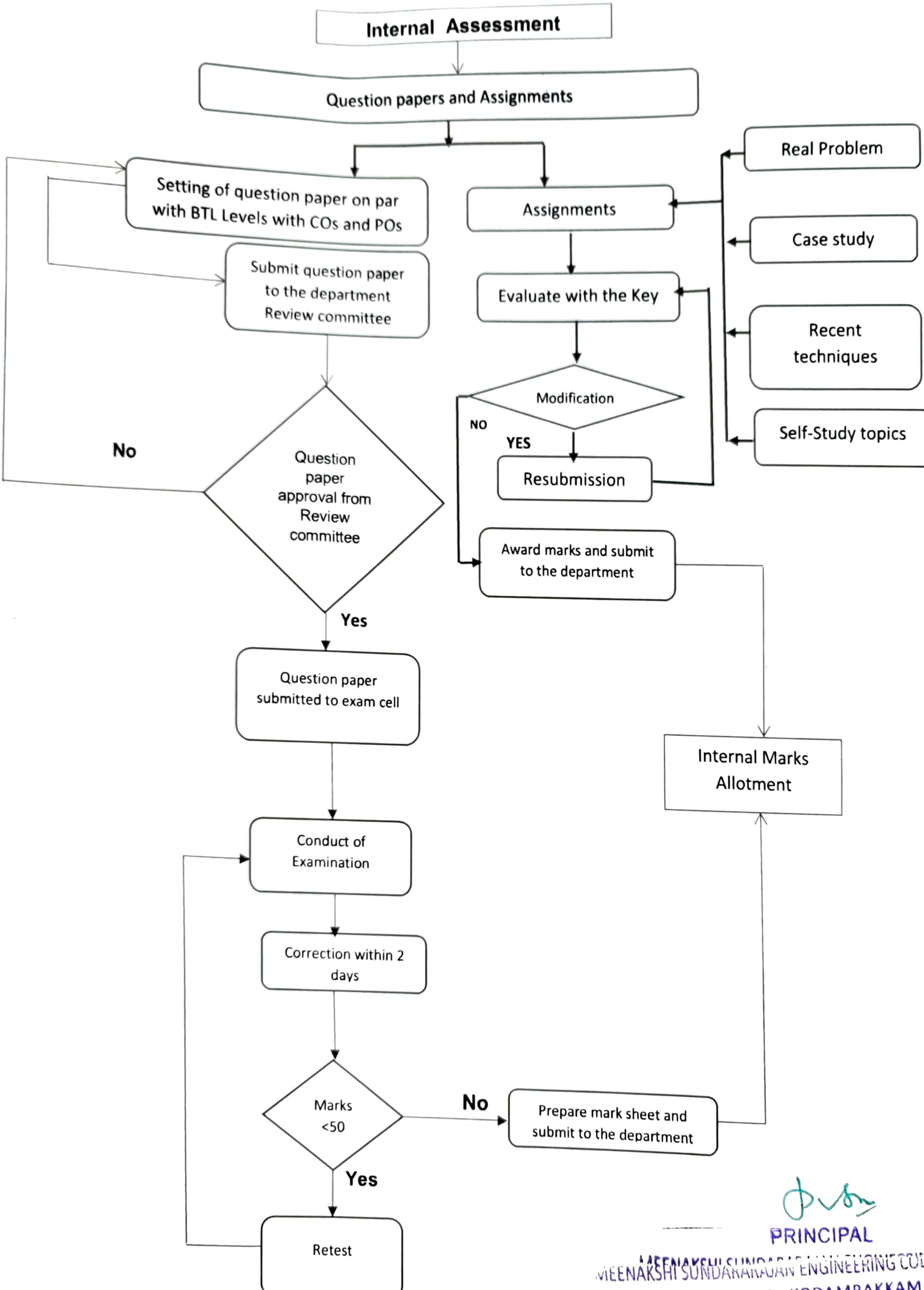
MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE

363, Arcot Road, Kodambakkam, Chennai – 24
Approved by AICTE & Affiliated to Anna University
email Id: principal@msec.edu.in
Website : www.msec.edu.in

INDEX



PRINCIPAL
MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE
363, ARCOT ROAD, KODAMBAKKAM,
CHENNAI-600 024

MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE, KODAMBAKKAM, CHENNAI – 600024

LIST OF EXPERIMENTS

DEPT. : EEE

SUBJECT NAME : EE6511 Control & Instrumentation lab

Expt. No	Experiment Title
1	Analog Simulation Of Type 0 & Type 1 Systems
2	AC Position Control System
3	DC Position Control System
4	Transfer Function of DC Generator
5	Transfer Function of DC Motor
6	Stability Analysis of Linear Systems
7	Digital Simulation of Linear First Order System
8	Digital Simulation of Linear Second Order System
9	Design of lead, lag & lead lag Compensators
10	Synchro Transmitter - Receiver characteristics

A – Attended C – Completed

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(STUDENTS' PRACTICAL WORK)

DEPT. : EEE

SUBJECT NAME : EE6511 Control & Instrumentation Lab

Group No	Name of Student	1 A	1 C	2 A	2 C	3 A	3 C	4 A	4 C	5 A	5 C	6 A	6 C	7 A	7 C	8 A	8 C	9 A	9 C	10 A	10 C
	Adithya. M	4/8	28/8	4/7	17/7	4/7	17/7	5/9	11/10	15/9	11/10	12/9	11/10	29/8	11/10	29/8	15/10	22/9	15/10	22/9	11/10
	Akshaya. P	4/8	28/8	4/7	17/7	4/7	24/7	15/9	4/10	15/9	4/10	22/9	4/10	29/8	30/8	29/8	4/10	22/9	4/10	22/9	4/10
	Almas. A	4/8	28/8	4/9	17/7	4/9	24/7	11/9	4/10	11/9	4/10	24/9	4/10	29/8	4/10	29/8	4/10	22/9	4/10	22/9	4/10
	Amirthavarshini. R	29/8	5/10	4/8	11/8	18/7	18/7	1/9	5/10	1/9	5/10	27/9	5/10	4/7	11/8	22/9	5/10	4/8	29/8	22/9	5/10
	Anashwitha A B	29/8	5/10	4/8	11/8	18/7	11/8	1/9	5/10	1/9	4/10	22/9	4/10	4/7	11/8	22/9	5/10	4/8	13/8	22/9	4/10
	Arun Karthik. P	29/8	5/10	4/8	10/8	18/7	10/8	22/9	4/10	22/9	4/10	22/9	4/10	4/7	10/8	22/9	4/10	4/8	13/8	22/9	4/10
	Ashwin Kumar. B	4/7	28/7	4/9	19/9	5/9	19/9	29/8	4/10	29/8	4/10	22/9	4/10	22/9	4/10	22/9	4/10	22/9	4/10	22/9	4/10
	Azar Mohammed. J	4/7	28/8	5/9	22/9	5/9	22/9	29/8	19/9	29/8	19/9	24/9	4/10	22/9	4/10	22/9	4/10	5/9	4/10	22/9	4/10
	Badrinathan. N	4/7	28/7	4/8	9/8	14/9	24/9	29/8	8/9	29/8	8/9	22/9	4/10	22/9	4/10	22/9	4/10	4/8	6/8	14/9	26/9
	Balaji G. S	4/8	18/8	4/7	6/7	4/7	6/7	29/8	19/9	29/8	19/9	24/9	4/10	24/9	8/10	24/9	8/10	29/8	3/10	22/9	3/10
	Balaji. S	4/8	28/8	4/7	17/7	4/7	17/7	29/8	6/9	29/8	6/9	24/09	4/10	24/09	4/10	24/09	4/10	29/8	4/10	22/9	4/10
	Dinesh Raja	4/8	24/8	4/7	17/7	4/7	17/7	29/8	24/9	29/8	24/9	24/9	8/10	24/9	9/10	24/9	8/10	24/9	22/9	24/9	8/10
	Divya. P	1/9	4/10	18/7	11/8	4/8	11/8	1/9	1/9	1/9	4/10	22/9	4/10	4/7	28/8	22/9	4/10	29/8	4/10	22/9	4/10
	Gomathi N	1/9	2/9	18/7	10/8	4/8	10/8	1/9	25/9	1/9	24/9	22/9	24/9	4/7	10/8	22/9	24/9	29/8	20/9	22/9	24/9
	Guru Prasadh. T R	1/9	4/10	18/7	10/8	4/8	10/8	[illegible]	1/9	1/9	4/10	22/9	4/10	4/7	10/8	22/9	4/10	29/8	4/10	22/9	4/10

(A-Attended) (C- Completed)

07/09/21

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(STUDENTS' PRACTICAL WORK)

DEPT. : EEE **SUBJECT NAME :** EE6511 Control & Instrumentation Lab

Group No	Name of Student	(A-Attended) Analog 1		AC 2		DC 3		TF DC Gen 4		EXPERIMENT NO 5		Stability 6		First order 7		Second order 8		(C- Completed) Lead lag 9		10 Synchro	
		A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C
	Jeyavardhany . P	11/7	4/9	11/7	23/7	11/7	23/7	22/8	4/9	22/8	25/9	22/8	25/9	5/9	25/9	5/9	25/9	5/9	25/9	5/9	25/9
	Keerthana . S	11/7	4/9	11/7	[illegible]	11/7	11/7	22/8	4/9	22/8	8/10	22/8	8/10	5/9	8/10	5/9	8/10	5/9	8/10	5/9	8/10
	Krishnamurthy . M	[illegible]	4/9	11/7	24/7	11/7	24/7	22/8	4/9	22/8	25/9	22/8	28/9	5/9	28/9	5/9	4/10	5/9	4/10	5/9	25/9
	Madhu Kumarappan	5/9	22/9	11/7	12/7	11/7	12/7	5/9	22/9	22/8	[illegible]	22/9	4/10	22/8	27/8	22/8	[illegible]	25/7	[illegible]	[illegible]	[illegible]
	Mahanya	5/9	4/10	11/7	[illegible]	11/7	1/8	5/9	4/10	22/9	4/10	13/9	4/10	22/8	13/9	22/8	4/10	25/7	[illegible]	13/9	4/10
	Mithun Raj . R	5/9	13/10	11/7	[illegible]	11/7	[illegible]	5/9	13/10	5/9	13/10	22/9	13/10	22/8	1/9	22/9	13/10	25/7	14/8	15/7	13/10
	Muthu Mano	11/7	4/8	25/7	4/8	25/7	4/8	22/8	4/9	21/9	4/10	22/9	4/10	5/9	4/10	5/9	4/10	22/9	4/10	22/9	4/10
	Padma Bhushan	11/7	30/7	25/7	30/7	25/7	7/8	22/8	4/9	24/9	8/10	22/9	8/10	5/9	8/10	5/9	8/10	22/9	8/10	22/9	8/10
	Pavithra N D	11/7	28/7	25/7	28/7	26/7	28/7	28/8	28/8	22/9	29/9	22/9	4/10	5/9	19/9	5/9	4/10	[illegible]	19/9	[illegible]	25/9
	Pooja	11/7	1/8	25/7	[illegible]	25/7	[illegible]	22/8	4/9	22/8	8/10	22/9	8/10	5/9	8/10	5/9	8/10	[illegible]	8/10	[illegible]	8/10
	Rahul . M	5/9	9/10	25/7	10/8	25/7	10/8	5/9	9/10	11/9	9/10	28/9	9/10	11/7	25/8	28/9	9/10	22/8	[illegible]	[illegible]	9/10
	Rahul . S	5/9	9/10	25/7	27/7	25/7	27/7	5/9	9/10	[illegible]	9/10	22/9	9/10	11/7	9/10	[illegible]	9/10	11/9	9/10	[illegible]	9/10
	Raj Surya . R	[illegible]	15/10	25/7	13/8	25/7	13/8	5/9	15/10	[illegible]	15/10	[illegible]	15/10	[illegible]	25/8	[illegible]	15/10	22/8	4/9	[illegible]	15/10
	Ramya . M	[illegible]	[illegible]	25/7	25/7	25/7	[illegible]	5/9	[illegible]	[illegible]	22/9	22/9	28/9	[illegible]	21/8	[illegible]	28/9	22/8	4/9	[illegible]	28/9

[illegible] 07/09/18

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(STUDENTS' PRACTICAL WORK)

DEPT. : EEE **SUBJECT NAME :** EE6511 Control & Instrumentation Lab

Group No	Name of Student	1 A	1 C	2 AC A	2 AC C	3 DC A	3 DC C	4 A	4 C	5 M A	5 M C	6 A	6 C	7 A	7 C	8 A	8 C	9 C A	9 C C	10 S A	10 S C
✓	Vanitha. V	11/8	4/9	21/7	9/8	21/7	9/8	15/9	15/10	15/9	15/10	22/9	18/10	7/7	4/9	22/9	15/10	27/8	4/9	27/8	4/9
✓	Varalakshmi. G ✓	11/8	27/8	21/7	4/8	21/7	4/8	15/9	1/10	15/9	1/10	22/9	1/10	7/7	3/8	22/9	1/10	27/8	3/8	27/8	3/8
	Venkat Anamika ✓	11/8	29/8	21/7	10/8	21/7	10/8	15/9	[illegible]	15/9	15/10	22/7		7/7	[illegible]	22/9	[illegible]	27/8	6/9	27/8	6/9
✓	Vignesh	27/8	1/5	21/7		21/7		22/5		22/5		22/5		7/7						22/5	
	Vinith Raja	27/8	1/5	21/7		21/7		22/5		22/5		22/5		7/7						22/5	
	Vishwanath	27/8	1/5	21/7		21/7		22/5		22/5		22/5		7/7						22/5	
	Yuvachandra Kumar ✓	7/7	15/8	7/7	7/7	7/7	15/8	22/5	15/8	22/5	15/8	22/5	15/8	27/8	15/10	22/9	15/10	22/9	19/10	22/5	15/10
✓	Ranjith ✓	29/8	15/10	7/7	7/7	7/7	21/7	22/5	15/9	22/5	15/9	22/5	15/10	11/.	15/10	11/8	15/10	29/9	15/10	22/5	15/10
✓	Rathna Raj ✓	29/8	11/5	7/7	7/7	7/7	21/7	15/9	8/10	15/5	8/10	22/5	8/10	11/.	22/8	22/8	8/10	22/9	8/10	22/9	8/10
✓	Sangeetha ✓	29/8	30/1	7/7	7/7	7/7	27/7	15/5	8/10	15/5	8/10	22/5	8/10	11/.	27/8	29/8	8/10	22/9	8/10	22/9	8/10
✓	Sasi Kumar ✓	11/8	8/9	7/7	6/8	7/7	6/8	15/5	4/10	15/5	4/10	22/9	4/10	27/8	4/10	27/8	4/10	22/5	4/10	22/9	4/10
✓	Vivek ✓	11/8	31/8	7/7	6/8	7/7	6/8	15/5	9/10	15/5	9/10	22/5	9/10	27/8	9/10	27/8	9/10	22/9	9/10	22/5	9/10
✓	Subhiksha ✓	11/8	30/8	7/7	11/8	7/7	11/8	15/5	4/10	15/5	4/10	22/5	4/10	27/8	4/10	27/8	4/10	22/9	4/10	22/9	4/10
✓	Swetha ✓	11/8	29/8	7/7	10/8	7/18	10/8	15/5	4/10	15/5	4/10	22/5	4/10	27/8	4/10	27/8	4/10	22/9	6/10	22/9	4/10

