\nabla \times \vec{E}) ds = -\int_S \frac{\partial \vec{B}}{\partial t} \cdot ds$	
	$\nabla \times \vec{E} = \frac{-\partial \vec{B}}{\partial t}$	
	(2) from Ampere circuit law.	
	$\oint \vec{H} \cdot d\vec{l} = \int_S (J + \frac{\partial \vec{D}}{\partial t}) ds$	
	$\nabla \times \vec{H} = J + \frac{\partial \vec{D}}{\partial t}$	

(iii) from

$$\int_V (\nabla \cdot \vec{D})\, dv = \int \rho_v\, dv$$

$$\nabla \cdot \vec{D} = \rho_v.$$

(iv) from Gauss law for magnetic field

$$\int_c (\nabla \cdot \vec{B})\, ds = 0$$

$$(\nabla \cdot \vec{B}) = 0$$

2+2+2+2 = (8)

(b)

$$\vec{D} = \epsilon_0 \vec{E} \quad \text{—— (1)}$$

$$= E_m \epsilon_0 \sin(\omega t - \beta z)\, \vec{a_y}$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}.$$

$$\nabla \times \vec{E} = \begin{vmatrix} \vec{a_x} & \vec{a_y} & \vec{a_z} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ E_x = 0 & E_y & E_z = 0 \end{vmatrix} \quad \text{—— (2)}$$

$$= -E_m \cos(\omega t - \beta z)(-\beta)\, \vec{a_x}$$

$$-\frac{\partial \vec{B}}{\partial t} = E_m \beta \cos(\omega t - \beta z)\, \vec{a_x}$$

$$B = -E_m \beta \int \cos(\omega t - \beta z)\, \vec{a_x}\, dt$$

$$B = -E_m \beta \frac{\sin(\omega t - \beta z)}{\omega}\, \vec{a_x}$$

$$\vec{B} = \frac{-E_m \beta}{\omega} \sin(\omega t - \beta z)\, \vec{a_x}$$

$$H = \frac{B}{\mu} = \frac{-E_m \beta}{\omega \mu} \sin(\omega t - \text{[illegible]}$$

—(

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(c) $J_D = \frac{\partial D}{\partial t}$ Explanation (2)

(8)

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Associate Professor, Dept. of ECE
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Solution	Marks Allocated
$\nabla \times \vec{H} = J + \frac{\partial \vec{D}}{\partial t}$	
apply $(\nabla \cdot)$ on both side	
$\nabla \cdot (\nabla \times H) = \nabla \cdot (J + \frac{\partial \vec{D}}{\partial t})$	(02)
$0 = \nabla \cdot J + \frac{\partial}{\partial t}(\nabla \cdot \vec{D})$ $\quad \nabla \cdot (\nabla \times H) = 0$	
$\nabla \cdot J = -\frac{\partial \rho_v}{\partial t}$	
$\int_V (\nabla \cdot J) dv = -\frac{\partial}{\partial t} \int_V \rho_v dv = -\frac{dQ_i}{dt}$	(03)
Apply divergence	
$\oint J \cdot ds = -\frac{dQ_i}{dt}$ — 05	(5)
from maxwell's Eqn	
$\nabla \times \vec{E} = -\mu \frac{\partial \vec{H}}{\partial t}$	
$\nabla \times \vec{H} = \sigma \vec{E} + \epsilon \frac{\partial E}{\partial t}$	
$\nabla \cdot B = 0 \quad \nabla \times H = 0$	
$\nabla \cdot \vec{D} = 0 \quad \nabla \cdot E = 0$	
$\nabla \times \vec{E} = -\mu \frac{\partial H}{\partial t}$	
$\nabla \times \nabla \times \vec{E} = -\mu [\nabla \times \frac{\partial H}{\partial t}]$	
Solve	
$\nabla^2 E = \mu\sigma \frac{\partial E}{\partial t} + \mu\epsilon \frac{\partial^2 E}{\partial t^2}$ — (4)	
$\nabla^2 H = \mu\sigma \frac{\partial H}{\partial t} + \mu\epsilon \frac{\partial^2 H}{\partial t^2}$ — (4)	
$4 + 4 =$	(8)
$E_y = E_m e^{j(\omega t - \beta x)}$ V/m.	
the wave travels in x direction	
$\omega = 2\pi \times 10^9$, $\quad E_m = 10.4 \times 10^{-6}$	
(i) $v = c = 3 \times 10^8$ m/s	

$\sqrt{\mu\epsilon\omega}$:

$= 20.958$ radian

(iv) $H_m = \frac{E_m}{\eta_0} = \frac{10.4\times10^{-6}}{377} = 0.0265\times10^{-6}$ A/m

(v) $H_z = H_m e^{j(\omega t - \beta z)}$

$H_z = 0.0265\, e^{j(2\pi\times10^8 t - 20.95 z)}$ A/m.

(c) $E = E_m e^{\alpha z} \cos(\omega t - \beta z)\, \vec{a_x}$ 2 Each $2\times4 =$ 8

$E_s = E_m e^{\alpha z} e^{-j\beta z}\, \vec{a_x}$

$\frac{E_s}{H_s} = \sqrt{\frac{\mu}{\epsilon}} = \eta$

$H_s = \frac{E_s}{\eta}$

$= \frac{E_m e^{\alpha z}}{\eta}$

$= \frac{E_m e^{\alpha z}}{377}$

Direction

$E\times H \propto \vec{a_z}$

$\vec{a_x}\times(\vec{a_y}) \propto \vec{a_z}$

$H_s = \frac{E_m e^{\alpha z}}{377} e^{-j\beta z}\, \vec{a_y}$

$P_{ave} = 1/2\, Re\{E_s \times H_s\}$ 2

$= 1/2\, Re\{E_m e^{\alpha z} e^{-j\beta z}\, \vec{a_x} \times \frac{E_m e^{\alpha z}}{377} e^{j\beta z}\, \vec{a_y}\}$.

$P_{ave} = 1/2\, \frac{E_m^2}{377} e^{2\alpha z}\, a_z$

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APPRO

(i) power density

$P_{1i\,ave} = \frac{1}{2} Re\{ E_1^{-i} \times H_1^{-i} \}$

$= \frac{1}{2} \{ 100 e^{-j\beta_1 z} \vec{a_x} + 1 e^{+j\beta_1 z} a_y \}$

$= \frac{1}{2} \times 100 \vec{a_z}$

$P_{1i\,ave} = 50\ W/m^2$

(iii) $P_{1r\,ave} = \left[\frac{50 \times (-0.5)}{2} \right] = +2.5\ W/m^2$ — (5)

In region 2

$E_{x_2}^{i} = \tau E_{x_1}^{i} = 1.5 \times 100 e^{-j\beta_2 z}$

$H_{y_2}^{i} = \frac{1}{300} \times 1.5 \times 100 e^{-j\beta_2 z}$

$= 0.5 e^{-j\beta_2 z}$

$P_{2\,ave} = \frac{1}{2} \times 1.5 \times 100 \times 0.5$

$= 37.5\ W/m^2$

~~$P_{1i\,av}$~~ Power conservation

$P_{1i\,ave} = P_{1r\,av} + P_{2\,ave}$

$50 = 12.5 + 37.5$ — (5)