(A-Attended) (C- Completed)

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(STUDENTS' PRACTICAL WORK)

DEPT. : EEE

SUBJECT NAME : EE6511 Control & Instrumentation Lab

Group No	Name of Student	1 A	1 C	2 AC A	2 AC C	3 DC A	3 DC C	4 A	4 C	5 A	5 C	6 A	6 C	7 A	7 C	8 A	8 C	9 A	9 C	10 A	10 C
✓	Ramyalakshmi. S ✓	28/7	27/8	14/7	7/8	14/7	7/8	1/9	5/10	18/8	27/8	17/9	5/10	27/6	27/8	1/9	5/10	11/7	14/7	10/9	5/10
✓	Rebin D ✓	28/7	17/9	14/7	27/7	14/7	27/7	22/9	13/10	18/8	17/9	22/9	13/10	27/6	13/10	[illegible]	13/10	11/7	28/7	1/9	13/10
✓	Sandhya Mohan ✓	28/7	10/8	14/7	27/7	14/7	27/7	1/9	14/9	18/8	20/8	10/9	24/9	27/6	20/8	1/9	24/9	11/7	14/7	11/9	24/9
✓	Sanjana ✓	28/7	14/8	14/7	27/7	14/7	27/7	1/9	20/9	18/8	21/8	22/9	24/9	27/6	20/8	1/9	[illegible]	21/9	3/9	1/9	24/9
	Sanjay kumar ✓	28/7	14/8	14/7	1/9	14/7	1/9		13/10	1/9	13/10		13/10	27/6	1/9		13/10	11/7	1/9		4/10
✓	Sankar ✓	28/7	6/9	14/7	27/7	14/7	27/7	18/8	6/9	1/9	4/10	22/9	4/10	27/6	4/10	22/9	4/10	11/7	14/7	1/9	4/10
✓	Santhosh ✓	28/8	1/9	11/7	11/8	28/7	11/8	01/9	12/10	22/9	12/10	22/8	12/10	27/6	1/9	1/8	12/10	14/7	1/9	22/8	12/10
✓	Sasirekha ✓	28/6	31/8	11/7	14/7	28/7	31/7	01/9	1/9	23/9	4/10	[illegible]	4/10	27/6	31/8	1/9	4/10	[illegible]	2/7	20/9	4/10
✓	Shwetha ✓	28/8	1/9	11/7	7/8	28/7	11/8	01/9	1/9	22/9	4/10	20/9	4/10	27/6	1/9	1/8	4/10	14/7	14/8	1/8	4/10
✓	Sivarama Krishnan ✓	14/7	27/7	14/7	27/7	14/7	27/7	22/9	13/10	01/9	13/10	22/9	13/10	11/7	28/8	18/8	13/10	28/7	28/8	22/9	13/10
✓	Sowmiya. M ✓	14/7	10/8	27/6	11/7	27/6	11/7	22/9	4/10	01/9	4/10	2/9	4/10	11/7	25/8	18/8	1/9	28/7	25/8	[illegible]	4/10
✓	Sri Ratchanya. K ✓	14/7	27/7	27/6	11/7	27/6	11/7	22/9	25/9	01/9	25/9	1/9	26/9	11/7	[illegible]	18/8	28/8	28/7	18/8	2/9	25/9
✓	Sulthana Parveen ✓	14/7	27/8	27/6	11/7	27/6	11/7	22/9	4/10	22/9	4/10	22/9	4/10	11/7	27/8	18/8	1/9	28/7	25/8	22/9	4/10
✓	Surendran ✓	14/7	30/8	27/6	12/7	27/6	12/7	22/9	14/10	22/9	14/10	22/9	14/10	11/7	30/8	22/9	14/10	28/7	30/8	22/9	14/10
	Thirunavukkarasu	14/7	25/8	27/6	17/7	27/6	17/7	22/9	4/10	22/9	4/10	22/9	4/10	11/7	22/9	1/9	4/10	28/8	22/9	22/9	4/10

(A-Attended) (C-Completed)

07/09/18

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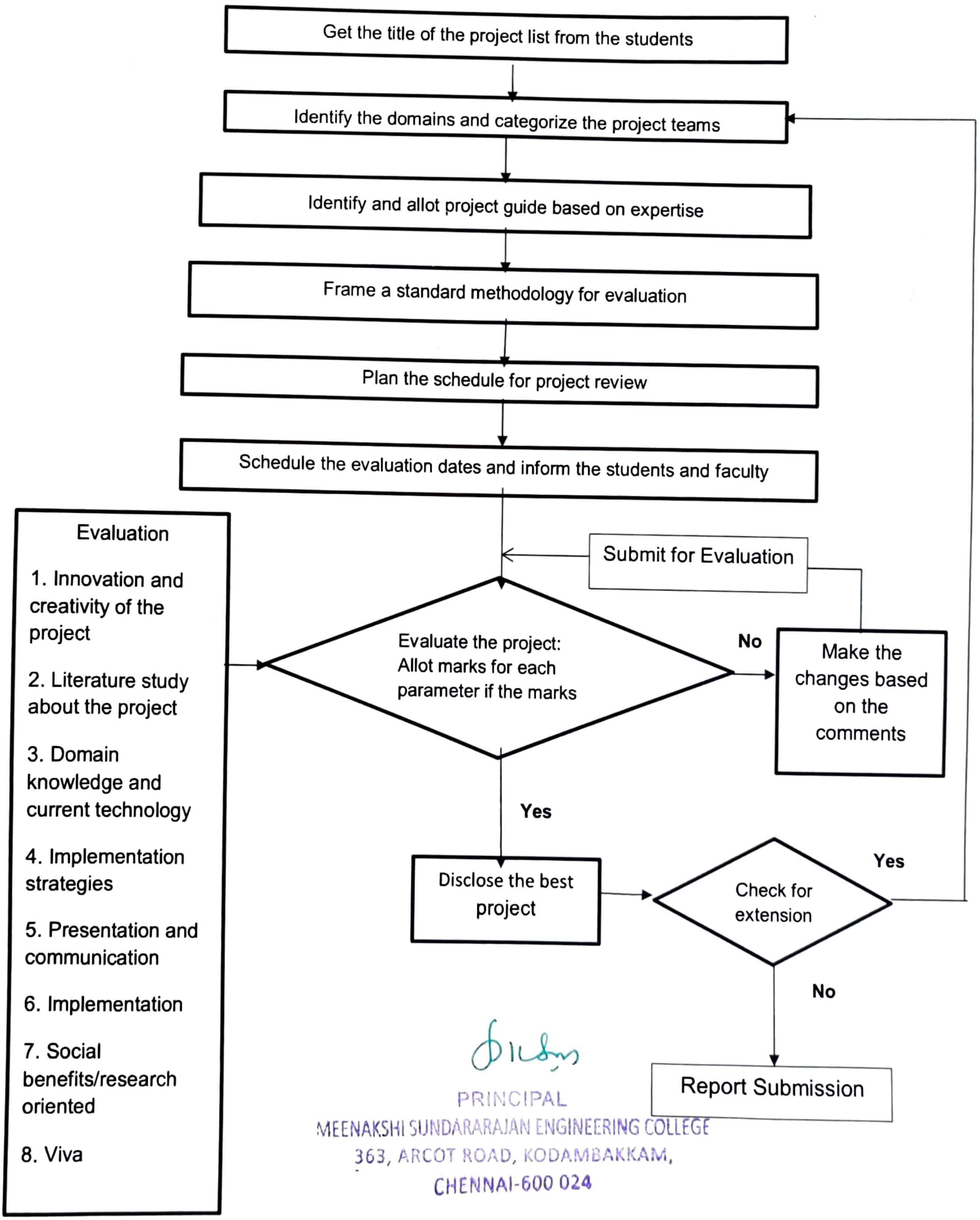
PROJECT IDENTIFICATION, ALLOTMENT MONITORING AND EVALUATION PROCESS



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DEPARTMENT OF EEE

PROJECT REVIEW

NAME : Arul selvan, Surendran, Yogesh

TITLE : Driver fatigue detection and accident prevention using eye blink sensor

INTERNAL GUIDE : Gayatri. G

EXTERNAL GUIDE : Prabhakar

COMPANY/ INDUSTRY NAME : Srinivasa Engineering projects, PVT. LTD

REVIEW	DATE	REMARKS	PROGRESS EXPECTED	INTERNAL GUIDE SIGN
Zeroth Review	5/1/18	Title finalised	Block diagram Explanation to be given	G. Gayat
First Review	19/1/18	Block diagram to be changed	IR sensor complete working to be given	G. Gayat
Second Review	3/2/17	Coding given	Detailed Explanation of coding to be presented properly. OP	G. Gayat
Third Review	1/3/17	O/p hardware photos & working video shown	Report to be given properly	G. Gayat

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MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE

DEPARTMENT OF EEE

PROJECT REVIEW

NAME : 1. ARAVINDKUMAR. K.M 2. ARUN KUMAR R 3. VIKRAMAN B.

TITLE : GENERATOR CONTROL USING WEB SERVER SYSTEM

INTERNAL GUIDE : HARITHA

EXTERNAL GUIDE : B. VINAYAGAM (ASSISTANT ENGINEER C&I)

COMPANY/ INDUSTRY NAME : NORTH CHENNAI THERMAL POWER STATION STAGE-II

REVIEW	DATE	REMARKS	PROGRESS EXPECTED	INTERNAL GUIDE SIGN
Zeroth Review	15/12/17	Redo	Exact Circuit Diagram.	[signature]
First Review	5/1/18	Block Diagram to be changed	Detailed explanation of Circuit Diagram	[signature]
Second Review	3/2/18	Coding partially done	Simulation need improvement.	[signature]
Third Review	1/3/18	explained Coding.	Report and model	[signature]

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MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE
ACADEMIC CALENDER 2019-2020 EVEN SEMESTER

December 2019			
Date	Days	Particulars	
1	Sunday	Holiday	
2	Monday		
3	Tuesday		
4	Wednesday		
5	Thursday		
6	Friday		
7	Saturday		
8	Sunday	Holiday	
9	Monday		
10	Tuesday		
11	Wednesday		
12	Thursday	College Reopening II,IV,VI,VIII Semester	
13	Friday		
14	Saturday		
15	Sunday	Holiday	
16	Monday		
17	Tuesday		
18	Wednesday		
19	Thursday		
20	Friday		
21	Saturday		
22	Sunday	Holiday	
23	Monday		
24	Tuesday		
25	Wednesday	Holiday- Christmas	
26	Thursday		
27	Friday		
28	Saturday		
29	Sunday	Holiday	
30	Monday		
31	Tuesday		

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MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE
ACADEMIC CALENDER 2019-2020 EVEN SEMESTER

January - 2020

Date	Days	Event	
1	Wednesday	Holiday - New Year	
2	Thursday		
3	Friday		
4	Saturday		
5	Sunday	Holiday	
6	Monday		
7	Tuesday		
8	Wednesday		
9	Thursday		
10	Friday		
11	Saturday		
12	Sunday	Holiday	
13	Monday		
14	Tuesday		
15	Wednesday	Holiday- Pongal	
16	Thursday	Thiruvalluvar Day	
17	Friday		
18	Saturday		
19	Sunday	Holiday	
20	Monday		
21	Tuesday		
22	Wednesday		
23	Thursday		
24	Friday		
25	Saturday		
26	Sunday	Holiday - Republic Day	
27	Monday		
28	Tuesday		
29	Wednesday		
30	Thursday	IAT 1 - II YEAR/III YEAR/IV YEAR	
31	Friday	IAT 1 - II YEAR/III YEAR/IV YEAR	

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MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE
ACADEMIC CALENDER 2019-2020 EVEN SEMESTER

February - 2020			
Date	Days	Event	
1	Saturday	IAT 1 - II YEAR/III YEAR/IV YEAR	
2	Sunday	Holiday	
3	Monday	IAT 1 - II YEAR/III YEAR/IV YEAR	
4	Tuesday	IAT 1 - II YEAR/III YEAR	
5	Wednesday	IAT 1 - II YEAR/III YEAR	
6	Thursday		
7	Friday		
8	Saturday		
9	Sunday	Holiday	
10	Monday		
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28	Friday		
29	Saturday		

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MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE
ACADEMIC CALENDER 2019-2020 EVEN SEMESTER

March - 2020			
Date	Days	Event	
1	Sunday	Holiday	
2	Monday		
3	Tuesday	IAT2-II YEAR/III YEAR	
4	Wednesday	IAT2-II YEAR/III YEAR	
5	Thursday	IAT2-II YEAR/III YEAR/IV YEAR	
6	Friday	IAT2-IV YEAR	
7	Saturday		
8	Sunday	Holiday	
9	Monday		
10	Tuesday	IAT3-II YEAR/III YEAR	
11	Wednesday	IAT3-II YEAR/III YEAR	
12	Thursday	IAT3-II YEAR/III YEAR/IV YEAR	
13	Friday	IAT3-IV YEAR	
14	Saturday		
15	Sunday	Holiday	
16	Monday		
17	Tuesday		
18	Wednesday		
19	Thursday		
20	Friday		
21	Saturday		
22	Sunday	Holiday	
23	Monday	Model Exam - II YEAR/III YEAR	
24	Tuesday	Model Exam - II YEAR/III YEAR	
25	Wednesday	Model Exam - II YEAR/III YEAR	
26	Thursday	Model Exam - II YEAR/III YEAR/IV YEAR	
27	Friday	Model Exam - II YEAR/III YEAR/IV YEAR	
28	Saturday	Model Exam - II YEAR/III YEAR/IV YEAR	
29	Sunday	Holiday	
30	Monday	Model Exam - IV YEAR	
31	Tuesday		

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ACADEMIC CALENDER 2019-2020 EVEN SEMESTER

April - 2020			
Date	Days	Event	
1	Wednesday		
2	Thursday		
3	Friday		
4	Saturday		
5	Sunday	Holiday	
6	Monday		
7	Tuesday		
8	Wednesday		
9	Thursday		
10	Friday	Good Friday - Holiday	
11	Saturday		
12	Sunday	Holiday	
13	Monday		
14	Tuesday	Tamil New Year - Holiday	
15	Wednesday		
16	Thursday		
17	Friday		
18	Saturday		
19	Sunday	Holiday	
20	Monday		
21	Tuesday		
22	Wednesday		
23	Thursday		
24	Friday		
25	Saturday		
26	Sunday	Holiday	
27	Monday		
28	Tuesday		
29	Wednesday		
30	Thursday		

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ACADEMIC CALENDER 2019-2020 EVEN SEMESTER

May - 2020			
Date	Days	Event	
1	Friday	Holiday - May Day	
2	Saturday		
3	Sunday	Holiday	
4	Monday		
5	Tuesday	Holiday	
6	Wednesday		
7	Thursday		
8	Friday		
9	Saturday		
10	Sunday	Holiday	
11	Monday		
12	Tuesday		
13	Wednesday		
14	Thursday		
15	Friday		
16	Saturday		
17	Sunday	Holiday	
18	Monday		
19	Tuesday		
20	Wednesday		
21	Thursday		
22	Friday		
23	Saturday		
24	Sunday	Holiday	
25	Monday		
26	Tuesday		
27	Wednesday		
28	Thursday		
29	Friday		
30	Saturday		
31	Sunday	Holiday	

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SUBJECT : EC8451 - ELECTROMAGNETIC FIELDS

SEM / YEAR : IV/II

UNIT I INTRODUCTION

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem

PART - A

Q.No	Questions	BT Level	Competence
1.	List the source quantities in the electromagnetic model.	BTL 1	Remembering
2.	Describe line, surface and volume charge density.	BTL 2	Understanding
3.	State divergence theorem.	BTL 1	Remembering
4.	Define Stokes theorem.	BTL 1	Remembering
5.	Name the universal constants in the electromagnetic model.	BTL 1	Remembering
6.	What are surface and volume integrals?	BTL 1	Remembering
7.	Give the relationship between potential and electric field intensity.	BTL 2	Understanding
8.	Identify the unit vector and its magnitude corresponding to the given vector $\boldsymbol{A}=5\,\hat{\mathbf{a}}_x + \hat{\mathbf{a}}_y + 3\,\hat{\mathbf{a}}_z$.	BTL 3	Applying
9.	Estimate the distance between the given vectors ***A*** (1, 2, 3) and ***B*** (2, 1, 2).	BTL 6	Creating
	Outline the relationship between magnetic flux density and field density.	BTL 2	Understanding
11.	Calculate the values of universal constants of free space.	BTL 5	Evaluating
12.	Analyze a differential volume element in spherical coordinates (r, θ, φ) resulting from differential charges in the orthogonal coordinate systems.	BTL 4	Analyzing
13.	Specify the unit vector extending from the origin towards the point **G** (2,-2,-1).	BTL 3	Applying
14.	Compare orthogonal and non-orthogonal coordinate systems.	BTL 4	Analyzing
15.	Point out the role of vector algebra in electromagnetics.	BTL 2	Understanding

16.	Convert the point **P** (5, 1, 3) from Cartesian to spherical coordinates.	BTL 4	Analyzing
17.	Write the transformation between spherical and Cartesian coordinates.	BTL 1	Remembering
18.	Justify that electric field is conservative.	BTL 3	Applying
19.	Obtain the value of α if magnetic field **B** is a solenoid where **B**=$25x\mathbf{a}_x+12y\mathbf{a}_y+\alpha z\mathbf{a}_z$.	BTL 6	Creating
20.	Assess the physical significance of curl of a vector field.	BTL 5	Evaluating
	PART - B		
1.	What is electromagnetics? Give detailed explanation on Electromagnetic model with corresponding units and constants. (13)	BTL 1	Remembering
2.	(i) Verify whether the vector field **E**= $yz\,\hat{a}_x + xz\,\hat{a}_y + xy\,\hat{a}_z$ is both solenoidal and irrotational. (7) (ii) Given **A** =$5\hat{a}_x$ and **B**= $4\,\hat{a}_y + t\,\hat{a}_y$. Find t such that angle between **A** and **B** is 45^0. (6)	BTL 1	Remembering
3.	(i) Write short notes on scalar and vector field. (4) (ii)What is unit vector? Discuss on the mathematical operations with Vectors. (9)	BTL 1	Remembering
4.	Explain how a spherical coordinate system describes the position of the point in free space and its differential elements. (13)	BTL 1	Remembering
5.	(i) Summarize about the Dot product and cross product of vectors. State its properties and applications. (7) (ii)The three fields are given by **A** = $2\hat{a}_x - \hat{a}_z$, **B** = $2\hat{a}_x - \hat{a}_y + 2\hat{a}_z$ and **C** = $2\hat{a}_x - 3\hat{a}_y + \hat{a}_z$. Find the scalar and vector triple product. (6)	BTL 2	Understanding
6.	Obtain the expressions for differential area and volume element in cylindrical coordinate system. (13)	BTL 2	Understanding
7.	Analyze the geometrical position of the point in Cartesian coordinate system and obtain distance vector and differential elements. (13)	BTL 4	Analyzing
8.	Asses the spherical coordinates of **A** and Cartesian coordinates of **B** for the two given points **A**(x = 2, y = 1, z = 3) and **B**(ρ= 1, φ = 45^0, z = 2) (13)	BTL 3	Applying
9.	Given the two points **A** (x = 2, y = 3, z = -1) and **B** (r=4, θ=25^0, φ=120^0). Solve the spherical coordinates of **A** and Cartesian coordinates of **B**. (13)	BTL 3	Applying
10.	State and prove divergence theorem for a given differential volume element. (13)	BTL 2	Understanding
11.	Verify divergence theorem for the vector **A**= $4x\,\hat{a}_x - 2y^2\,\hat{a}_y + z^2\,\hat{a}_z$ taken over the cube bounded between x=0,x=1, y=0 ,y=1 and z=0, z=1. (13)	BTL 4	Analyzing
12.	(i)Explain in detail line, surface and volume integral of vector function.(7) (ii)Express the rate of change of a scalar in a given direction in terms of its gradient and its properties. (6)	BTL 4	Analyzing
13.	(i)Verify the null identities using general orthogonal coordinates. (7) (ii) How do you explain the use of Helmholtz's theorem in electromagnetic engineering? (6)	BTL 5	Evaluating

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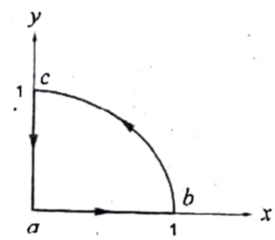
14.	(i) Elaborate on curl of a vector and its significance. (7) (ii) State and prove Stokes theorem to relate line integral and surface integral (6)	BTL 6	Creating
PART - C			
1.	Evaluate divergence theorem for the given $\mathbf{D} = 2r z^2\, \hat{a}_r + r \cos^2\varphi\, \hat{a}_z$, where r =3 and z=5. (15)	BTL 5	Evaluating
2.	Express vector **B** in Cartesian and cylindrical systems .Given $\mathbf{B} = 10/r\, \hat{a}_r + r \cos\theta\, \hat{a}_\theta + \hat{a}_\varphi$, Then find **B** at (-3,4,0) and (5,π/2,-2) (15)	BTL 5	Evaluating
3.	Validate stokes theorem for a vector field $\mathbf{A} = 2r \cos\varphi\, \hat{a}_r + r\, \hat{a}_\varphi$ in cylindrical coordinates for the contour shown in figure below. (15)  	BTL 6	Creating
4.	Estimate $\iint \mathbf{F}.\mathbf{n}\, ds$ using divergence theorem where $\mathbf{F} = 2\,xy\, \hat{a}_x + y^2\, \hat{a}_y + 4\,yz\, \hat{a}_z$, surface of the cube bounded by x=0,x=1, y=0 ,y=1 and z=0, z=1. (15)	BTL 6	Creating

UNIT II ELECTROSTATICS

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law

PART – A

Q.No	Questions	BT Level	Competence
1.	Define electric field intensity.	BTL 1	Remembering
2.	Write the statement of Coulomb's law.	BTL 1	Remembering
3.	What is the difference between potential and potential difference?	BTL 1	Remembering
4.	Mention the two sources of electromagnetic fields.	BTL 1	Remembering
5.	Describe the relationship between electric field intensity and electric flux density.	BTL 1	Remembering
6.	State Gauss law.	BTL 2	Understanding
7.	Calculate the values of ***D*** at a distance r = 5m for the uniformly charged sphere of radius 2m with charge density of 20 nC/m^3.	BTL 3	Applying
8.	Give examples for uniform and non-uniform electric fields.	BTL 2	Understanding
9.	Explain the principle of Superposition as applied to an electric potential of a point.	BTL 2	Understanding

10.	List the properties of conductor and dielectric materials.	BTL 1	Remembering
11.	Describe about capacitance and capacitors.	BTL 2	Understanding
12.	Solve the energy stored in a 10 μF capacitor which has been charged to a voltage of 400V.	BTL 3	Applying
13.	How do you find the equivalent capacitance of two capacitors C_1 and C_2 connected in series?	BTL 3	Applying
14.	Obtain the relation between current and current density.	BTL 4	Analyzing
15.	Identify equation of Ohm's law in point form.	BTL 4	Analyzing
16.	Compare Poisson's and Laplace's equation.	BTL 4	Analyzing
17.	Evaluate the unique solution of electrostatic fields.	BTL 5	Evaluating
18.	Calculate the value of capacitance between two square plates having cross sectional area of 1 sq.cm separated by 1 cm placed in a liquid whose dielectric constant is 6 and the relative permittivity of free space is 8.854 pF/m.	BTL 5	Evaluating
19.	Formulate the current density of copper wire having conductivity of 5.8 $*10^7$ S/m and magnitude of electric field intensity **E** is 20V/m.	BTL 6	Creating
20.	Derive the continuity equation in integral and differential form.	BTL 6	Creating

PART - B

1.	Q_1 and Q_2 are the point charges located at (0,-4, 3) and (0, 1, 1).If Q1 is 2 nC, Find Q2 such that the force on test charge at (0,-3, 4) has no z component. (13)	BTL 1	Remembering
2.	(i)State and explain coulomb's law and deduce the vector form of force equation between the two point charges. (7) (ii) Write note on principle of Superposition as applied to charge distribution.	BTL 1	Remembering
3.	Obtain the formula for the electric field intensity of an infinite long straight line carrying uniform line charge density of ρ_L. (13)	BTL 4	Analyzing
4.	(i) State and prove Gauss law. (7) (ii) Obtain the point form of gauss law. (6)	BTL 1	Remembering
5.	Explain about any two applications of Gauss law with neat diagrams. (13)	BTL 2	Understanding
6.	Derive the expression for potential due to an electric dipole at any point P. Also find the electric field intensity and in terms of dipole moment. (13)	BTL 2	Understanding
7.	(i) Analyze about nature of dielectric material and polarization. (7) (ii)Determine the value of polarization and electric field intensity of homogeneous slab of lossless dielectric with electric susceptibility of 0.12 and electric flux density of 1.6nC/m^2. (6)	BTL 4	Analyzing
8.	Explain the importance of Poisson's and Laplace's equation in electromagnetics with necessary equations. (13)	BTL 2	Understanding
9.	Derive the boundary conditions of the normal and tangential components of electric field at the interface of two media with different dielectrics. (13)	BTL 3	Applying

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10.	Formulate the expression for electrostatic energy required to assemble a group of charges at rest. (13)	BTL 3	Applying
11.	Derive the boundary conditions between conductor and dielectrics from the boundary conditions between conductor and free space. (13)	BTL 6	Creating
12.	(i) Write the equation of continuity in integral and differential form. (7) (ii) Discuss the point form of ohm's law and obtain the expression for resistance of a conductor. (6)	BTL 1	Remembering
13.	A cylindrical capacitor consists of an inner conductor of radius 'a' & an outer conductor whose inner radius is 'b'. The space between the conductors is filled with a dielectric permittivity ε_r & length of the capacitor is L. Estimate the value of the Capacitance. (13)	BTL 4	Analyzing
14.	Evaluate the expression for a parallel plate capacitor. Also derive the equation for composite parallel plate capacitor with dielectric boundary parallel and normal to the plates. (13)	BTL 5	Evaluating

PART - C

1.	Determine the expression for the electric field due to a charge circular ring of radius r placed in xy plane with center at origin having charge density of ρ_L C/m. Find **E** at the point (0, 0, 5) m from the circular ring of charge with radius 5 m lying in z = 0 plane with center at origin and having ρ_L = 10 nC/m. (15)	BTL 5	Evaluating
2.	(i) Derive the equation of potential due to point, line, and surface and volume charge and obtain the relation between **E** and **V**. (8) (ii) Given the potential $V = (10 \sin\theta \cos\varphi)/r^2$. Find the electric flux density at (2, π/2, 0). (7)	BTL 5	Evaluating
3.	Obtain at point P the magnitudes of **V, E, E_t, E_N, D, D_N** and ρ_S of a potential field $V = 100\, e^{-5x} \sin 3y \cos 4z$ volts. Let point P (0.1, π/12, π/24) be located at a conductor free space boundary. (15)	BTL 6	Creating
4.	(i) Determine the capacitance of general spherical capacitor, isolated sphere coated with dielectric. (10) (ii) For a conducting sphere of 2 cm in diameter, covered with a layer of polyethylene with ε_r = 2.26 and 3 cm thick, find the capacitance. (5)	BTL 6	Creating

UNIT III MAGNETOSTATICS

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques

PART - A

Q.No	Questions	BT	Competence
1.	Define magnetic field and magnetic lines of force.	BTL 1	Remembering
2.	State Biot-Savart's law.	BTL 1	Remembering

3.	Describe Ampere's circuital law.	BTL 1	Remembering
4.	What is scalar magnetic potential?	BTL 1	Remembering
5.	Write about magnetic flux and flux density.	BTL 1	Remembering
6.	List the applications of Ampere's circuital law.	BTL 1	Remembering
7.	Point out the relation between magnetic flux density and magnetic field intensity.	BTL 2	Understanding
8.	Outline the concept of permeability and its unit.	BTL 2	Understanding
9.	Infer the Lorentz force equation for a moving charge?	BTL 2	Understanding
10.	Explain magnetic moment.	BTL 2	Understanding
11.	Identify the relationship between magnetic field intensity and magnetization.	BTL 3	Applying
12.	Classify the different types of magnetic materials.	BTL 3	Applying
13.	Derive the expression of force between two current elements.	BTL 3	Applying
14.	Express the self and mutual inductance.	BTL 4	Analyzing
15.	Examine the expression of energy stored in an inductor.	BTL 4	Analyzing
16.	Analyze the mutual inductance of two inductively tightly coupled coils with self-inductance of 25mH and 100mH.	BTL 4	Analyzing
17.	Find the energy stored in inductor having current of 3A flowing through the inductor of 100mH.	BTL 5	Evaluating
18.	Compute torque where magnetic field is $\mathbf{B}=0.2\,\hat{a}_x + 0.4\,\hat{a}_z$ Wb/m^2 and magnetic dipole moment is $\mathbf{M}=8*10^{-3}\,\hat{a}_z$ Am^2.	BTL 5	Evaluating
19.	Explain the phenomenon of hysteresis with reference to ferromagnetic materials.	BTL 6	Creating
20.	Obtain the energy stored in a magnetic field in terms of field quantities.	BTL 6	Creating
	PART – B		
1.	From the Biot-Savart's law, write the expression for magnetic field intensity at a point P and distance R from the infinitely long straight current carrying conductor. (13)	BTL 1	Remembering
2.	Derive the equations for magnetic field intensity and magnetic flux density at the center of the square current loop using Biot-Savart's law. (13)	BTL 1	Remembering
3.	Write short notes on (i)Magnetic field due to current carrying conductors. (7) (ii)Law of non-magnetic monopoles. (6)	BTL 1	Remembering
4.	State about magnetization? Describe the classification of magnetic materials with examples. (13)	BTL 1	Remembering
5.	Determine the magnetic field intensity at the origin due to current element $\mathbf{Idl} = 3\pi\,(\hat{a}_x + 2\,\hat{a}_y + 3\hat{a}_z)$ µA · m at (3,4,5)m in free space. (13)	BTL 5	Evaluating
6.	(i) Discuss about the force on a straight and long current carrying conductor placed in the uniform magnetic field. (7) (ii)Illustrate with diagram magnetic torque. (6)	BTL 2	Understanding