5+5 = (10)

(c) Definition + Equation (2) — (2)

APPROVED

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Registrar (Evaluation)
Visvesvaraya Technological University
BELGAUM - 14

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Field Theory

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Three point charges $Q_1 = -1\ \mu c$, $Q_2 = -2\ \mu c$ and $Q_3 = -3\ \mu c$ are placed at the corners of an equilateral triangle of side 1 m. Find the magnitude of the electric field intensity at the point bisecting the joining Q_1 and Q_2. **(07 Marks)**

b. Derive an expression for the electric field intensity due to infinite line charge. **(08 Marks)**

c. Let $\vec{D} = (2y^2z - 8xy)\hat{a}_x + (4xyz - 4x^2)\hat{a}_y + (2xy^2 - 4z)\hat{a}_z$. Determine the total charge within a volume of $10^{-14}\ m^3$ located at P(1, –2, 3). **(05 Marks)**

2 a. Infinite number of charges each of Qnc are placed along x axis at x = 1, 2, 4, 8,.....∞. Find the electric potential and electric field intensity at a point x = 0 due to the all charges. **(06 Marks)**

b. Find the work done in assembling four equal point charges of 1 μc each on x and y axis at ±3m and ±4m respectively. **(06 Marks)**

c. Derive the expression for a capacitance of a parallel plate capacitor. **(08 Marks)**

3 a. Explain Poisson's and Laplace's equations. **(06 Marks)**

b. Find $\vec{E}$ at P(3, 1, 2) for the field of two co-axial conducting cylinders V = 50 V at ρ = 2 m and V = 20 V at ρ = 3m. **(08 Marks)**

c. Using Poisson's equation obtain the expression for the potential in a p-n junction. **(06 Marks)**

4 a. An infinite filament on the z-axis carries 20π mA in the $\hat{a}_z$ direction. Three uniform cylindrical sheets are also present, 400 mA/m at r = 1 cm, - 250 mA/m at r = 2 cm, 400 mA/m at r = 3m. Calculate H_ϕ at r = 0.5, 1.5 and 2.5 cm in cylindrical co-ordinates. **(10 Marks)**

b. If the vector magnetic potential at a point in a space is given as $\vec{A} = 100\rho^{1.5}\hat{a}_z$ wb/m, find the following : (i) $\vec{H}$ (ii) J and show that $\oint \vec{H}.d\vec{c} = I$ for the circular path with ρ = 1. **(10 Marks)**

PART – B

5 a. A conductor 4 m long lies along the y-axis with a current of 10.0 A in the $\hat{a}_y$ direction. Find the force on the conductor if the field in the region is $\vec{B} = 0.005\ \hat{a}_z$ Tesla. **(04 Marks)**

b. Discuss the boundary between two magnetic materials of different permeabilities. **(08 Marks)**

c. A solenoid with air core has 2000 turns and a length of 5000 mm. Core radius is 40 mm. Find its inductance. **(08 Marks)**

Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define electric field intensity ($\vec{E}$). Find an expression for electric field intensity due to N different point charges. **(04 Marks)**

b. Derive Maxwell's first equation in electrostatics. **(04 Marks)**

c. Given $\vec{D} = z\,\text{Sin}\phi\,\vec{ap} + P\,\text{Sin}\,\phi\,\vec{az}$ c/m^2 compute the volume charge density at (1, 30° 2). **(04 Marks)**

d. Verify both sides of Gauss Divergence theorem if $\vec{D} = 2xy\,\vec{ax} + x^2\,\vec{ay}$ c/m^2 present in the region bounded by $0 \le x \le 1$, $0 \le y \le 2$, $0 \le z \le 3$ **(08 Marks)**

2 a. Derive an equation for potential due to infinite line charge. **(04 Marks)**

b. If $U = \dfrac{60\sin\theta}{r^2}$ V find V and $\vec{E}$ at P (3,60,25) **(05 Marks)**

c. Derive an equitation for energy stored in terms of $\vec{E}$ and $\vec{D}$ **(05 Marks)**

d. Derive Boundary conditions for conductor and Dielectric interface. **(06 Marks)**

3 a. Expand ∇^2 operation in different co-ordinate system. **(03 Marks)**

b. Verify that the potential field given below satisfies the Laplace equation **(08 Marks)**

$V = 2x^2 - 3y^2 + z^2$

$V = [Ar^4 + Br^{-4}]\,\text{Sin}\,4P$

c. 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 = Vo at r = a. **(09 Marks)**

4 a. Derive expression for $\vec{H}$ due to straight conductor of finite length. **(08 Marks)**

b. State and explain the following **(08 Marks)**

i) Ampere circuit law

ii) Stokes theorem.

c. Given the vector magnetic potential $\vec{A} = x^2\,\vec{ax} + 2yz\,\vec{ay} + (-x^2)\,\vec{az}$ Find magnetic flux density. **(04 Marks)**

PART – B

5 a. Derive expression for force on a differential current element **(06 Marks)**

b. A current element $I_1\,\Delta L_1 = 10^{-5}\,\vec{az}$ A.m is located at P_1(1, 0, 0) while second element $I_2\,\Delta L_2 = 10^{-5}\,(0.6 \bullet \vec{ax} - 2\,\vec{ay} + 3\,\vec{az})$ A.m is at P_2 (-1, 0,0) both in free space find the vector force exerted on $I_2\,\Delta L_2$ by $I_1\,\Delta L_1$ **(08 Marks)**

c. Derive an equation of inductance of Toroid. **(06 Marks)**

6 a. Derive Maxwell's equations for time varying fields. (05 Marks)

b. $\vec{E} = Em \sin(wt - Bz)\ \vec{ay}$ in free space find $\vec{D}, \vec{B}, \vec{H}$ (02 Marks)

c. Define displacement current density. (05 Marks)

d. Derive continuity equation from Maxwell's equation. (08 Marks)

7 a. Derive General wave equation

b. The uniform plane wave travelling in free space is given by

$Ey = 10.4\ e^{j(2\pi\times10^{9}t-\beta x)}\ \mu v/m$

Find:

i) Direction of wave propagation.

ii) Phase velocity

iii) Phase constant (08 Marks)

iv) Equation for magnetic field

c. For $E = E_m e^{-\alpha z} \cos(wt - \beta z)\ \vec{ax}$ find average power density. Assume free space. (04 Marks)

8 a. Derive expression for transmission co-efficient and Reflection co-efficient for uniform waves at normal incidence. (08 Marks)

b. For $n_1 = 100\Omega$, $n_2 = 100\Omega$ and $Ex_1 = 100v/m$ calculate amplitude of incident, reflected and transmitted waves. Also show that average power is conserved. (10 Marks)

c. Define SWR. (02 Marks)

* * * * *

Field Theory

3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, selecting at least Two full questions from each part.***

PART – A

State and prove Divergence theorem. (06 Marks)

Define: i) Electric field intensity; ii) Electric flux density; iii) Volume charge density. (06 Marks)

Let $\vec{D} = 5r^2\,\hat{a}r$ mc/m^2 for $r \le 0.08$m and $\vec{D} = \frac{.205}{r^2}\hat{a}r$ μc/m^2 for $r \ge 0.08$m. Find ρ_v for i) r = 0.06m ii) r = 0.1m. (08 Marks)

Derive the expression for the energy stored in Electrostatic field using electric field intensity $\vec{E}$. (06 Marks)

A 15-nc point charge is at the origin in free space. Calculate V_1 if point P is located at (2, -3, -1). Also calculate V_1 at P if V = 0 at (6, 5, 4). (08 Marks)

Derive point form of continuity equation. (06 Marks)

Derive Laplace's equations. (05 Marks)

Using Laplace equations, derive the expression for the capacitance of a co-oxial cable. (10 Marks)

Calculate the numerical values for V and ρ_v in free space of $V = \frac{4yz}{x^2+1}$ at p: (1, 2, 3). (05 Marks)

Derive the expression for field at a point P due to an infinitely long filament carrying direct current I. (06 Marks)

Explain scaler and vector Magnetic Potential. (08 Marks)

Calculate the value of vector current density in cylindrical co-ordinates at P. (1.5, 90°, 0.5) if $\vec{H} = \frac{2}{\rho}\cos 0.2\phi\,ap$. (04 Marks)

PART – B

Define: i) Magnetization; ii) Permeability; iii) Torque. (06 Marks)

Obtain the boundary conditions at interface between two magnetic materials. (06 Marks)

Find Magnetization in magnetic material, where: (08 Marks)

i) $\mu = 1.8 \times 10^{-5}$ H/m and H = 120 A/m; ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m^3 and each atoms has a dipole moment of 4.5×10^{-27} A – m^2; iii) B = 300 μT and $X_m = 15$. (08 Marks)

List Maxwell's equations in point form and integral form. (06 Marks)

Let $\mu = 10^{-5}$ H/m, $\epsilon = 4 \times 10^{-9}$ F/m, $\sigma = 0$ and $\rho_v = 0$. Find K so that each of he following pair of fields satisfies Maxwell's equation. (10 Marks)

i) $\vec{D} = \left(6\,\hat{a}_x - 2y\,\hat{a}_y + 2z\,\hat{a}_z\ \text{nc/m}^2\right)$, $\vec{H} = \left(kx\,\hat{a}_x + 10y\,\hat{a}_y - 25z\,\hat{a}_z\right)$ A/m.

ii) $\vec{E} = (20y - kt)\hat{a}x$ v/m, $\vec{H} = (y + 2\times10^{6}t)\,\hat{a}_z$ A/m. (10 Marks)

Write a note on Retarded Potential. (10 Marks)

State and prove Poynting's theorem. (08 Marks)

Discuss the behaviour of good conductor when uniform ϕ line wave propagates through it. (04 Marks)

Discuss the problem of wave reflections from multiple interfaces. (08 Marks)

Define: i) Reflection coefficient; ii) Standing wave Ratios. (08 Marks)

Consider a 50 MHz uniform plane wave having Electric field amplitude 10 v/m. The medium is loss less having $\epsilon_r = \epsilon_{r1} = 9.0$ and $\mu r = 1.0$. The wave propagates in xy plane at 45° axis and is linearly polarized along z. Write the phasor expression for the (08 Marks)

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PART B

a. Obtain the expression of magnetic force between two current elements and hence for current loops. (06 Marks)

b. Find the magnetization in a magnetic material where:

i) $\mu = 1.8 \times 10^{-5}$ (H/m) and H = 120 (A/m).

ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m^3 and each atom has a dipole moment of 4.5×10^{-27} (A/m^2) and

iii) B = 300 (μT) and $\chi_m = 15$. (06 Marks)

c. Define self inductance. Find the same of a solenoid with air core has 2000 turns and a length of 500(mm) core with radius 40 (mm). (08 Marks)

a. Explain transformer and motional induced emfs. (06 Marks)

b. Show that an emf induced in a Faraday's disc generator is $e = -\frac{WBa^2}{2}$ (Volts), where 'W' is the angular velocity in rad/sec, B is the magnetic flux density in Tesla and 'a' is the radius of the disc in metre. (06 Marks)

c. Write the Maxwell's equations in point form for static fields and in integral form for time varying fields. (08 Marks)

a. Discuss the uniform plane wave propagation in a good conducting medium. (06 Marks)

b. The magnetic field intensity of uniform plane wave in air is 20 (A/m) in $\vec{a}_y$ direction. The wave is propagating in the $\vec{a}_z$ direction at an angular frequency of 2×10^9(rad/sec)

Find: i) Phase shift constant; ii) Wavelength;

iii) Frequency and iv) Amplitude of electric field intensity. (06 Marks)

c. A circular wire having a conductivity σ and radius 'a' carrying a direct current I(Amperes). Using Poynting's theorem, determine the net power entering the wire of length l(m). (08 Marks)

a. Derive the expressions for transmission co-efficient and reflection co-efficient. (08 Marks)

b. Define Standing Wave Ratio(S). What value of S results when reflection coefficient= $\pm$ ½? (04 Marks)

c. Given $\Gamma = 0.5$, $\eta_1 = 100$ (Ω), $\eta_2 = 300$ (Ω), $E^i_{x1} = 100$ (v/m). Calculate values for the incident, reflected and transmitted waves. Also show that the average power is conserved. (08 Marks)

USN

Third Semester B.E. Degree Examination, Dec.08/Jan.09
Field Theory

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions by choosing at least Two from each Part.*
2. Any missing data can be assumed.
3. Draw neat diagram wherever necessary.

PART - A

1 a. State Coulomb's law of force between any two point charges and indicate the units of the quantities involved. (06 Marks)

b. Volume charge density, $\rho_v = 0$ for $\rho < 0.01(m)$ and also for $\rho > 0.03(m)$. In the region $0.01 < \rho < 0.03(m)$, $\rho_v = 10^{-8}\cos(50\pi\rho)$ (c/m^3), find electric flux density $\vec{D}$ everywhere. (07 Marks)

c. Evaluate both sides of gauss – divergence theorem for the field $\vec{D}\ 2xyz\vec{a}_x + 3y^2z\vec{a}_y + x\vec{a}_z (c/m^2)$. the region is defined by $-1 \le x, y, z \le 1(m)$. (07 Marks)

2 a. Define electric scalar potential. With usual notations, establish the relationship between electric field intensity and electric scalar potential. (06 Marks)

b. A metallic sphere of radius 0.1(m) has a surface change density of $10(nc/m^2)$. Calculate electric energy stored in the system. Derive the formula employed. (07 Marks)

c. A capacitor has square plates each of side 'a'(m). The plates make an angle θ with each other. Show that for small θ, the capacitance is $C = \frac{\epsilon_o a^2}{d}\left(1 - \frac{a\theta}{2d}\right)(F)$. (07 Marks)