7.	(i) Using Biot-Savart's law, illustrate the magnetic field intensity on the axis of a circular loop of radius R carrying a steady current I. (7) (ii) A circular loop located on $x^2 + y^2 = 9, z = 0$ carries a direct current of 10 A along $\mathbf{a}_\varphi$. Calculate **H** at (0, 0, 4) and (0, 0,-4). (6)	BTL 2	Understanding
8.	Derive the expression for Ampere circuital law. Apply the law for any two applications with necessary illustrations. (13)	BTL 3	Applying
9.	(i)Derive the Maxwell's curl equation for magnetic field from Ampere circuital law. (7) (ii)Solve the magnetic field at a point P(0.01, 0, 0)m if current through a co-axial cable is 6A. which is along the z-axis and a=3mm, b=9mm, c=11mm.(6)	BTL 3	Applying
10.	Let **A**=(3y-z)ax+2xzay Wb/m in a region of free space. [illegible] (5) (ii)At P(2,-1,3) find **A, B, H** and **J** (8)	BTL 4	Analyzing
11.	(i) Estimate the expression for inductance of a toroidal coil carrying current I, with N turns and the radius of toroid 'r'. (7) (ii) Formulate the expression for inductance of a coaxial cable. (6)	BTL 6	Creating
12.	Examine the magnetic field intensity within a magnetic material where (i)**M**=150A/m and $\mu=1.5\times10^{-5}$ H/m (7) (ii)**B**=300μT and $\chi_m=15$. (6)	BTL 4	Analyzing
13.	Describe about the magnetic boundary condition at the interface between two magnetic medium and derive the necessary boundary conditions. (13)	BTL 2	Understanding
14.	A solenoid with $N_1=2000$, $r_1=2$ cm and $l_1=100$cm is concentric within a second coil of $N_2=4000$, $r_2=4$cm and $l_2=100$cm.Calculate mutual inductance assuming free space conditions. (13)	BTL 4	Analyzing
	PART – C		
1.	(i) Distinguish magnetic scalar potential from the vector potential with necessary equations. (8) (ii) Calculate the magnetic flux density for a current distribution in free space, **A**= $(2x^2y+yz)\,\hat{a}_x + (xy^2-xz^3)\,\hat{a}_y-(6xyz-2x^2y^2)\,\hat{a}_z$ Wb/m. (7)	BTL 5	Evaluating
	(i) At a point P(x, y, z) the components of vector magnetic potential are given as $A_x = (4x + 3y+2z)$, $A_y = (5x +6y +3z)$ and $A_z = (2x+3y+5z)$. Invent at point P. (8) (ii) A solenoid has an inductance of 20mH. If the length of the solenoid is increased by two times and the radius is decreased to half of its original value, Compute the new inductance. (7)	BTL 5	Evaluating
3.	Region 1 is the semi-infinite space in which 2x-5y>0, while region 2 is defined by 2x-5y<0. Let $\mu_{r1}=3$, $\mu_{r2}=4$ and $\bar{\mathbf{H}}_1=30a_x$ A/m. Calculate (a) $\|\mathbf{B}_1\|$, (b) $\|\bar{\mathbf{B}}_{N1}\|$, (c) $\|\bar{\mathbf{H}}_{tan1}\|$, (d) $\|\bar{\mathbf{H}}_2\|$. (15)	BTL 6	Creating
4.	(i) A solenoid is 50 cm long, 2 cm in diameter and contains 1500 turns. The cylindrical core has a diameter of 2 cm and a relative permeability of 75. This coil is co-axial with second solenoid which is 50 cm long, 3 cm diameter and 1200 turns. Solve the inductance L for inner and outer solenoid. (8) (ii) Propose the solution for energy stored in the solenoid having 2m long and 10 cm in diameter and is wound with 4000 turns of wire, carrying a current of 8 A. (7)	BTL 6	Creating

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UNIT IV TIME-VARYING FIELDS AND MAXWELL's EQUATIONS

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields

1	State Lenz's law?	BTL 1	Remembering
2	What are the characteristics medium in which field exist?	BTL 1	Remembering
3	Write the Maxwell's expression for free space.	BTL 1	Remembering
4	Give the Maxwell's equation derived from faraday's law.	BTL 1	Remembering
5	Write about time varying field.	BTL 1	Remembering
6	Discuss phase velocity with expression.	BTL 2	Understanding
7	Infer the expression for induced emf when a moving closed path is placed in a time varying magnetic field.	BTL 1	Remembering
8	Summarize the differential form of Maxwell's Equation.	BTL 2	Understanding
9	Outline the difference between conduction current and displacement current.	BTL 2	Understanding
10	Illustrate the Maxwell's equation for a good conductor.	BTL 2	Understanding
11	Develop the expression for Maxwell's equation in integral form.	BTL 3	Applying
12	Identify the significance on displacement current.	BTL 3	Applying
13	Represent a phasor in rectangular and polar form.	BTL 3	Applying
14	Analyze on the materials in which both conduction and displacement current exist.	BTL 4	Analyzing
15	Point out on the phenomenon of electromagnetic induction.	BTL 4	Analyzing
16	Based on the magnitudes of current densities how to categorize conductor and dielectric materials?	BTL 4	Analyzing
17	Explain the significance of ratio of conduction current density and displacement current density.	BTL 5	Evaluating
18	Evaluate the modification in the equation of continuity due to inconsistency of ampere circuital law.	BTL 5	Evaluating
19	Obtain the retarded electric scalar potential and retarded magnetic vector potential.	BTL 6	Creating
20	Give the situations, when the rate of change of flux results in a non-zero value.	BTL 6	Creating

PART B

1	(i) Electric flux density in a charge free region is given by $\mathbf{D}=10x\mathbf{a}_x+5y\mathbf{a}_y+kz\mathbf{a}_z \mu C/m^2$. Find the constant k. (7) (ii) If the magnetic field $\mathbf{H}=(3x\cos\beta+6y\sin\alpha)\,\mathbf{a}_z$, Find current density **J** if fields are invariant with time. (6)	BTL 1	Remembering

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2	A circular loop of N turns of conducting wire lies in the XY plane with its center at the origin of magnetic field specified by **B**= B_0 Cos (πr/2b) * Sin ωt $\mathbf{a_z}$ where, b is the radius of the loop and ω is the angular frequency. Find the emf induced in the loop. (13)	BTL 1	Remembering
3	(i) Express Maxwell's equation for harmonically varying fields. (7) (ii) In a given lossy dielectric medium, conduction current density J_c=0.02 sin10^9t (A/m^2). Find the displacement current density if σ=10^3 S/m and ε_r=6.5 (6)	BTL 1	Remembering
4	Derive the Maxwell's equation for a time varying are modified for time varying from fundamental laws of electric and magnetic fields. (13)	BTL 1	Remembering
5	Write in detail on retarded scalar and vector potential and derive the generalized wave equation. In free space. (13)	BTL 2	Understanding
6	Illustrate the integral and point form of Maxwell's equations for static fields. (13)	BTL 3	Applying
7	(i)Express the transformer EMF induced in a stationary closed path in a time varying B field. (7) (ii)Obtain the motional EMF induced in moving closed path in static B field.(6)	BTL 2	Understanding
8	Calculate the maximum emf induced in a coil of 4000 turns of radius of 12 cm rotating at 30rps in a magnetic field of 0.05 Wb/m^2. (13)	BTL 2	Understanding
9	(i)Demonstrate the detailed steps for the derivation of electromagnetic boundary conditions for a time varying fields. (7) (ii)Determine emf induced about the path r = 0.5, z = 0, t = 0. If **B** = 0.01sin377t T. (6)	BTL 3	Applying
10	(i)Illustrate with necessary fundamentals the equation of continuity of current in differential form. (7) (ii) Prove that modified ampere's law is consistent with the time varying field. (6)	BTL 3	Applying
11	Give the physical interpretation of Maxwell's first and second equations. (13)	BTL 4	Analyzing
12	In a region where ε_r = μ_r =1 and σ=0 let **A**=10^{-3} y cos3*10^8 t cosz $\mathbf{a_z}$ Wb/m and V=3*10^5 y sin 3*10^8 t sinz V. Find **E** and **H.** (13)	BTL 4	Analyzing
13.	Derive an expression for displacement current density an the physical significance of it. (13)	BTL 5	Evaluating
14	Do the fields **E**=E_m sinx sint $\mathbf{a_y}$ and **H**=(H_m /μ_0) cosx cost $\mathbf{a_z}$ satisfy Maxwell's equations? (13)	BTL 6	Creating
	PART C		
1	In a material for which σ=5S/m and ε_r = 1, the electric field intensity is E= 250 sin10^{10}t V/m. Estimate the conduction and displacement current densities, and the frequency at which both have equal magnitudes. (15)	BTL 6	Creating

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2	The unit vector $0.48\,\hat{a}_x - 0.6\,\hat{a}_y + 0.64\,\hat{a}_z$ is directed from region 2 ($\varepsilon_{r2} = 2.5$, $\mu_{r2} = 2$, $\sigma_2 = 0$) towards region 1 ($\varepsilon_{r1} = 4$, $\mu_{r1} = 10$, $\sigma_1 = 0$). If $\mathbf{H_1} = (-100\,\hat{a}_x - 50\,\hat{a}_y + 200\,\hat{a}_z)\sin 400t$ A/m at the point p in region 1 adjacent to the boundary. Determine the amplitude at point P of $\mathbf{H}_{N1}$, $\mathbf{H}_{tan1}$, $\mathbf{H}_{N2}$, $\mathbf{H_2}$. (15)	BTL 5	Evaluating
3	Calculate β and **H** in a medium characterized by σ=0, μ= μ_0, $\varepsilon = 4\varepsilon_0$ and **E**=20 sin $(10^8 t-\beta z)\mathbf{a_y}$ V/m.. (15)	BTL 5	Evaluating
4	Solve the value of k such that following pairs of field satisfies Maxwell's equation in the region where σ=0, σ_v=0 (i) **E** =[kx-100t] $\mathbf{a_y}$ V/m, **H**=[x+20t] $\mathbf{a_z}$ A/m and μ=0.25H/m, ε=0.01F/m (8) (ii) $\bar{D}=5x\mathbf{a_x}-2\mathbf{a_y}+kz\mathbf{a_z}$ $\mu C/m^2$, $\bar{B}=2\mathbf{a_y}$ mT and $\mu=\mu_0$, $\varepsilon=\varepsilon_0$. (7)	BTL 6	Creating

UNIT V PLANE ELECTROMAGNETIC WAVES

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary.

PART - A

1	Define wavelength.	BTL 1	Remembering
2	State Poynting theorem.	BTL 1	Remembering
3	Describe the characteristics of uniform plane wave?	BTL 1	Remembering
4	What is meant by depth of penetration?	BTL 1	Remembering
5	Give the expressions for propagation constant, intrinsic impedance if a wave propagates in a lossy dielectric.	BTL 1	Remembering
6	Write down the significance of loss tangent.	BTL 1	Remembering
7	Demonstrate intrinsic impedance of free space.	BTL 2	Understanding
8	Point out the difference between attenuation constant and phase constant.	BTL 2	Understanding
9	Infer about general wave equation in terms of electric and magnetic fields.	BTL 2	Understanding
10	Explain the significance of pointing vector?	BTL 2	Understanding
11	Identify the relationship between average power density and amplitude of electric field.	BTL 3	Applying
12	Construct the expressions for instantaneous, average and complex Poynting vector.	BTL 3	Applying
13	Derive the expression for transmission and reflection coefficient for normal incidence at plane conducting boundary.	BTL 3	Applying
14	Express the values of skin depth for a plane wave propagating through the dielectric with attenuation constant of 0.2887 Np/m.	BTL 4	Analyzing
15	Examine the significance of intrinsic impedance.	BTL 4	Analyzing
16	Analyze the wave equation in phasor form.	BTL 4	Analyzing
17	Find the expression for the intrinsic impedance, attenuation constant and phase constant for good conducting medium.	BTL 5	Evaluating
18	Compute propagation constant in free space for a wave with 100MHz.	BTL 5	Evaluating
19	Express Poynting theorem in point form and integral form.	BTL 6	Creating
20	Develop the expressions for Standing wave ratio when the amplitudes of reflected and incident waves are equal.	BTL 6	Creating

PART – B

1	Starting from the Maxwell's equation derive homogenous vector Helmholtz's equation in phasor form. (13)	BTL 1	Remembering
2	Find the wave equation for the electric and magnetic fields for free space conditions. (13)	BTL 1	Remembering
3	Write short notes on uniform plane waves and derive the wave equation. (13)	BTL 1	Remembering
4	(i) State and prove Poynting theorem. (8) (ii)Describe the Poynting vector, average power and instantaneous power. (5)	BTL 1	Remembering
5	A uniform plane wave $\mathbf{E}_y = 10 \sin(2\pi * 10^{8} t - \beta x)\,\hat{\mathbf{a}}_y$ is travelling in x directon in free space. Determine Phase constant, Phase velocity, Expression for $\mathbf{H}_z$. Assume $\mathbf{E}_z = 0 = \mathbf{H}_y$. (13)	BTL 5	Evaluating
6	Explain the condition under which the magnitude of the reflection coefficient equals that of the transmission coefficient for a uniform wave at normal incidence on an interface between two lossless dielectric medium. (13)	BTL 2	Understanding
7	Demonstrate the equations for a plane wave incident normally on a plane dielectric boundary. (13)	BTL 2	Understanding
8	A uniform plane wave in a lossless medium with intrinsic impedance η_1 is incident normally onto another lossless medium with intrinsic impedance η_2 through a plane boundary. Develop the expressions for the time average power densities. (13)	BTL 3	Applying
9	In free space, $\mathbf{E} = 50 \cos(\omega t - \beta z)\,\hat{\mathbf{a}}_x$ V/m. Solve for the average power crossing (13) a circular area of radius 2.5 m in the plane Z=0. Assume $E_m = H_m\,\eta_0$ and	BTL 3	Applying
10	$\eta_0 = 120\pi\Omega$. phase and propagation constant for electromagnetic waves in any medium.(13)	BTL 4	Analyzing
11	Derive the electromagnetic wave equation in phasor form with necessary equations. (13)	BTL 4	Analyzing
12	Illustrate the power flow in a coaxial cable using Poynting theorem. (13)	BTL 2	Understanding
13	Examine the expressions for the transmission and reflection coefficients at the interface of two media for normal incidence. (13)	BTL 4	Analyzing
14	Estimate the frequency of a wave and the conductivity of the medium for a uniform plane wave travelling at a velocity of $2.5*10^{5}$ m/s having a wavelength of 0.25 mm in a non-magnetic good conductor. (13)	BTL 6	Creating