3 a. Derive Poisson's and Laplace's equations. Write laplace's equation in CCS and SCS. (06 Marks)

b. Using laplace's equation, prove that the potential distribution at any point in the region between two concentric cylinders of radii A and B as $V = Vo\frac{\ln\left(\rho/B\right)}{\ln\left(A/B\right)}$ (Volts) (07 Marks)

c. It is known that V = XY is a solution of laplace's equation, where X is a function of x alone and Y is a function y alone. Determine which of the following potential functions are also solutions of laplace's equation i) V = 100X, ii) V = 80XY, iii) V = 3XY + x – 5y. (07 Marks)

4 a. State and explain Biot – savart law. Using this, find the magnetic flux density at the centre of a circular current loop of radius 'a'(m) (07 Marks)

b. Magnetic field intensity in free space is $\vec{H} = 10\rho^2\vec{a}_\phi\left(A/m\right)$ Determine

i) $\vec{J}$

ii) Integrate $\vec{J}$ over the circular surface $\rho = 1(m)$, all ϕ and $z = 0$. (06 Marks)

c. Verify the stoke's theorem for the field $\vec{H}\ 6xy\vec{a}x - 3y2\vec{a}y\left(A/B\right)$ and the rectangular path around the region, $2 \le x \le 5$, $-1 \le y \le 1$, $Z = 0$. Let the positive direction of $\vec{ds}$ be $\vec{a}_z$.

USN

06ES36

Third Semester B.E. Degree Examination, June / July 08
Field Theory

Time: 3 hrs. Max. Marks:100

Note : *Answer FIVE full questions, selecting atleast two question from each part.*

PART - A

1 a. State and explain Coulomb's law in vector form. (04 Marks)

b. Two point charges of magnitudes 2 mc and –7 mc are located at places $P_1(4, 7, -5)$, and $P_2(-3, 2, -9)$ respectively in free space, evaluate the vector force on charge at P_2. (06 Marks)

c. From Gauss Law show that $\nabla.\hat{D} = \rho_v$. (10 Marks)

2 a. Find the potentials at $\gamma_A = 5m$ and $\gamma_B = 15m$ due to a point charge Q = 500 pc placed at the origin. Find the potential at $\gamma_A = 5m$ assuming zero as potential at infinity. Also obtain the potential difference between points A and B. (06 Marks)

b. Derive an expression for the potential of co-axial cable in the dielectric space between inner and outer conductors. (06 Marks)

c. Discuss the boundary conditions between two perfect dielectrics. (08 Marks)

a. State and prove uniqueness theorem. (08 Marks)

b. From the Gauss's law obtain Poisson's and Laplace's equation. (06 Marks)

c. Determine whether or not the following potential fields satisfy Laplace's equation –

i) $V = x^2 - y^2 + z^2$, ii) $V = r\cos\phi + z$. (06 Marks)

4 a. Using Biot – Savart law find an expression for the magnetic field of a straight filamentary conductor carrying current 'I' in the Z – direction. (08 Marks)

b. Given the magnetic field $H = 2r^2(Z+1)\sin\phi\hat{a}_\phi$, verify Stokes theorem for the portion of a cylindrical surface defined by $r = 2$, $\frac{\pi}{4} < \phi < \pi/2$, $1 < Z < 1.5$ and for its perimeter. (08 Marks)

c. With necessary expressions, explain scalar magnetic potential. (04 Marks)

PART - B

5 a. Find the expression for the force on a differential current carrying elements. (06 Marks)

b. Find the normal component of the magnetic field which traverses from medium 1 to medium 2 having $\mu_{r_1} = 2.5$ and $\mu_{r_2} = 4$. Given that $\hat{H} = -30\hat{a}_x + 50\hat{a}_y + 70\hat{a}_z$ v/m. (06 Marks)

c. Derive an expression for the self inductance of a co – axial cable. (08 Marks)

a. For a closed stationary path in space linked with a changing magnetic field prove that $\nabla \times \hat{E} = \frac{-\partial\hat{B}}{\partial t}$, where $\hat{E}$ is the electric field and $\hat{B}$ is the magnetic flux density. (08 Marks)

b. Determine the frequency at which conduction current density and displacement current density are equal in a medium with $a = 2\times10^{-4}$ s/m and $\epsilon_r = 81$. (04 Marks)

c. List the Maxwell's equations in differential and integral form as applied to time varying fields. (08 Marks)

7 a. Starting from Maxwell's equation, derive the wave equation for a uniform plane wave traveling in free space. (08 Marks)

b. A 300 MHz uniform plane wave propagates through fresh water for which $\alpha = 0$, $\mu_r = 1$ $\epsilon_r = 78$. Calculate i) attenuation constant ii) phase constant iii) wave length iv) intrinsic impedance. (06 Marks)

c. Explain the skin depth. Determine the skin depth for copper with conductivity of 58×10^6 s/m at a frequency of 10 MHz. (06 Marks)

8 a. Show that at any instant t, the magnetic and electric field in a reflected wave are out of phase by 90^0. (10 Marks)

b. With necessary expression, explain standing wave ratio (SWR). (10 Marks)

USN

06ES36

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define electric field intensity due to a point charge in vector form. With usual notations, derive the expression for field at a point due to many charges. **(07 Marks)**

b. State and prove divergence theorem. **(05 Marks)**

c. Calculate the divergence of vector D at the points specified using cartesian, cylindrical and spherical coordinates:

i) $D = \frac{1}{z^2}[10xyz.a_x + 5x^2za_y + (2z^3 - 5x^2y)a_z]$ c/m^2 at point P(2, 3, 5)

ii) $D = 5z^2.a_\rho + 10\rho z \,.\, a_z$ at $\rho(3, -45°, 5)$ **(08 Marks)**

2 a. Define electric field and electric potential. With usual notations establish the relationship between electric field intensity and electric potential. **(10 Marks)**

b. With usual notations, derive the boundary conditions for perfect dielectric materials of permitivities $\in_1$ and $\in_2$. **(05 Marks)**

c. Given the potential field $V = 50x^2yz + 20y^2$ volts in free space, find

i) Potential V at P(1, 2, 3)

ii) $|E_p|$ (Magnitude of electric potential)

iii) $\hat{a}_r$ at P. **(05 Marks)**

3 a. With usual notations, deduce the Poisson's equation and Laplace equation from Maxwell's first equation. Express $\nabla^2 V$ in different co-ordinate systems. **(10 Marks)**

b. Given $V = A\ln\left[B\frac{(1-\cos\theta)}{1+\cos\theta}\right]$ volts

i) Show that V satisfies Laplace equation in spherical coordinates.

ii) Find A and B so that V = 100V, |E| = 500 V/m at r = 5mt, $\theta = 90°$ and $\phi = 60°$. **(10 Marks)**

4 a. State and prove the Stroke's theorem. **(06 Marks)**

b. If the vector magnetic potential at a point in a space is given as $A = 100\,\rho^{1.5}a_z$ wb/mt, find the following: i) H ii) J and show that $\oint H.dl = I$ for the circular path with $\rho = 1$. **(06 Marks)**

c. In cylindrical coordinates, a magnetic field is given as $H = [4\rho - 2\rho^2]a_\phi$ A/m, $0 \le \rho \le 1$.

i) Find the current density or a function of ρ within cylinder.