PART – C

1	A 6580 MHz uniform plane is propagating in a material medium of $\varepsilon_r = 2.25$. If the amplitude of electric field intensity of a losseless medium is 500 V/m. Calculate the phase constant, Propagation constant, velocity , wavelength and intrinsic impedance. Also find the amplitude of magnetic field intensity. (15)	BTL 5	Evaluating

2	(i) Determine α, β and the wavelength of a material for a 9 GHz wave propagating through a material that has a dielectric constant of 2.4 and loss tangent of 0.005. (10) (ii)Calculate the skin depth for a medium with conductivity 100 Ω / , relative permeability of 2 and relative permittivity of 3A at 1 GHz. (5)	BTL 5	Evaluating
3	Determine the amplitudes of reflected and transmitted fields (electric and magnetic both) at the interface of two regions, if $\mathbf{E}_i$ = 1.5 mV/m in region 1 for which ε_{r1} = 8.5, μ_r = 1 and σ =0 and region 2 is a free space. (15)	BTL 6	Creating
4	(i) Calculate the skin depth and wave velocity at 2 MHz in aluminum with conductivity 40 MS/m and μ_r = 1. (10) (ii) A plane wave propagating in free space has a peak electric field of 750mV/m. Estimate the average power through a square area of 12cm on a side perpendicular to the direction of propagation. (5)	BTL 6	Creating

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TIME TABLE
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II YEAR – III SEMESTER
Time: 9.30AM TO 11.30 AM

ECE

DATE	CIVIL ENGG	CSE	EEE	ECE	MECH ENGG	IT
30.01.2020	Construction Techniques and Practice	Computer Architecture	Transmission and Distribution	Electronic Circuits II	Kinematics of Machinery	Computer Architecture
31.01.2020	Strength of Materials II	Database Management Systems	Measurements and Instrumentation	Communication Theory	Manufacturing Technology II	Database Management and Systems
01.02.2020	Applied Hydraulic Engineering	Design and Analysis of Algorithms	Linear Integrated circuits and applications	Electromagnetic Fields	Engineering Metallurgy	Design and Analysis of Algorithms
03.02.2020	Concrete Technology	Operating Systems	Electrical Machines - II	Linear Integrated Circuits	Thermal Engineering I	Operating Systems
04.02.2020	Soil Mechanics	Software Engineering	Control Systems	Environmental Science and Engineering	Strength of Materials for Mechanical Engineers	Environmental Science and Engineering
05.02.2020	Numerical Methods	Probability and Queueing Theory	Numerical Methods	Probability and Random Processes	Statistics and Numerical Methods	Probability and Statistics

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III YEAR – VI SEMESTER
Time: 9.30AM TO 11.30 AM

DATE	CIVIL ENGG	CSE	EEE	ECE	MECH ENGG	IT
30.01.2020	Design of Steel Structural Elements	Internet Programming	Protection and switch gear	Microprocessors and Microcontrollers	Design of Transmission Systems	Computational Intelligence
31.01.2020	Structural Analysis II	Artificial Intelligence	Embedded Systems	VLSI Design	Computer Aided Design and Manufacturing	Object Oriented Analysis and Design
01.02.2020	Irrigation Engineering	Mobile Computing	Communication Engineering	Wireless Communication	Heat and Mass Transfer	Mobile Communication
03.02.2020	Wastewater Engineering	Compiler Design	Solid State Drives	Principles of Management	Hydraulics and Pneumatics	Big Data Analytics
04.02.2020	Highway Engineering	Distributed Systems	Design of Electrical Apparatus	Transmission Lines and RF Systems	Finite Element Analysis	Computer Graphics and Multimedia
05.02.2020	Air Pollution and Control Engineering	Software Testing	----------	Wireless Networks	Gas Dynamics and Jet Propulsion/ Automobile Engineering	Software Testing

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INTERNAL ASSESSMENT TEST - I JAN-FEB 2020
IV YEAR – VIII SEMESTER
Time: 9.30AM TO 11.30 AM

DATE	CIVIL ENGG	CSE	EEE	ECE	MECH ENGG	IT
30.01.2020	Principles of Management	Multi-Core Architectures and Programming	Electric Energy Generation, Utilization and Conservation	Wireless Communication	Engineering Economics	Service Oriented Architecture
31.01.2020	Prefabricated Structures	Human Computer Interaction	Power Electronics for Renewable Energy Systems	Wireless Networks	Production Planning and Control	Software Project Management
01.02.2020	Repair and Rehabilitation of Structures	Professional Ethics in Engineering	Professional Ethics in Engineering	Professional Ethics in Engineering	Advanced I.C. Engines	Professional Ethics in Engineering
03.02.2020	----	----	----	Total Quality Management	----	Business Intelligence

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DEPARTMENT OF ECE

IAT SEATING PLAN

CLASS	VENUE	REGISTER NUMBER
II ECE A	III F ECE A CR2	311518106001-6018
	III F ECE A CR3	311518106019-6036
	EMBEDDED LAB	311518106037-6052, 6301
II ECE B	GF ECEB CR2	311518106053-6070
	III F ECE B CR3	311518106071-6091
	LIC LAB	311518106092-6105
	VLSI LAB	311518106106-6108
III ECE A	III F ECE A CR2	311517106001-6018
	II F ECE A CR4	311517106019-6037
	LIC LAB	311517106038-6051
	VLSI LAB	311517106052-6057, 6301, 6306
III ECE B	II F ECE B CR4	311517106077-6094
	GF ECEB CR2	311517106058-6076
	LIC LAB	311517106095-6108
	VLSI LAB	311517106109-6112, 6302, 6303, 6305
IV ECE A	III F ECE A CR3	311516106001-6019
	II F ECE A CR4	311516106020-6039
	EMBEDDED LAB	311516106040-6058, 6304
	VLSI LAB	311516106305-6308, 6310, 6312
IV ECE B	III F ECE B CR3	311516106059-6077
	II F ECE B CR4	311516106078-6097
	SIMULATION LAB	311516106098-6112
	VLSI LAB	311516106113-6116, 6301-6303, 6309, 6313

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CLASS	VENUE	REGISTER NUMBER
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	III F ECE A CR3	311518106019-6036
	EMBEDDED LAB	311518106037-6052, 6301
II ECE B	GF ECE B CR2	311518106053-6070
	III F ECE B CR3	311518106071-6091
	LIC LAB	311518106092-6105
	VLSI LAB	311518106106-6108
III ECE A	III F ECE A CR2	311517106001-6018
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	LIC LAB	311517106038-6051
	VLSI LAB	311517106052-6057, 6301, 6308
III ECE B	II F ECE B CR4	311517106077-6094
	GF ECE B CR2	311517106056-6076
	LIC LAB	311517106095-6108
	VLSI LAB	311517106109-6112, 6302, 6303, 6305
IV ECE A	III F ECE A CR3	311516106001-6019
	II F ECE A CR4	311516106020-6039
	EMBEDDED LAB	311516106040-6058, 6304
	VLSI LAB	311516106305-6307, 6310, 6312
IV ECE B	III F ECE B CR3	311516106059-6077
	II F ECE B CR4	311516106078-6097
	SIMULATION LAB	311516106098-6112
	VLSI LAB	311516106113-6116, 6301-6303, 6309, 6313

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TIME TABLE
INTERNAL ASSESSMENT TEST – I JAN-FEB 2020
II YEAR – IV SEMESTER
Time: 9.30AM TO 11.30 AM

ECE

DATE	CIVIL ENGG	CSE	EEE	ECE	MECH ENGG	IT
30.01.2020	Construction Techniques and Practice	Computer Architecture	Transmission and Distribution	Electronic Circuits II	Kinematics of Machinery	Computer Architecture
31.01.2020	Strength of Materials II	Database Management Systems	Measurements and Instrumentation	Communication Theory	Manufacturing Technology II	Database Management and Systems
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03.02.2020	Concrete Technology	Operating Systems	Electrical Machines - II	Linear Integrated Circuits	Thermal Engineering I	Operating Systems
04.02.2020	Soil Mechanics	Software Engineering	Control Systems	Environmental Science and Engineering	Strength of Materials for Mechanical Engineers	Environmental Science and Engineering
05.02.2020	Numerical Methods	Probability and Queueing Theory	Numerical Methods	Probability and Random Processes	Statistics and Numerical Methods	Probability and Statistics

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INTERNAL ASSESSMENT TEST – I JAN-FEB 2020
IV YEAR – VIII SEMESTER
Time: 9.30AM TO 11.30 AM

DATE	CIVIL ENGG	CSE	EEE	ECE	MECH ENGG	IT
30.01.2020	Principles of Management	Multi-Core Architectures and Programming	Electric Energy Generation, Utilization and Conservation	Wireless Communication	Engineering Economics	Service Oriented Architecture
31.01.2020	Prefabricated Structures	Human Computer Interaction	Power Electronics for Renewable Energy Systems	Wireless Networks	Production Planning and Control	Software Project Management
01.02.2020	Repair and Rehabilitation of Structures	Professional Ethics in Engineering	Professional Ethics in Engineering	Professional Ethics in Engineering	Advanced I.C. Engines	Professional Ethics in Engineering
03.02.2020	—	—	—	Total Quality Management	—	Business Intelligence

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INTERNAL ASSESSMENT TEST – I JAN-FEB 2020
III YEAR – VI SEMESTER
Time: 9.30AM TO 11.30 AM

DATE	CIVIL ENGG	CSE	EEE	ECE	MECH ENGG	IT
30.01.2020	Design of Steel Structural Elements	Internet Programming	Protection and switch gear	Microprocessors and Microcontrollers	Design of Transmission Systems	Computational Intelligence
31.01.2020	Structural Analysis II	Artificial Intelligence	Embedded Systems	VLSI Design	Computer Aided Design and Manufacturing	Object Oriented Analysis and Design
01.02.2020	Irrigation Engineering	Mobile Computing	Communication Engineering	Wireless Communication	Heat and Mass Transfer	Mobile Communication
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04.02.2020	Highway Engineering	Distributed Systems	Design of Electrical Apparatus	Transmission Lines and RF Systems	Finite Element Analysis	Computer Graphics and Multimedia
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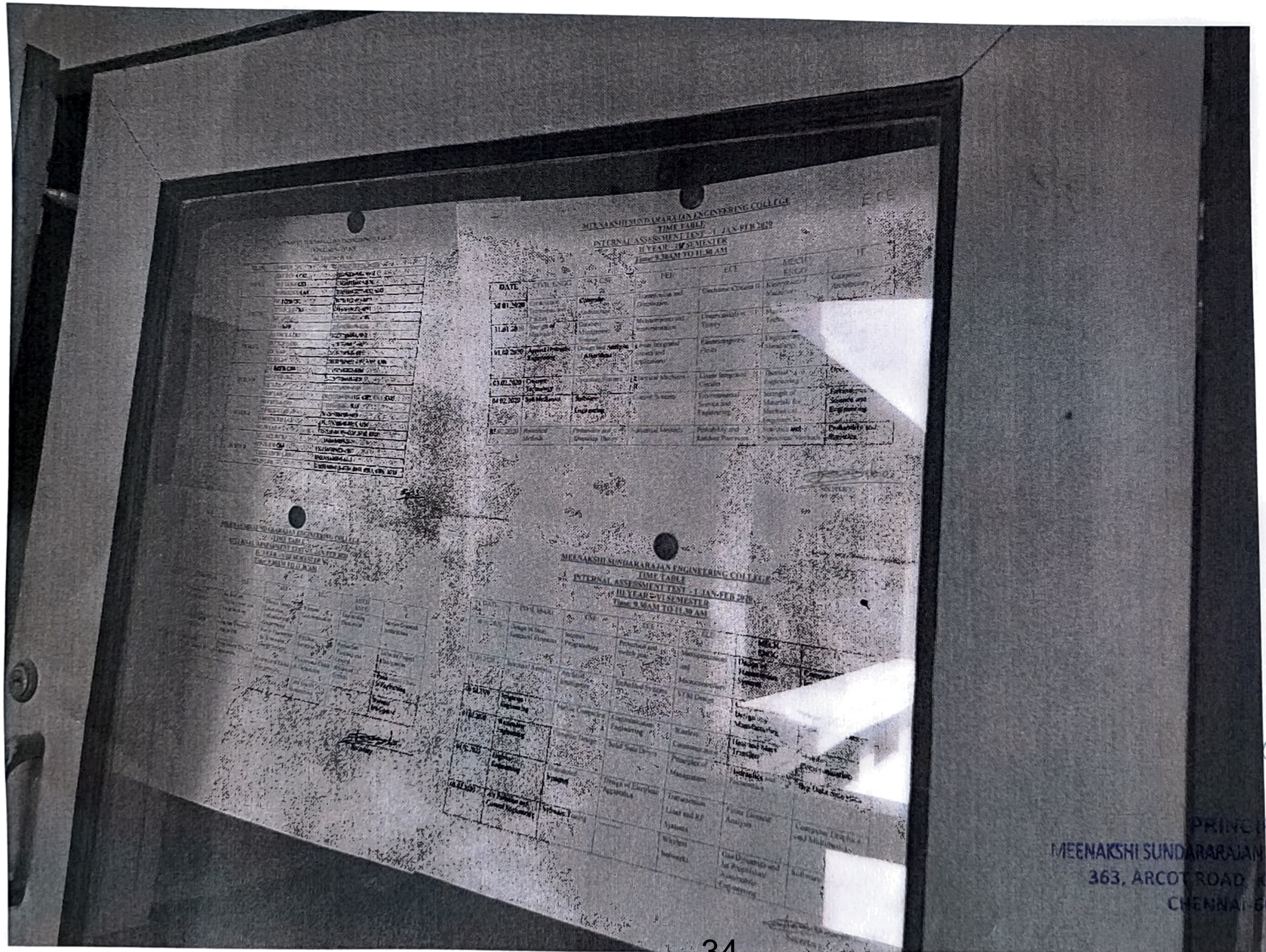

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INTERNAL ASSESSMENT TEST 1 –EVEN SEMESTER 2019-2020

DATE	CLASS ROOM II A	CLASS ROOM III A	CLASS ROOM IV A	CLASS ROOM II B	CLASS ROOM III B	CLASS ROOM IV B	LIC LAB1	LIC LAB2	EM LAB1	EM LAB2
30.01.2020	A JOSEPH	~~M DEEPA~~ M.A Seshaiah	S ELANGOVAN 30/1/2020	S.SATHEESH KUMAR	S BALASUBRAMANIAN	A VELU	Seethalakshmi	N MEENAKSHI 30/1/2020	J PRATHIBA NANDHI 30/1/2020	RND ~~M MANJULA~~
31.01.2020	N MEENAKSHI 31/1/2020	NOOR KHAN	31/1/2020 S.E	A JOSEPH	R NIRMALADEVI	J PRATHIBA NANDHI	D KARTHIKA 31/1		SSI 31/1	M.D
01.02.2020	M.D 1/2	AMUTHA (Maths) 1/02/2020	NOOR KHAN	K.T.MANJULA	A.VELU A.V	SSI 1/2/20	SSK		S ELANGOVAN 1/2/20	S BALASUBRAMANIAN
03.02.2020	D KARTHIKA	M.A.S	S.SATHEESH KUMAR	M.M	N MEENAKSHI	R NIRMALADEVI	S ELANGOVAN 3/1/20		A JOSEPH	J PRATHIBA NANDHI
04.02.2020	S SINDHU	[illegible] (MATHS)	M.A.Seshaiah	M DEEPA	D KARTHIKA	A VELU	---	---	---	---
05.02.2020	S BALASUBRAMANIAN	M MANJULA	SUJEE	J PRATHIBANANDHI	NOOR KHAN	D.K	---	---	---	---

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STAFF NAME	NO OF DUTIES	STAFF NAME	NO OF DUTIES
S BALASUBRAMANIAN	3	A VELU	4
N MEENAKSHI	3	S SINDHU	4
M MANJULA	3	R NIRMALADEVI	4
A JOSEPH	3	S ELANGOVAN	4
M A SESHIAHA	3	D KARTHIGA	4
M DEEPA	3	J PRADEEPA	4
NOOR KHAN	3	P MANJULA	1
S SATHISHKUMAR	4	AMUTHA	1
		SEETHALAKSHI (CHEM)	1
		SUJEE (CHEM)	1

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EXAM COORDINATORS SUPERVISION DUTY

INTERNAL ASSESSMENT TEST I - EVEN SEMESTER 2019-2020

DATE	NAME OF FACULTY	DEPARTMENT
30.01.2020	MALINI GAYATHRI (CE)	IT
	YAMUNA S (CSE)	ECE
	BHASKAR (EEE)	CSE
	SARASWATHI B (ECE)	MECH
	TORAL	CIVIL
	SRIRAM K P	EEE
31.01.2020	YAMUNA S (CSE)	EEE
	MALINI GAYATHRI (CE)	MECH
	SARASWATHI B	CSE
	TORAL(MECH)	IT
	BHASKAR (EEE)	CIVIL
	SRIRAM K P	ECE
01.02.2020	MALINI GAYATHRI (CE)	CSE
	YAMUNA S (CSE)	MECH
	BHASKAR (EEE)	ECE
	SARASWATHI B (ECE)	CIVIL
	TORAL(MECH)	IT
	SRIRAM K P(IT)	EEE
03.02.2020	BHASKAR (EEE)	MECH
	YAMUNA S (CSE)	CIVIL
	MALINI GAYATHRI (CE)	ECE
	SARASWATHI B	IT
	TORAL	CSE
	SRIRAM K P	EEE

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DATE	NAME OF FACULTY	DEPARTMENT
04.02.2020	YAMUNA S (CSE)	IT
	MALINI GAYATHRI (CE)	EEE
	SARASWATHI B	CSE
	TORAL(MECH)	MECH Civil
	BHASKAR (EEE)	~~CIVIL~~ Mech
	SRIRAM K P	ECE
05.02.2020	BHASKAR (EEE)	IT
	YAMUNA S (CSE)	MECH
	MALINI GAYATHRI (CE)	ECE
	SARASWATHI B	EEE
	TORAL	CIVIL
	SRIRAM K P	CSE

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INTERNAL ASSESSMENT TEST -I JAN /FEB 2020

Sub Name:	ELECTROMAGNETIC FIELDS	Semester:	IV
Sub Code:	EC 8451	Time:	2 hours
Class:	II YEAR ECE	Marks:	60
Date:	01.02.2020	CO 1 & CO 2	

Part-A(6X2=12)

1 Define Stokes theorem.

2 Outline the relationship between magnetic flux density and field density.

3 Obtain the value of α if magnetic field **B** is a solenoid where B=25xax+12yay+ α zaz.

4 Write the statement of Coulomb's law.

5 State Gauss law.

6 Solve the energy stored in a 10 μF capacitor which has been charged to a voltage of 400V.

Part-B(2*11=22)

7. a) Explain how a spherical coordinate system describes the position of the point in free space and its differential elements.

OR

b) (i) Elaborate on curl of a vector and its significance.
(ii) State and prove Stokes theorem to relate line integral and surface integral

8. a)(i)State and explain coulomb's law and deduce the vector form of force equation between the two point charges.
(ii) Write note on principle of Superposition as applied to charge distribution.

OR

b) A cylindrical capacitor consists of an inner conductor of radius 'a' & an outer conductor whose inner radius is 'b'. The space between the conductors is filled with a dielectric permittivity Ɛr & length of the capacitor is L. Estimate the value of the Capacitance.

Part-C(2*13=26)

9. a)Evaluate divergence theorem for the given **D**= $2rz^2\,\hat{a}_r + r\cos^2\phi\,\hat{a}_z$, where r =3 and z=5.

OR

b) Estimate ∬F.nds using divergence theorem where F= 2 xy âx +y2 ây + 4 yz âz , surface of the cube bounded by x=0,x=1, y=0,y=1 and z=0, z=1.

10. a)(i) Derive the equation of potential due to point, line, and surface and volume charge and obtain the relation between E and V.
(ii) Given the potential V= (10 sin θ cosϕ) /r2. Find the electric flux density at (2, π/2, 0).

OR

b) (i) Determine the capacitance of general spherical capacitor, isolated Sphere coated with dielectric.(ii) For a conducting sphere of 2 cm in diameter, covered with a layer of polyethylene with Ɛr = 2.26 and 3 cm thick, find the capacitance.

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(Managed by I.I.E.T Society)
363, Arcot Road, Kodambakkam, Chennai-24
Approved by AICTE & Affiliated to Anna University

ACADEMIC YEAR : 2019 - 2020

Degree	: B.E	Branch	: ECE - B
Register Number	: 311518106108	Semester	: 03
Subject Name	: ElectroMagnetic Fields	Max.Marks	: 60
Subject Code	: EC8451	Date	: 01-02-2020

Name of the Invigilator	Signature of the Invigilator with Date (All the above particulars are verified)
A. JOSEPH	Joseph 1/2/2020

Instruction to the candidate: Put a tick mark (✓) for the questions attended in the tick mark column against each question

PART-A

Q.No.	✓	Marks
1	✓	3
2	✓	
3	✓	3
4	✓	3
5	✓	02
6		
Total		11

PART-B&C

Question No.		i ✓	i Marks	ii ✓	ii Marks	iii ✓	iii Marks	Total Marks
7	A							
	B	✓	6	✓	5			11
8	A	✓	6	✓	5			11
	B							
9	A							
	B	✓	13					13
10	A		5					5
	B							
							Total	40

Grand Total (in words): FIVE ONE

Grand Total: 51/60

Date	Name of the Examiner	Signature of the Examiner
2/2/2020	N.MEENAKSHI	[signature]

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Part-C

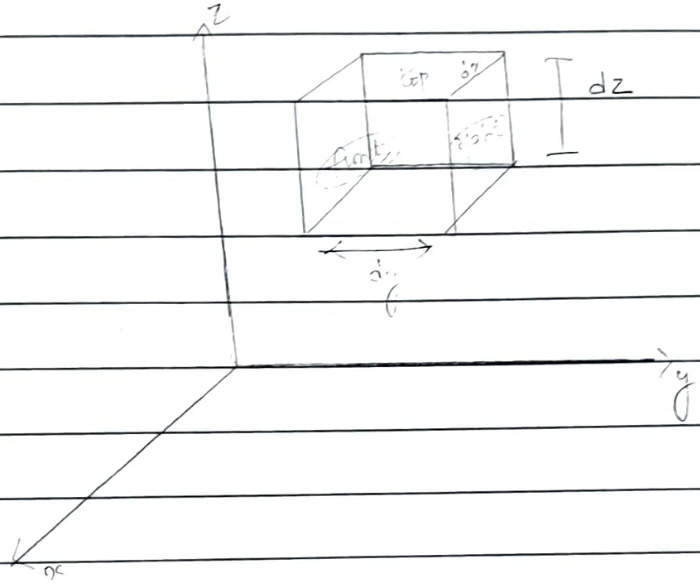
9) b) Given:-

$$F = 2xy\,\hat{a_x} + y^2\hat{a_y} + 4yz\,\hat{a_z}$$

$x=0 \quad x=1$

$y=0 \quad y=1$

$z=0 \quad z=1$



Divergence Theorem States that

$$\oint_S A\cdot ds = \int_V \nabla\cdot A\cdot dv$$

$$\oint_S A\cdot ds = \iint_{front} + \iint_{back} + \iint_{left} + \iint_{right} + \iint_{top} + \iint_{bottom}.$$

Front:-

$ds = dz\,dy\,\hat{a_x}$ $\boxed{x=1}$

$$\therefore \int_0^1\int_0^1 2xy\cdot dz\,dy \Rightarrow \int_0^1 2xy(z)_0^1\cdot dy$$

$$= \int_0^1 2xy\cdot dy \Rightarrow \int_0^1 2x\left(\frac{y^2}{2}\right)_0^1$$

$$\frac{2x}{2} = x$$

$$x = 1$$

$$\Rightarrow 1$$

Back:-

$ds = dz\,dy\,(-\hat{a_x})$ $\boxed{x = 0}$

$$\int_0^1 \int_0^1 -2xy \; dx\,dy$$

$$-2x\left(\frac{y^2}{2}\right)_0^1$$

$$\Rightarrow -2x \cdot \frac{1}{2}$$

$$= -x$$

$$= 0$$

Right:-

$ds = dx\,dz \cdot \hat{a_y}$ $\boxed{y = 1}$

$$\int_0^1 \int_0^1 y^2 \cdot dx\,dz$$

$$\int_0^1 y^2 (x)_0^1 \; dz$$

$$\int_0^1 y^2 \; dz$$

$$y^2 (z)_0^1 = y^2 = 1$$

Left :-

$ds = dx\,dz\,(-\hat{a_y})$ $\boxed{y=0}$

$\int_0^1\int_0^1 -y^2(x)_0^1 . dz$

$-y^2(z)_0^1$

$= y^2$

$= 0 //.$

Top :-

$ds = dx\,dy\,\hat{a_z}$ $\boxed{z=1}$

$\int_0^1\int_0^1 4yz\,dx\,dy$

$\int_0^1 4yz(x)_0^1\,dy$

$\int_0^1 4yz\,.dy$

$4\left(\frac{y^2}{2}\right)_0^1 . z$

$4\left(\frac{1}{2}\right) . z$

$2z = 2//.$

Bottom :-

$ds = dx\,dy\,(-a_z)$ $z = 0.$

$\therefore \int_0^1\int_0^1 -4yz . dx\,dy = 0$

$$\oint A\cdot ds = 1+1+2$$
$$= 4. \quad -(1)$$

To find Divergence $(\nabla\cdot A)$

$$\nabla\cdot A = \frac{\partial}{\partial x}A_x + \frac{\partial}{\partial y}A_y + \frac{\partial}{\partial z}A_z$$

$$= \frac{\partial}{\partial x}2xy + \frac{\partial}{\partial y}y^2 + \frac{\partial}{\partial z}4yz$$

$$2y + 2y + 4y$$

$$= 8y$$

$$\int_V \nabla\cdot A\cdot dv = \int_0^1\int_0^1\int_0^1 8y\cdot dx\, dy\, dz.$$

$$= \int_0^1\int_0^1 8(x)_0^1 y \; dy\, dz$$

$$\int_0^1\int_0^1 8y \; dy\, dz$$

$$\int_0^1 8\left(y^2/2\right)_0^1 .dz$$

$$= \int_0^1 4.dz$$

$$4(z)_0^1$$

$$= 4 \quad (2)$$

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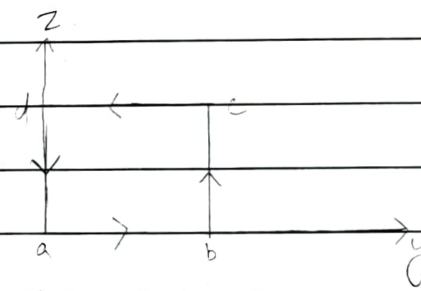
(1) = (2) Hence Divergence Theorem is Verified.

Part - B :-

7b) i) The curl of a vector is an axial or rotational vector which involves circulation ~~over~~ of an area in a closed path as the area shrinks to 0 and having a normal or unit vector pointing / projecting out of the area. The curl of a vector is denoted as $(\nabla \times \vec{A})$ and the curl of a vector gives us a vector equation.