ii) Find the total current that passes through the surface Z = 0 and $0 \le \rho \le 1$ mt in the a_z direction. **(08 Marks)**

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elements.

b. Find the torque vector on a square loop having corners (-2, -2, 0), (2, -2, 0), (2, 2, 0) and (-2, 2, 0) i) about the origin by $B = 0.4a_x T$ ii) About the origin by $B = 0.6a_x - 0.4a_y T$. **(06 Marks)**

c. Determine the mutual inductance between conducting loop and a very long straight wire shown in Fig.5(c). **(08 Marks)**

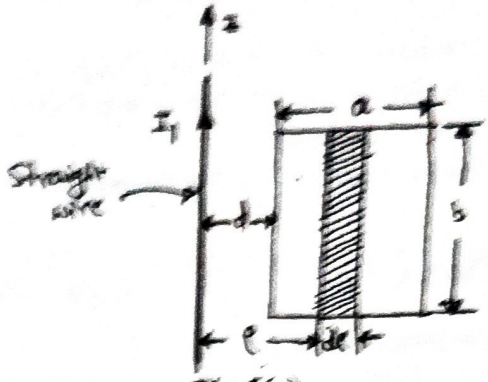


Fig.5(c)

6 a. With usual notations, derive the Maxwell's equation in point form as derived from Faraday's law. Hence show that electric field $E = 2x^3 a_x + 4x^4 a_y$ v/m can not arise from a static distribution of charges. **(08 Marks)**

b. With usual notations, derive the differential form of continuity equation from the Maxwell's equations. **(04 Marks)**

c. The time varying magnetic field in free space is given as $B = \begin{cases} 4\sin\omega t a_z & \rho \le \rho_0 \\ 0 & \rho > 0 \end{cases}$

Determine E using Faraday's law. Verify the same using Maxwell's equations. **(08 Marks)**

7 a. State and explain Poynting theorem. **(04 Marks)**

b. With usual notations, derive the expression for intrinsic impendence for lossy media. **(06 Marks)**

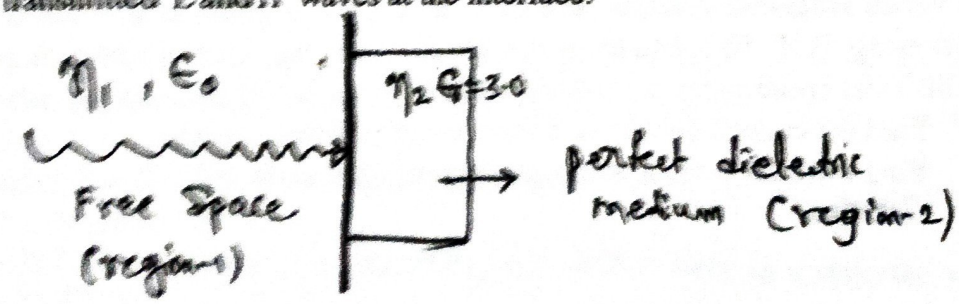
c. The electric field intensity of 300 MHz uniform plane wave in free space is given by $E = (20 + j50)(a_x + 2a_y)e^{-j\beta z}$ V/m. Find

i) ω, λ, u and β ii) E at t = 1 ns z = 10 cm iii) What is $|H|_{max}$? **(10 Marks)**

8 a. Write a short note on standing wave ratio (SWR). **(04 Marks)**

b. With usual notations, derive a general expression for a traveling plane wave. **(06 Marks)**

c. Travelling $\vec{E}$ and $\vec{H}$ waves in the free space (region-1) are normally incident on the interface with a perfect dielectric (region-2) with $\epsilon_r = 3.0$. Compare the magnitude of the incident wave and transmitted $\vec{E}$ and $\vec{H}$ waves at the interface.



(10 Marks)

* * * * *

Alva's Institute of Engineering & Technology

Shobhavana Campus, Mijar, Moodbidri, D.K – 574225
Phone: 08258-262725, Fax: 08258-262726

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

5th SEM Digital Signal Processing Lab -18ECL57 MARKS 22-23(ODD)

USN	NAME	TOTAL	TEST	AVG CIE	SIGNATURE
4AL20EC001	Aishwarya A P	30	16	14	
4AL20EC002	Aishwarya P	34	18	16	
4AL20EC004	Akshay	33	19	14	
4AL20EC005	Akshay Sonar	34	18	16	
4AL20EC006	Aravinda Jogi	37	19	18	
4AL20EC007	Bhavana M	34	18	16	
4AL20EC008	Chaithrashree M G	32	18	14	
4AL20EC010	Chethana.M	37	18	19	
4AL20EC011	Darshan Madival	35	18	17	
4AL20EC012	Disha H	36	18	18	
4AL20EC013	Harshitha D K	37	19	18	
4AL20EC014	Jyoti P	34	18	16	
4AL20EC015	K.Vijay Bhanu	36	19	17	
4AL20EC016	Karthik G Shet	35	18	17	
4AL20EC017	Kishan Kumar	35	18	17	
4AL20EC018	Krathika	33	18	15	
4AL20EC019	Kshama Tc	40	20	20	
4AL20EC020	Libina Lal	38	19	19	
4AL20EC021	Manjunath Sajjan	40	20	20	
4AL20EC023	Mohammed S	40	20	20	
4AL20EC024	Mokshith	40	20	20	
4AL20EC025	Monika. D. B.	27	14	13	
4AL20EC026	Monisha P	28	15	13	
4AL20EC027	Nagarjuna GS	33	18	15	

PROF.VIJETHA

Alva's Institute of Engineering & Technology

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

5th SEM Digital Signal Processing Lab -18ECL57 MARKS 22-23(ODD)

	4AL20EC028	Padala Sattibabu	**30**	16	14	
	4AL20EC029	P V Likhitha	**39**	20	19	
	4AL20EC030	Pavan Kh	**32**	17	15	
	4AL20EC031	Pooja P	**32**	18	14	
	4AL20EC032	Prajaktha Poojary	**38**	19	19	
	4AL20EC033	Prajwal R	**31**	18	13	
	4AL20EC034	Prashanth VK	**27**	15	12	
	4AL20EC035	Pratham Puthran	**35**	18	17	
	4AL20EC036	Prathish G Nayak	**37**	19	18	
	4AL20EC037	Praveen V	**38**	20	18	
5.	4AL20EC038	Preeti G M	**38**	19	19	
6.	4AL20EC039	Rakesh Sangshetty	**27**	13	14	
7.	4AL20EC040	Rakshitha S	**36**	18	18	
38.	4AL20EC041	Ramya K	**35**	18	17	
39.	4AL20EC042	Ranjitha R	**40**	20	20	
40.	4AL20EC043	Rohan H	**30**	18	12	
41.	4AL20EC045	Sangamesh Biradar	**28**	18	10	
42.	4AL20EC046	Sanjay Gk	**32**	18	14	
43.	4AL20EC048	Santhripti C S	**39**	20	19	
44.	4AL20EC049	Shravan V U	**40**	20	20	
45.	4AL20EC050	Shridevi Rao	**39**	20	19	
46.	4AL20EC051	Shruthi	**40**	20	20	
47.	4AL20EC052	Shubhashri S	**36**	18	18	
48.	4AL20EC053	Shwetha	**40**	20	20	
49.	4AL20EC054	Soumya N	**39**	20	19	

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ICS AND COMMUNICATION ENGINEERING

ssing Lab -18ECL57 MARKS 22-23(ODD)

36	18	18	
32	17	15	
37	19	18	
27	15	12	
35	18	17	
31	16	15	
38	19	19	
32	18	14	
31	15	16	

Course Coordinator

Shobhavana Campus, Mijar, Moodbidri, D.K – 574225
Phone: 08258-262725, Fax: 08258-262726

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

5th semester - Academic year 2022-23

II IA AVERAGE MARKS AND ATTENDENCE

USN	FIRST NAME	ME (18ES51)		DSP(18EC52)		PCS(18EC53)		ITC(18EC54)		EM(18EC55)		HDL (18E	
		Marks	Attendence	Marks	Attendence	Marks	Attendence	Marks	Attendence	Marks	Attendence	Marks	A
4AL20EC001	Aishwarya A P	22	85.00%	12	83	14	71.00%	AB	86	12	84	10	
4al20ec002	Aishwarya Panchagavi	21	82.00%	22	80	20	65.00%	27	82	21	75	8	
4AL20EC004	Akshay	22	94.00%	30	93	29	94.00%	30	86	22	98	25	
4AL20EC005	AKSHAY SONAR	25	82.00%	19	83	25	65.00%	28	80	17	91	26	
4AL20EC006	Aravinda Jogi	24	100.00%	27	93	14	100.00%	30	100	24	98	24	
4al20ec007	Bhavana M	24	100.00%	26	95	28	100.00%	25	82	11	88	16	
4AL20EC008	CHAITHRASHREE M G	16	78.00%	28	88	20	53.00%	22	86	12	88	15	
4AL20EC010	Chethana.M	17	82.00%	29	88	20	82.00%	30	95	14	93	23	
4AL20EC011	Darshan Madival	20	82.00%	30	98	26	82.00%	30	93	21	100	19	
4AL20EC012	Disha H	23	100.00%	18	98	27	100.00%	27	82	14	100	18	
4al20ec013	Harshitha D K	22	84.00%	26	90	27	76.00%	25	95	21	95	17	
4AL20EC014	Jyoti Phakkirannanavar	23	82.00%	26	95	29	82.00%	29	95	13	95	15	
4AL20EC015	K.Vijay Bhanu	21	82.00%	20	93	25	71.00%	30	93	15	93	14	
4AL20EC016	KARTHIK G SHET	21	100.00%	30	85	27	100.00%	27	82	6	82	24	
4AL20EC017	Kishan Kumar	20	94.00%	30	90	29	94.00%	30	95	27	95	30	
4AL20EC018	Krathika	25	88.00%	25	90	20	88.00%	30	91	16	91	25	
4AL20EC019	Kshama Tc	24	88.00%	20	93	18	88.00%	23	98	9	93	2	
4AL20EC020	Libina Lal	25	86.00%	30	83	20	82.00%	30	88	25	93	22	
4AL20EC021	MANJUNATH SAJJAN	20	82.00%	30	93	25	76.00%	30	88	26	88	22	
4AL20EC023	Mohammed Sharfuddin	24	82.00%	30	88	27	76.00%	24	93	21	91	30	
4AL20EC024	Mokshith	24	94.00%	30	85	29	94.00%	29	100	24	98	27	
4AL20EC025	Monika. D. B.	24	82.00%	25	78	13	82.00%	12	98	1	86	8	
4AL20EC026	Monisha P	23	75.00%	23	63	15	65.00%	26	86	5	82	20	
4AL20EC027	Nagarjuna GS	19	82.00%	22	71	21	82.00%	26	82	7	86	27	
4al20ec028	PADALA SATTIBABU	25	72.00%	17	68	25	53.00%	25	86	4	80	14	
4AL20EC029	P V Likhitha	25	88.00%	30	98	30	88.00%	30	80	26	100	27	
4AL20EC030	Pavan Kh	23	77.00%	23	78	30	71.00%	26	100	11	82	16	
4AL20EC031	Pooja P	19	94.00%	30	83	28	94.00%	24	82	11	86	5	
4AL20EC032	Prajaktha Poojary	21	82.00%	27	93	28	76.00%	29	98	27	92	5	
4AL20EC033	Prajwal R	23	70.00%	30	44	26	41.00%	24	86	3	34	29	
4AL20EC034	Prashanth VK	22	77.00%	29	90	28	65.00%	28	82	16	93	12	
4AL20EC035	Pratham Puthran	23	77.00%	27	80	27	71.00%	29	86	20	86	15	
4AL20EC036	Prathish G Nayak	26	94.00%	30	85	30	94.00%	30	80	16	82	27	

AL20EC037	Praveen Vishwakarma	24	94.00%	30	80	23	94.00%	25	100	24	98	27	98
AL20EC038	Preeti G M	22	82.00%	30	88	27	82.00%	30	82	23	93	19	95
AL20EC039	Rakesh Sangshetty	22	100.00%	28	88	27	100.00%	29	93	14	93	23	95
AL20EC040	RAKSHITHA S	17	82.00%	23	80	27	82.00%	24	95	13	96	24	95
AL20EC041	Ramya K	26	82.00%	29	95	29	82.00%	30	98	30	95	22	95
AL20EC042	Ranjitha R	25	94.00%	30	90	29	94.00%	30	98	24	100	22	95
20ec043	Rohan H	21	82.00%	25	76	29	82.00%	14	98	5	79	18	90
AL20EC045	Sangamesh Biradar	25	70.00%	29	85	29	53.00%	12	95	6	100	26	90
AL20EC046	Sanjay Gk	22	94.00%	26	83	29	94.00%	28	88	0	93	14	100
AL20EC048	Santhripti C S	24	88.00%	26	90	29	88.00%	23	93	22	95	26	95
AL20EC049	Shravan V Upadhyaya	26	76.00%	30	78	29	76.00%	28	95	13	99	27	90
AL20EC050	Shridevi Rao	20	100.00%	23	93	19	100.00%	26	98	15	99	17	100
AL20EC051	Shruthi	18	94.00%	30	85	28	94.00%	20	98	23	99	25	99
AL20EC052	Shubhashri S	AB	100.00%	AB	83	AB	84	ab	98	AB	95	AB	98
AL20EC053	Shwetha	23	100.00%	30	98	29	100.00%	30	95	23	88	23	99
4AL20EC054	Soumya N	27	82.00%	30	95	29	82.00%	29	88	28	84	15	100
4AL20EC055	spoorthi salaskar	25	100.00%	29	98	28	100.00%	28	84	21	89	12	94
4al20ec056	Srujan S	18	100.00%	28	90	17	100.00%	24	88	17	74	18	49
4AL20EC057	UMESH	24	88.00%	30	95	27	88.00%	27	88	21	95	18	98
4AL20EC058	Varshini K L	26	94.00%	26	78	29	94.00%	30	93	26	86	17	80
4AL20EC059	Veena Talawar	23	82.00%	29	83	28	82.00%	28	100	23	85	19	92
4AL20EC060	VINOD RAJ G N	24	77.00%	25	76	25	71.00%	28	93	2	88	27	86
4AL20EC061	Vinyashree Jain	19	94.00%	30	85	26	94.00%	30	95	23	86	17	92
4AL20EC062	VISHANTH	22	88.00%	23	85	19	88.00%	23	98	12	88	16	92
4AL20EC063	Vishwanath	23	94.00%	29	90	29	94.00%	27	98	8	86	20	96
No. of students present		57		57		56		56		57		57	
No. of students absent		1		1		1		1		1		1	
No. of students who got 0-12		0		1		0		0		18		7	
No. of students who got 13 - 20		12		3		7		0		14		24	
No. of students who got 21-30		45		53		48		56		25		26	
Faculty name		Neeraj S. Rai		Udaya Kumar. S		Mrs. Shwetha MS		Mrs. Bhagyashree K		Mrs. Vijetha TS		Mr. Sudhakara HM	
Faculty sign													