Let us consider a closed path in the YZ plane which is shown in the fig below



We know that

$$\oint A \cdot dl = \int_{ab} + \int_{bc} + \int_{cd} + \int_{da}.$$

$\int_{ab}$:-

$dl = dy\, a_z$

From the Taylor Series Expansion we can write

$$\int_{ab} = dy \left[A_z(x_0, y_0, z_0) - \left(z - \frac{z_0}{2}\right) \frac{d}{dz} A_y \Big|_P \right]$$

Similarly for

$$\int_{bc} = dz \left[A_x(x_0, y_0, z_0) - \left(x + \frac{x_0}{2}\right) \frac{d}{dy} A_z \Big|_P \right]$$

Similarly for

$$\int_{cd} = -dy\left[A_z(x_0,y_0,z_0) + (z-z_0/2)\frac{d}{dz}A_y\Big|_p\right]$$

$$\int_{da} = -dz\left[A_x(x_0,y_0,z_0) + (x-x_0/2)\frac{d}{dy}A_z\Big|_p\right].$$

By Simplifying the expressions we get,

$$(\text{curl } A)_x = \left[\frac{\partial}{\partial z}A_y - \frac{\partial}{\partial y}A_z\right]$$

Similarly

$$(\text{curl } A)_y = \left[\frac{\partial}{\partial x}A_z - \frac{\partial}{\partial z}A_x\right]$$

Similarly

$$(\text{curl } A)_z = \left[\frac{\partial}{\partial y}A_x - \frac{\partial}{\partial x}A_y\right]$$

Since the curl of a vector is independent of its coordinates, we represent the curl in the matrix format as:-

$$\text{Curl } \vec{A} = (\nabla \times A) = \begin{bmatrix} a_x & a_y & a_z \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ A_x & A_y & A_z \end{bmatrix}$$

Similarly for cylindrical coord, we write

$$\nabla \times A = \begin{bmatrix} \rho a_\rho & a_\phi & \rho a_z \\ \partial/\partial\rho & \partial/\partial\phi & \partial/\partial z \\ \rho A_\rho & A_\phi & \rho A_z \end{bmatrix}$$

Similarly for Spherical Coord. we can write,

$$\nabla \times A = \frac{1}{r^2 \sin\theta} \begin{bmatrix} r^2 \sin\theta \, a_r & r\sin\theta \, a_\phi & r a_\phi \\ & & \\ & & \end{bmatrix}$$

7)b) ii) Stokes theorem States that the

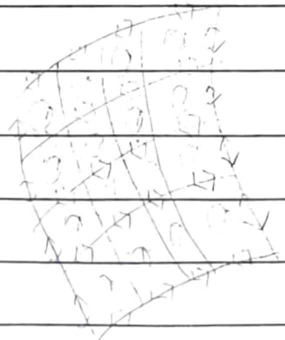
The line integral of a vector of a closed path is equal to the surface integral of the curl of that particular vector

(ie),

$$\oint_L A \cdot dl = \int_S (\nabla \times A) \cdot ds$$

Stokes theorem can be easily proved similar to the divergence theorem.

Let us Consider a Surface:



If we Consider the K^{th} cell in the Surface shown above then we can write

$$\int_S (\nabla \times A) \cdot ds = \frac{\lim_{\Delta K \to 0} \sum_{K=1}^{n} S_K \Delta_K}{\int_L A\, dl}$$

Where S_K denotes the K^{th} surface

Therefore ~~after few~~ we obtain

$$\boxed{\int_S (\nabla \times A) \cdot ds = \oint_L A\, dl}$$

8) a) i) Coulomb's law states that the force of attraction or repulsion between any two charges is directly proportional to the product of magnitude of charges and inversely proportional to the square of the distance between them.

$$F \propto q_1 q_2$$

$$F \propto \frac{1}{R^2}$$

$$F \propto \frac{q_1 q_2}{R^2}$$

$$F = \frac{K Q_1 Q_2}{R^2} \cdot \hat{a_R}$$

where K is the constant of proportionality $= \frac{1}{4\pi\varepsilon_0}$

$$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 R^2} \cdot \hat{a_R} \quad \text{—(1)}$$

where $\hat{a_R}$ is the unit vector which is normal to the surface and which can be obtained by

$$\hat{a_R} = \frac{\vec{a_R}}{|a_R|}$$

~~Let us consider~~

$$\hat{a_R} = \frac{\vec{R}}{|R|} = \frac{\vec{R}}{|R|} \quad -(2) = \frac{\vec{R}}{R}.$$

Substituting (2) in (1) we write

$$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 R^2} \frac{R}{|R|}$$

$$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 R^2} \cdot \frac{R}{R}$$

$$\vec{F} = \frac{Q_1 Q_2 \vec{R}}{4\pi\varepsilon_0 R^3}$$ [Force Eq. in vector form]

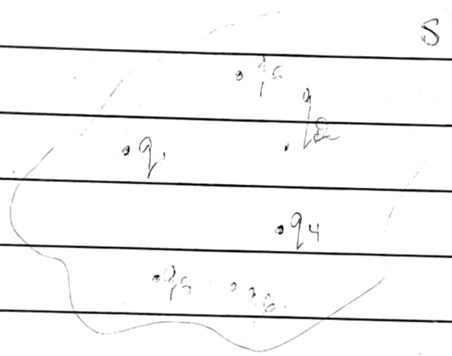
Similarly, when the point charges are placed at different distances namely R_1 and R_2, then the Force equation using Coulomb's law can be written as.

$$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 (R_1 - R_2)^2} \hat{a}_{R_1 - R_2}$$

$$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 (R_1 - R_2)^2} \frac{(\vec{R_1} - \vec{R_2})}{R_1 - R_2} \Rightarrow \vec{F} = \frac{Q_1 Q_2}{4\pi\varepsilon_0 (R_1 - R_2)^3} (\vec{R_1} - \vec{R_2})$$

ii) The principle of Superposition states that the total charge enclosed by a surface is equal to the sum of the individual charges present in that particular surface.

Let us consider a surface which is having uniform charge distribution as shown.



According to the Superposition principle, the total charge enclosed in this surface S is equal to the sum of the individual charges which can be written as

$$q_{Total} = q_1 + q_2 + q_3 + q_4 + q_5 + q_6.$$

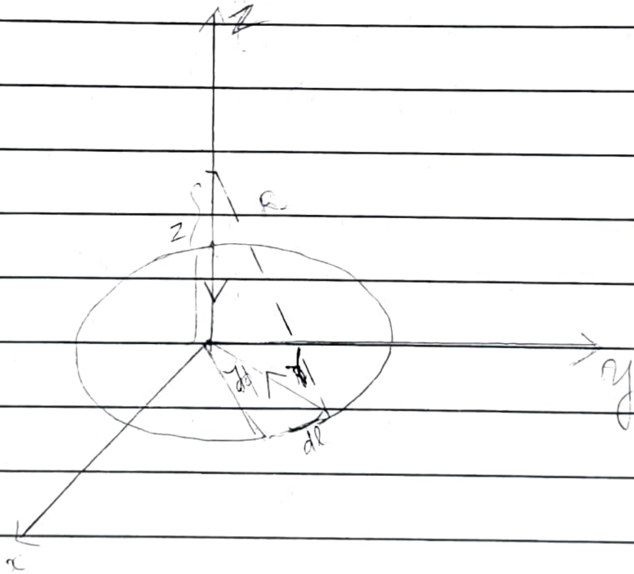
The superposition principle proves the cumulative effect of the charges present enclosed in a surface.

The superposition principle can also be applied to the Coulomb's force of charges where the total force exerted by the charges in a surface equals the sum of individual forces exerted by the individual charges on a test charge which can be written as

$$\vec{F}_{total} = \vec{F}_{1q} + \vec{F}_{2q} + \vec{F}_{3q} + \vec{F}_{4q} + \vec{F}_{5q} + \vec{F}_{6q}.$$

Part - C :-

10) Electric field due to a circular ring :-



we let us consider a small point charge

$dQ = \rho . dl$.

where ρ is the surface charge density and dl is the small differential length.

we know that $dE = \frac{dQ}{4\pi\varepsilon_0 R^2} \hat{a_R}$ from

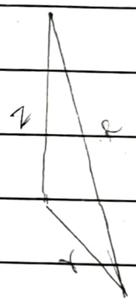
Coulomb's law.

Here we consider only a point charge dq

$\therefore$ E becomes dE

$$\therefore dE = \frac{dQ}{4\pi\varepsilon_0 R^2} \cdot \hat{a}_R$$

we know that $R = \sqrt{r^2+z^2}$



To find the unit vector $\hat{a}_R$:

$$|R| = \sqrt{r^2+z^2}$$

$$\vec{R} = -r a_r + z a_z$$ [Since the direction of r is reversed]

$$\hat{a}_R = \frac{-r a_r + z a_z}{\sqrt{r^2+z^2}}$$

$$dE = \frac{dQ}{4\pi\varepsilon_0 R^3} \cdot \vec{R}$$

$$dE = \frac{\rho\, dl}{4\pi\varepsilon_0 (r^2+z^2)^{3/2}} \cdot (-r a_r + z a_z)$$

From the arc sector theorem,

$$dl = r \cdot d\phi,$$

$$dE = \frac{\rho\, r \cdot d\phi}{4\pi\varepsilon_0 (r^2+z^2)^{3/2}} (-r a_r + z a_z)$$

Neglecting the r component, we get

$$dE = \frac{\rho r \, d\phi}{4\pi\varepsilon_0 (r^2+z^2)^{3/2}} \, z \, a_z . \quad (1)$$

To find out the electric field b/w the circular ring

$$\int_0^{2\pi} dE \cdot = \int_0^{2\pi} \frac{\rho r z a_z}{4\pi\varepsilon_0 (r^2+z^2)^{3/2}} \cdot d\phi$$

$$E = \frac{\rho r z a_z}{4\pi\varepsilon_0 (r^2+z^2)^{3/2}} (2\pi - 0)$$

$$\therefore \boxed{E = \frac{\rho r z \, a_z}{2\varepsilon_0 [r^2+z^2]^{3/2}}}$$

Part-A

(1) Stokes theorem states the integral of a vector over a path or a line is equal to the integral of the curl of the vector over a surface.

$$\int_L A \cdot dl = \int_S (\nabla \times A) \cdot ds ,$$

Line Integral of a vector equals the surface integral of the curl of the vector.

(3) Solenoid $\Rightarrow \nabla \cdot B = 0$

$$\partial/\partial x \, A_x + \partial/\partial y \, A_y + \partial/\partial z \, A_z = 0$$

$$\frac{\partial}{\partial x} 25x + \frac{\partial}{\partial y} 12y + \frac{\partial}{\partial z} \alpha z = 0$$

$$25 + 12 + \alpha = 0$$

$$37 + \alpha = 0$$

$$\boxed{\alpha = -37}$$

(4) Coulomb's law states that force of attraction / repulsion b/w 2 charges is directly proportional to the product of their magnitude and inversely proportional to the square of the distance b/w them

$$F = \frac{q_1 q_2}{4\pi\varepsilon_0 R^2} \hat{a}_R$$

5) The total flux ψ ~~enclosed~~ ~~in~~ from a surface ~~equals~~ is equal to $1/\varepsilon_0$ times the total charge enclosed by that surface

$$\int_S \psi \cdot ds = \frac{Q}{\varepsilon_0}$$

2) Mag. flux Density $\vec{B}$

ELECTROMAGNETIC FIELDS ASSIGNMENT - 2

10/2/2020

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DEPARTMENT : ECE - 'B'
REGISTER NO: 311518106100
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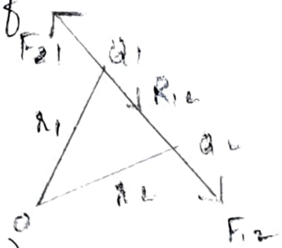
PART – B

i) State and explain coulomb's law and deduce the vector form of force equation between the two point charges.

Soln :

Coulomb's law states that the force F between two point charges Q_1 and Q_2 is :

1. Along the line joining them.
2. Directly proportional to the product $Q_1 Q_2$ of the charges.
3. Inversely proportional to the square of the distance R between them.



It is expressed as,

$$F = \frac{k Q_1 Q_2}{R^2} \quad \text{——— (1)}$$

Where k is the proportionality constant whose value depends on the choice of system of units. In SI units, charges Q_1 and Q_2 are in coulombs (c), the distance R is in meters (m), and the force F is in newtons (N) so that $k = 1/4\pi\varepsilon_0$.

The constant ε_0 is known as the permittivity of free space and has the value,

$$\left.\begin{aligned} \varepsilon_0 &= 8.854 \times 10^{-12} \simeq \frac{10^{-9}}{36\pi} \text{ F/m} \\ &\text{(or)} \\ k &= \frac{1}{4\pi\varepsilon_0} \simeq 9 \times 10^{9} \text{ m/F} \end{aligned}\right\} \text{ — (2)}$$

eq (1) becomes,

$$F = \frac{Q_1 Q_2}{4\pi\epsilon_0 R^2} \quad \text{--- (3)}$$

If point charges Q_1 and Q_2 are located at points having position vectors r_1 and r_2, then the force F_{12} on Q_2 due to Q_1, is given by

$$F_{12} = \frac{Q_1 Q_2}{4\pi\epsilon_0 R^2} a_{R_{12}} \quad \text{--- (4)}$$

where

$$R_{12} = r_2 - r_1 \quad \text{--- 5(a)}$$

$$R = |R_{12}| \quad \text{--- 5(b)}$$

$$a_{R12} = \frac{R_{12}}{R} \quad \text{--- 5(c)}$$

By substituting (5) in (4) and we may write as,

$$F_{12} = \frac{Q_1 Q_2}{4\pi\epsilon_0 R^3} R_{12} \quad \text{--- 6(a)}$$

(or)

$$F_{12} = \frac{Q_1 Q_2 (r_2 - r_1)}{4\pi\epsilon_0 |r_2 - r_1|^3} \quad \text{--- 6(b)}$$

i) the Force F_{21} on Q_1 due to Q_2 is given by

$$F_{21} = |F_{12}| a_{R21} = |F_{12}|(-a_{R12})$$

(or)

$$F_{21} = -F_{12} \quad \text{--- (7)}$$

Since

$$a_{R21} = -a_{R12}$$

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Like charges repel each other, while unlike charges attract. ~~This~~ +

3. The distance R between the charged bodies Q_1 and Q_2 must be large compared with the linear dimensions of the bodies; that is Q_1 and Q_2 must be points charges.

4. Q_1 and Q_2 must be static (at rest)

5. The signs of Q_1 and Q_2 must be taken into account in eq (4.4). For like charges, $Q_1 Q_2 > 0$. For ~~unlike~~ charges, $Q_1 Q_2 < 0$

2 ii) Write note on principle of superposition as applied to charge distribution.

If we have more than two point charges, we can use the principle of superposition to determine the force on a particular charge. The principle states that if there are N charges $Q_1, Q_2 \ldots Q_N$ located respectively, at points with position vectors $r_1, r_2, \ldots r_N$ the resultant force F on a charge Q located at a point with its position vector r is the vector sum of the forces exerted on Q by each of the charges $Q_1, Q_2, \ldots Q_N$, Hence

$$F = \frac{QQ_1(r - r_1)}{4\pi\varepsilon_0 |r - r_1|^3} + \frac{QQ_2(r - r_2)}{4\pi\varepsilon_0 |r - r_2|^3} + \ldots + \frac{QQ_N(r - r_N)}{4\pi\varepsilon_0 |r - r_N|^3}$$

(or)

$$F = \frac{Q}{4\pi\epsilon_0} \sum_{k=1}^{N} \frac{Q_k (r - r_k)}{|r - r_k|^3} \quad \text{--- (1)}$$

The electric field intensity concept is introduced

The electric field intensity (or electric field strength) E is the force that a unit positive charge experiences when placed in an electric field.

Thus,

$$E = \lim_{Q \to 0} \frac{F}{Q} \quad \text{--- (2)}$$

or simply,

$$E = \frac{F}{Q} \quad \text{--- (3)}$$

For $Q > 0$, the electric field intensity E is obviously in the direction of the force F and is measured in newtons per coulomb or volts per meter.

$$E = \frac{Q}{4\pi\epsilon_0 R^2} a_R = \frac{Q(r - r')}{4\pi\epsilon_0 |r - r'|^3} \quad \text{--- (4)}$$

(or)

$$E = \frac{Q}{4\pi\epsilon_0 r^2} a_r \quad \text{--- (5)}$$

For N point charges $Q_1, Q_2, \ldots Q_N$ located at $r_1, r_2, \ldots r_N$, the electric field intensity at point r is obtained from (1) and (3) as

$$E = \frac{1}{4\pi\epsilon_0} \sum_{k=1}^{N} \frac{Q_k (r - r_k)}{|r - r_k|^3} \quad \text{--- (6)}$$

3. Obtain the formula for the electric field intensity of an infinite long straight line carrying uniform line charge density of ρ_L.

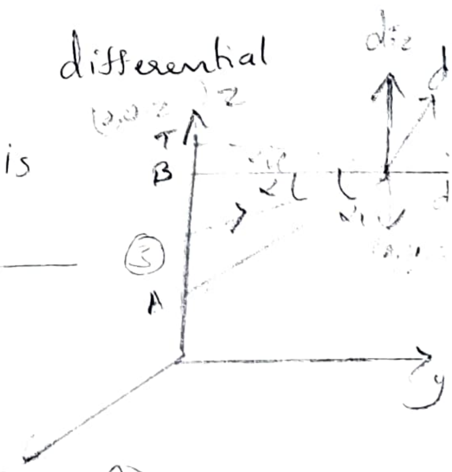
Let us assume that the line charge lies along the 'z' axis. Here we use cylindrical co-ordinates.

$$E = \frac{1}{4\pi\varepsilon_0} \int_L \rho_l \frac{R}{R^3} \, dl' \quad (V/m) \qquad \text{——— (1)}$$

Here ρ_L is constant and a line element $dl' = dz'$ is chosen to be at an arbitrary distance z' from the origin. It is most important to remember that R is the distance vector directed from the source to the field point, not the other way around. We have

$$R = a_r r - a_z z' \qquad \text{——— (2)}$$

The electric field, dE due to the differential line charge element $\rho_l \, dl' = \rho_l \, dz'$ is



$$dE = \frac{\rho_l \, dz'}{4\pi\varepsilon_0} \frac{a_r r - a_z z'}{(r^2 + z'^2)^{3/2}} \qquad \text{——— (3)}$$

$$= a_r dE_r + a_z dE_z$$

where,

$$dE_r = \frac{\rho_l r \, dz'}{4\pi\varepsilon_0 (r^2 + z'^2)^{3/2}} \qquad \text{——— (4)}$$

and $dE_z = \frac{-\rho_L z' dz'}{4\pi\epsilon_0 (r^2+z'^2)^{3/2}}$ —— (5)

In the above two eqns we have decomposed dE into its components in the a_r and a_z directions. It is easy to see that for every $\rho_L dz'$ at $+z'$ there is a charge element $\rho_L dz'$ at $-z'$, which will produce a dE with components dE_r and $-dE_z$. Hence the a_z components will cancel in the integration process, and we only need to integrate the dE_r in Eqn (4).

$$E = a_r E_r = a_r \frac{\rho_L r}{4\pi\epsilon_0} \int_{-\infty}^{\infty} \frac{dz'}{(r^2+z'^2)^{3/2}}$$

$$E = a_r \frac{\rho_L}{2\pi\epsilon_0 r} \quad (V/m) \quad \text{—— (6)}$$

The above eqn is the result for an infinite line charge.

4.
i) State and prove Gauss law.
ii) Obtain the point form of Gauss law.

Soln :

i) Gauss's law states that the total electric flux ψ through any closed surface is equal to the total charge enclosed by that surface

Thus —— (1)
Q_{enc}

i.e

$$\Psi = \oint_S d\psi = \oint_S D \cdot ds \quad \text{------} \quad (2)$$

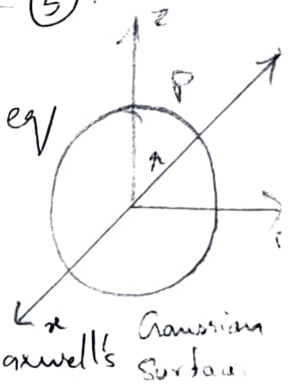
$$= \text{total charge enclosed } Q = \int_v \rho_v \, dv \quad \text{------} \quad (3)$$

(or)

$$Q = \oint_S D \cdot ds = \int_v \rho_v \, dv \quad \text{------} \quad (4)$$

By applying divergence theorem to the middle term in eq (4), we have

$$\oint D \cdot ds = \int_v \nabla \cdot D \, dv \quad \text{------} \quad (5)$$



Comparing the two volume integrals in eq (4) and (5), results in.

$$\rho_s = \nabla \cdot D \quad \text{------} \quad (6)$$

which is the first of the four Maxwell's equations. Eq (6) states that the volume charge density is the same as the divergence of the electric flux density.

1. Eqns (4) and (6) are basically stating Gauss's law in different ways; eq (4) is integral form, whereas eq (6) is the differential or point form of Gauss's law

2. Gauss's law is an alternative statement of Coulomb's law; proper application of the divergence theorem to Coulomb's law results in Gauss's law.

8. Gauss's law provides an easy means of finding E or D for symmetrical charge distributions such as a point charge, an infinite line charge, and a spherical distribution of charge.

5. Derive the expression for potential due to an electric dipole at any point P. Also find the electric field intensity and in terms of dipole moment

Soln:

An electric dipole is formed when two point charges of equal magnitude but opposite sign are seperated by a small distance.

The potential at point $p(r, \theta, \phi)$ is

$$V = \frac{Q}{4\pi\epsilon_0}\left[\frac{1}{r_1} - \frac{1}{r_2}\right] = \frac{Q}{4\pi\epsilon_0}\left[\frac{r_2 - r_1}{r_1 r_2}\right] \quad \text{——} (1)$$

where r_1 and r_2 are distances between P and Q. if $r >> d$, $r_2 - r_1 \simeq d\cos\theta$, $r_2 r_1 \simeq r^2$

eq (1) becomes.

$$V = \frac{Q}{4\pi\epsilon_0} \frac{d\cos\theta}{r^2} \quad \text{——} (2)$$

Since $d\cos\theta = d.a_r$, $d = da_z$ if we define

$$P = Qd \quad \text{——} (3)$$

as the dipole moment eq (2), may written as

$$V = P.a_r/4\pi\epsilon_0 r^2 \quad \text{——} (4)$$

The dipole moment p is directed from -Q to +Q

If the dipole center is not at the origin, but r', eq (4) becomes.

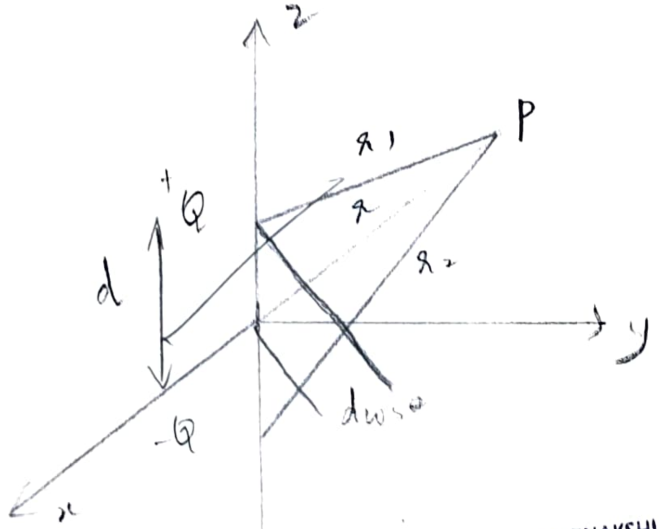
$$V(r) = \frac{p \cdot (r - r')}{4\pi \varepsilon_0 |r - r'|^3} \quad \text{—— (5)}$$

The electric field due to the dipole with centre at the origin.

$$E = -\nabla V = -\left[\frac{\partial V}{\partial r} a_r + \frac{1}{r}\frac{\partial V}{\partial \theta} a_\theta\right]$$

$$= \frac{Qd\cos\theta}{2\pi \varepsilon_0 r^3} + \frac{Qd\sin\theta}{4\pi\varepsilon_0 r^3} a_\theta$$

$$E = \frac{p}{4\pi\varepsilon_0 r^3}\left(2\cos\theta \, a_r + \sin\theta \, a_\theta\right)$$



2 marks:

1. Electric field intensity:

The experienced by a unit +ve charge placed at that particular point.

Electric field intensity is a vector quantity.

$E = F/q$

Unit: NC^{-1} (or) Vm^{-1}

2. Coulomb's law:

The force F that is experienced by 2 charges Q_1 and Q_2 is directly proportional to the product of two charges and inversely proportional to the ~~product of two charges an~~ square of the distance between the 2 charges.

(i.e) $F = \frac{k q_1 q_2}{R^2}$

$k = \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ m/F

$\varepsilon_0 = 8.854 \times 10^{-12}$

3.

Potential	Potential difference
Capability of charged body to do work. $V = \frac{W}{Q} = \frac{\text{Work done}}{\text{charge}}$	Amount of work done to carry a unit +ve charge from one point to another in an electric field. Unit is volt.

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4 Two sources of electro magnetic field:

* Electrical power supplies
* telecommunications.
* Broadcasting antennas
* microwave ovens.

5 Gauss law:

Total electric flux of closed surface = charge enclosed / permittivity

(i.e) $\oint \vec{E} \cdot d\vec{s} = \frac{1}{\varepsilon_0} q$.

PART - C

1. Determine the expression for electric field due to charge circular ring of radius r placed in xy plane with center at origin having charge density of ρ_L c/m. Find E at (0,0,5) from the circular ring of charge with radius 5m lying in z = 0 plane with center and having $\rho_L = 10$ nc/m

Consider a charged circular ring of radius r placed in xy plane with center at origin with charge density is ρ_L.

The point P is a perpendicular distance z from the ring. Consider a differential length dl. The charge on it is dQ.

$dQ = \rho_L . dl$

$$\vec{dE} = \frac{\rho_L \cdot dl}{4\pi\epsilon_0 R^2} \vec{a_R}$$

where R = distance from point P

for dl, $dl = r \cdot d\phi$

$$R^2 = r^2 + z^2$$

while $\vec{R}$ can be divided into two components (ie) distance r in the direction of $-\vec{a_r}$ radially inward.

ii) distance z in direction of $\vec{a_z}$ is

$$z\vec{a_z} : \vec{R} = -r\vec{a_r} + z\vec{a_z}$$

$$|\vec{R}| = \sqrt{r^2+z^2} \Rightarrow R^2 = r^2+z^2$$

$$\vec{a_R} = \frac{\vec{R}}{|R|} = \frac{-r\vec{a_r} + z\vec{a_z}}{\sqrt{r^2+z^2}}$$

$$\vec{dE} = \frac{\rho_L\, dl}{4\pi\epsilon_0 (r^2+z^2)} \times \frac{-r\vec{a_r} + z\vec{a_z}}{\sqrt{r^2+z^2}}$$

$$= \frac{\rho_L \cdot dl}{4\pi\epsilon_0 (r^2+z^2)^{3/2}} (-r\vec{a_r} + z\vec{a_z})$$

neglecting $\vec{a_r}$ component,

$$\vec{dE} = \frac{\rho_L \cdot dl}{4\pi\epsilon_0 (r^2+z^2)^{3/2}} z\vec{a_z}$$

$$E = \int \vec{dE} = \int_0^{2\pi} \frac{\rho_L \cdot dl}{4\pi\epsilon_0 (r^2+z^2)^{3/2}} z\vec{a_z}$$

$$= \int_0^{2\pi} \frac{\rho_L r d\phi}{4\pi\epsilon_0 (r^2+z^2)^{3/2}} z \cdot \vec{a_z}$$

$$\vec{E} = \frac{\rho_L r z}{2\pi \epsilon_0 (r^2+z^2)^{3/2}} \vec{a_z}$$

r = radius of ring z = perpendicular distance

This is electric field at a point P(0, 0, z) due to ~~ele~~ circular ring of radius r placed in xy plane.

PART - B.

1. Point charges Q_1 and Q_2 are located at (0,-4,3) and (0,1,1). If Q = 2nC. Find Q_2 such that the force on test charge at (0,-3,4) has no z component.

$$E = \frac{Q(r - r_1)}{4\pi\epsilon_0 |r - r_1|^3} + \frac{Q_2 (r - r_2)}{4\pi\epsilon_0 |r - r_2|^3}$$

$$= \frac{2\times10^{-9} ((0,-3,4) - (0,-4,3))}{4\pi\epsilon_0 |(0,-3,4) - (0,-4,3)|^3} +$$

$$\frac{Q_2 ((0,-3,4) - (0,1,1))}{4\pi\epsilon_0 |(0,-3,4) - (0,1,1)|^3}$$

$$= \frac{2\times10^{-9}(0,1,1)}{4\pi\varepsilon_0(\sqrt{2})^3} + \frac{Q_2(0,-4,1)}{4\pi\varepsilon_0|\sqrt{25}|^3}$$

$$E = 0 \Rightarrow \left[\frac{2\times10^{-9}}{(\sqrt{2})^3} + \frac{3Q_2}{(\sqrt{25})^3}\right]\frac{1}{4\pi\varepsilon_0}$$

$$= \frac{3Q_2}{(\sqrt{25})^3} = \frac{-2\times10^{-9}}{(\sqrt{2})^3}$$

$$Q = \frac{-2\times10^{-9}\times125}{3\times2}$$

$$Q_2 = -29.46\,nC$$

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ACADEMIC PERFORMANCE REPORT:

ODD SEMESTER 2018 -19

Parents/ Guardian are requested to examine this report and sign it and return to the tutor within **Three days**

NAME : Aishwarya. P ROLL NO: 03

BRANCH: EEE YEAR -IV SEM: 7

S. No.	SUBJECT	IAT I	IAT II	IAT III	Model Exam
1.	High Voltage Engineering	62	61	83	81
2.	Protection and Switchgear	74	66	90	90
3.	Special Electrical Machines	88	68	93	85
4.	Principles of Management	74	79	98	90
5.	FACTS / ~~Biomedical Instrumentation~~	60	76	80	76
6.	~~Micro Electro Mechanical Systems~~/ Microcontroller Based System Design	72	60	80	71
7.	Power System Simulation Laboratory	93	93	94	91
8.	Comprehension	92	75	89	93
Attendance up to :		21/7/18	25/8/18	22/9/18	3/10/18
No. of Working days :		30	55	78	86
No. of Days Absent :		02	02	03	03

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P.T.O

Signature With Remarks

IAT - I			
Good Class Teacher	V. Good. Keep it up HOD	Principal	Parent

IAT - II			
Good. Class Teacher	Very Good Keep it up HOD	Principal	Parent

IAT - III			
Good Class Teacher	V. Good HOD	Principal	Parent

MODEL EXAMINATION			
Good. Class Teacher	Good. HOD	Principal	Parent

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