Class co-ordinator

HOD

Academic Coordinator

Principal

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

5th semester - Academic year 2022-23

I IA AVERAGE MARKS AND ATTENDENCE

USN	FIRST NAME	ME (18ES51)		DSP(18EC52)		PCS(18EC53)		ITC(18EC54)		EM(18EC55)		HDL (18EC56)	
		Marks	Attendence	Marks	Attendence	Marks	Attendence	Marks	Attendence	Marks	Attendence	Marks	Attendence
4AL20EC001	Aishwarya A P	18	71.00%	27	70	24	81	21	65	16	81	18	40
4al20cc002	Aishwarya Panchagavi	20	65.00%	30	74	30	70	30	87	12	70	20	[illegible]
4AL20EC004	Akshay	21	94.00%	30	90	28	97	25	96	20	97	30	97
4AL20EC005	AKSHAY SONAR	22	65.00%	24	77	27	89	28	78	16	89	12	89
4AL20EC006	Aravinda Jogi	23	100.00%	30	90	29	97	24	100	17	97	27	97
4al20ec007	Bhavana M	21	100.00%	30	93	28	89	23	91	8	89	28	100
4AL20EC008	CHAITHRASHREE M G	AB	53.00%	AB	83	AB	87	ab	78	AB	87	28	87
4AL20EC010	Chethana.M	22	82.00%	30	83	30	87	26	78	21	87	26	87
4AL20EC011	Darshan Madival	24	82.00%	30	97	29	100	27	78	14	100	29	100
4AL20EC012	Disha H	21	100.00%	30	97	29	100	19	100	5	100	21	97
4al20ec013	Harshitha D K	21	76.00%	27	87	27	95	15	70	14	95	25	94
4AL20EC014	Jyoti Phakkirannanavar	24	82.00%	30	93	28	95	30	78	18	95	29	94
4AL20EC015	K.Vijay Bhanu	16	71.00%	30	90	27	92	25	74	16	92	26	94
4AL20EC016	KARTHIK G SHET	21	100.00%	30	90	30	78	26	87	28	78	22	80
4AL20EC017	Kishan Kumar	23	94.00%	30	87	28	95	30	100	21	95	30	94
4AL20EC018	Krathika	19	88.00%	30	87	27	89	30	91	12	89	27	90
4AL20EC019	Kshama Tc	22	88.00%	30	90	23	92	20	78	8	92	20	90
4AL20EC020	Libina Lal	22	82.00%	30	77	27	92	29	78	20	92	27	93
4AL20EC021	MANJUNATH SAJJAN	24	76.00%	30	90	28	87	27	87	21	87	28	96
4AL20EC023	Mohammed Sharfuddin	24	76.00%	30	83	28	89	30	91	24	89	30	90
4AL20EC024	Mokshith	24	94.00%	30	80	24	98	30	96	24	98	28	97
4AL20EC025	Monika. D. B.	24	82.00%	18	74	24	84	10	61	11	84	22	87
4AL20EC026	Monisha P	25	65.00%	30	60	30	78	20	74	11	78	29	80
4AL20EC027	Nagarjuna GS	22	82.00%	24	63	28	79	23	91	15	79	22	80
4al20ec028	PADALA SATTIBABU	17	53.00%	24	57	27	76	22	39	13	76	19	74
4AL20EC029	P V Likhitha	20	88.00%	30	97	30	100	30	100	30	100	26	100
4AL20EC030	Pavan Kh	22	71.00%	30	74	30	78	22	65	23	78	28	80
4AL20EC031	Pooja P	22	94.00%	30	87	29	84	17	74	23	84	19	87
4AL20EC032	Prajaktha Poojary	20	76.00%	30	90	28	97	21	79	18	97	25	97
4AL20EC033	Prajwal R	15	41.00%	16	24	23	22	22	76	9	22	23	43
4AL20EC034	Prashanth VK	18	65.00%	29	87	30	92	19	70	16	92	26	94
4AL20EC035	Pratham Puthran	22	71.00%	23	74	29	84	17	91	17	84	28	87
4AL20EC036	Prathish G Nayak	26	94.00%	30	80	30	78	26	87	26	78	30	84

4AL20EC039	Rakesh Sangshetty	23	82.00%	30	83	30	92	25	78	26	92	28	94
4AL20EC040	RAKSHITHA S	23	100.00%	30	90	27	92	16	87	8	92	28	94
4AL20EC041	Ramya K	21	82.00%	30	77	28	89	25	74	14	89	9	90
4AL20EC042	Ranjitha R	22	82.00%	30	93	30	95	30	91	22	95	30	97
4al20cc043	Rohan H	23	94.00%	30	90	30	100	30	96	20	100	30	100
4AL20EC045	Sangamesh Biradar	23	82.00%	30	74	27	65	24	57	19	85	25	79
4AL20EC046	Sanjay Gk	24	53.00%	22	83	28	84	30	39	15	84	19	87
4AL20EC048	Sapthripti C S	21	94.00%	30	77	29	84	21	91	12	84	23	87
4AL20EC049	Shravan V Upadhyaya	22	88.00%	25	93	29	100	28	100	9	100	28	100
4AL20EC050	Shridevi Rao	24	76.00%	29	70	29	70	25	87	15	70	30	73
4AL20EC051	Shruthi	16	100.00%	30	93	25	100	25	100	11	100	28	100
4AL20EC052	Shubhashri S	22	94.00%	30	90	29	92	30	74	AB	92	AB	97
4AL20EC053	Shwetha	25	100.00%	28	90	30	95	26	100	25	95	30	97
4AL20EC054	Soumya N	26	100.00%	30	97	30	97	30	100	AB	97	AB	97
4AL20EC055	spoorthi salaskar	24	82.00%	25	97	30	97	28	78	21	97	28	97
4al20ec056	Srujan S	25	100.00%	30	97	30	97	30	96	24	97	27	97
4AL20EC057	UMESH	18	100.00%	30	90	25	95	23	100	15	95	25	94
4AL20EC058	Varshini K L	22	88.00%	30	93	26	86	25	78	22	86	26	90
4AL20EC059	Veena Talawar	24	94.00%	30	70	27	81	30	83	20	81	24	83
4AL20EC060	VINOD RAJ G N	24	82.00%	30	77	29	86	28	74	27	86	26	87
4AL20EC061	Vinyashree Jain	21	71.00%	30	67	30	70	19	65	18	70	30	73
4AL20EC062	VISHANTH	19	94.00%	29	83	25	95	22	78	20	95	29	97
4AL20EC063	Vishwanath	23	88.00%	24	80	27	84	17	87	11	84	22	87
		23	94.00%	30	90	30	89	30	96	18	89	30	96
No. of students present		57		57		57		57		55		56	
No. of students absent		1		1		1		1		3		2	
No. of students who got 0-12		0		0		0		1		13		2	
No. of students who got 13 - 20		12		2		0		8		24		8	
No. of students who got 21-30		45		55		57		48		18		46	
Faculty name		Neeraj S. Rai		Udaya Kumar, S		Mrs. Shwetha MS		Mrs. Bhagyashree K		Mrs. Vijetha TS		Mr. Sudhakara Hill	
Faculty sign													

Class co-ordinator

HOD

Academic Coordinator

Principal

PRINCIPAL

Alva's Institute of Engg. & Technology

Mijar, MOODBIDRI - 574 225, D.K

PROGRAMME OUTCOME & PROGRAMME SPECIFIC OUTCOME ASSESSMENT MATRIX

Alva's Institute of Engineering and Technology, Moodbidri

Department of Computer Science and Engineering

Academic Year:	22-23
Course Name:	ELECTROMAGNETIC WAVES
Course Code:	18EC55
Faculty Name:	VIJETHA T S

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
18EC55.1	2													1	
18EC55.2		2											2		
18EC55.3		2											2		
18EC55.4	2												1		
18EC55.5		2	1				1							2	
18EC55.6															
AVG	2	2	1				1						1.67	1.5	

Key Words (POs)	Apply Knowledge	Solve Problems	Design/ Development of Solution	Conduct Investigations	Use Modern Tools	Engineer and Society	Environment and Sustainability	Professional Ethics	Individual and Team Work	Communicate Effectively	Project Management and Finance	Life-long Learning	PSO 1	PSO 2	PSO 3
18EC55 Direct (X)	1	1	0.5	0	0		0			0	0	0	4.74	0.25	0
18EC55 Indirect (Y	2	2	1	0	0		1			0	0	0	1.67	1.5	0
Attainment Level	1.1	1.1	0.55	0	0		0.1			0	0	0	4.44	0.38	0

PO Attainment Calculation Direct

COs	CO Attainment Grade	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
18EC55.1	1.50	1	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0
18EC55.2	1.50	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
18EC55.3		0	1	0												
18EC55.4	39.50	1	0	0	0	0	0	0	0	0	0	0	0	13.17	0	0
18EC55.5		0	1	0.5												
18EC55.6	57.93	0	0	0				0						0	0	
	Weighted Sum --->	2	3	0.5	0	0	0	0	0	0	0	0	0	14.17	0.5	0
	Max Weight -------->	4	6	1	0	0	0	1	0	0	0	0	0	5	3	0
PO Attainment in percentage	:---------->	50.00	50.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	283.40	16.67	0.00
	PO Attained Grade	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		1	1	0.5	0	0		0			0	0	0	4.74	0.25	0

PO Attainment Calculation Indirect

COs	CO Attainment Grade	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
18EC55.1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0
18EC55.2	3	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0
18EC55.3	3	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0
18EC55.4	3	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0
18EC55.5	3	0	2	1	0	0	0	1	0	0	0	0	0	0	2	0
18EC55.6	0	0	0	0				0						0	0	
	Weighted Sum --->	4	6	1	0	0	0	1	0	0	0	0	0	5	3	0
	Max Weight -------->	4	6	1	0	0	0	1	0	0	0	0	0	5	3	0
PO Attainment in percentage	:---------->	100.00	100.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00
	PO Attained Grade	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		2	2	1	0	0		1			0	0	0	1.67	1.5	0

Faculty Name & Signature:	

HOD Signature:	

COURSE OUTCOMES (COs) ASSESSMENT MATRIX

Alva's Institute of Engineering and Technology, Moodbidri

Department of Computer Science and Engineering

Academic Year:	22-23			CO Attainment Indirect	CO Attainment
Course Name & Course Code	ELECTROMAGNETIC WAVES/18EC55				
Faculty Name:	VIJETHA T S				
CO Attainment - Direct					
Cos	Formative Assessment	Summative Assessment	Total Attainment		
18EC55.1	3	0	1.50	3	1.65
18EC55.2	3	0	1.50	3	1.65
18EC55.3	3	0	1.50	3	1.65
18EC55.4	3	0	1.50	3	1.65
18EC55.5	3	0	1.50	3	1.65
18EC55.6					
Average			1.50		1.65

Faculty Name & Signature:		HOD Signature:	

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(Accredited by NBA)

VISION OF THE INSTITUTE

"Transformative education by pursuing excellence in Engineering and Management through enhancing skills to meet the evolving needs of the community"

MISSION OF THE INSTITUTE

M1: To bestow quality technical education to imbibe knowledge, creativity and ethos to student's community.

M2: To inculcate the best engineering practices through transformative education.

M3: To develop a knowledgeable individual for a dynamic industrial scenario.

M4: To inculcate research, entrepreneurial skills and human values in order to cater the needs of the society.

VISION OF THE DEPARTMENT

"Centre of Excellence to empower the young minds in the field of Electronics and Communication Engineering with research focus and skill development through Transformative Education catering to the needs of the Society."

MISSION OF THE DEPARTMENT

M1: To create Learning Environment to enable the Students for Excellence in the field of Electronics and Communication Engineering.

M2: To Empower the Students with necessary Skills for Solving the Complex Technological Problems.

M3: To Inculcate Research Culture among Teaching-Learning Group by guiding them towards Research Activities to bridge the gap between Industry and Academia.

M4: By Imbibing the Students with Human Values and Ethics through Transformative Education and make them Socially Responsible Professionals.

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY
(Unit of Alva's Education Foundation (R), Moodbidri)
Affiliated to Visvesvaraya Technological University, Belagavi& Approved by AICTE, New Delhi.
Recognized by Government of Karnataka.
Accredited by NAAC with A+ Grade
Shobhavana Campus, MIJAR-574225, Moodbidri, D.K., Karnataka

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(Accredited by NBA)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Apply Mathematical, Scientific and Engineering skills for solving problems in the area of Electronics and Communication Engineering.

PEO2: Expose to Emerging Technologies and excel in Industries/Higher studies/research.

PEO3: Apply analytical skills in the area of Electronics and Communication Engineering to become competent and Employable.

PEO4: Inculcate professional ethics, human values, team work for solving engineering problems and contribute to societal needs.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Understand and apply the principles of Electronics and Communication Engineering in various domains of Analog and Digital systems.

PSO2: Design and implement systems using the concepts of Electronics, signal processing, Embedded systems and Semiconductor Technology.

PSO3: Apply modern hardware and software tools to analyze and solve engineerin