JCT COLLEGE OF ENGINEERING AND TERCHNOLOGY

PICHANUR, COIMBATORE-641105

DEPARTMENT OF CIVIL ENGINEERING

INPLANT TRAINING

S.no	Register number	Name of the student	Name of the Company	Period
1	720918103002	ADITHYAN.D. K	CHAMUNNI ASSOCIATES, Palakkad-678007	02/08/21 to 2/09/21
2	720918103003	ALEN V S	PEE KEY BUILDERS, Anakkayam, Kerala-676509.	05/07/21 to 04/08/21
3	720918103004	AMAL RAJ	SOUBHAGYA ENGINEERING PVT LTD, Bellary, Karnataka-583104	01/09/21 to 30/09/21
4	720918103005	ASHWAN.O	SOUBHAGYA ENGINEERING PVT LTD, Bellary, Karnataka-583104	01/09/21 to 30/09/21
5	720918103006	ASLAH.P.M	SOUBHAGYA ENGINEERING PVT LTD, Bellary, Karnataka-583104	01/09/21 to 30/09/21
6	720918103007	BHAVYA.S	JK BUILDERS, Coimbatore.	20/08/21 to 22/09/21
7	720918103008	DHANUSH B	JK BUILDERS, Coimbatore.	20/08/21 to 21/09/21
8	720918103009	FAIZ MUHAMMED.N	KIRBY BUILDING SYSTEMS INDIA PVT LTD, Cochin, Kerala.	03/09/21 to 01/10/21
9	720918103011	HIJAS.A.S	KIRBY BUILDING SYSTEMS INDIA PVT LTD, Cochin, Kerala.	08/09/21 to 06/10/21
10	720918103013	JERON KISHOR J	JK BUILDERS, Coimbatore.	20/08/20 to 21/09/21

11	720918103014	LIBIN.B	ANTONY THOMAS CONTRACTING PVT LTD, Ernakulam, Kerala- 682032.	01/10/21 to 17/11/21
12	720918103015	MUHSINA.S	JK BUILDERS, Coimbatore	20/08/21 to 22/09/21
13	720918103017	NAVEEN.S	KIRBY BUILDING SYSTEMS INDIA PVT LTD, Cochin, Kerala.	03/09/21 to 01/10/21
14	720918103018	PRADEEP V	JK BUILDERS, Coimbatore.	20/08/21 to 21/09/21
15	720918103019	SOPNA.K	JK BUILDERS, Coimbatore.	20/08/21 to 21/09/21
16	720918103020	SUDHINRAJ. S	JK BUILDERS, Coimbatore.	20/08/21 to 22/09/21
17	720918103021	SYED AFSAL.M	SOUBHAGYA ENGINEERING PVT LTD, Bellary, Karnataka-583104	01/09/21 to 30/09/21
18	720918103301	AKSHAYA.K (LATERAL ENTRY)	CHAMUNNI ASSOCIATES, Palakkad	03/09/21 to 01/10/21
19	720918103302	JAYANIVEDA.T(LATERAL ENTRY)	CHAMUNNI ASSOCIATES, Palakkad	03/09/21 to 01/10/21
20	720918103901	RIZVIN AKBER (TRANSFER)	PEE KEY BUILDERS, Anakkayam, Kerala-676509.	05/07/21 to 04/08/21

HOD

JCT College of Engineering & Technology Pichanur CBE - 105.

PRINCIPAL

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PICHANUR, COIMBATORE - 641 105.

OUBHAGYA

Soubhagya Engineering Pvt. Ltd.
(An ISO 9001:2008 Certified Company)
Soubhagya Nilayam, Behind NCC Quarters, New Trunk Road,
Cantonment, Bellary, Karnataka - 583 104.
CIN : U45201KA2008PTC045654
Ph : +91 8277311132, +91 9448607161
Email : pksnair9@gmail.com
www.soubhagyaengineering.com

CERTIFICATE

This is to certify that Mr.Amal Raj(720918103004) BE Civil engineering student of JCT COLLEGE OF ENGINEERING AND TECHNOLOGY, Pichanur, Coimbatore has successfully completed industrial training program from 1st September 2021 to 30th September 2021 at this company. During this period of industrial training program with us he was found good.

Bellary, Karnataka

Sandeep S Nair
Soubhagya Engineering Pvt. Ltd.
SANDEEP
Director
Director

01.12.2021

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PEE KEY BUILDERS

PLAN, ESTIMATE, SURVEY, CONSTRUCTION AND 3D WORKS

CHEPPUR, ANAKKAYAM PO, 676509. MOB: - 98 46 90 18 59

CERTIFICATE

This is to certify that Alen VS, 720918103003, 7th semester BE Civil Engineering-student of JCT COLLEGE OF ENGINEERING AND TECHNOLOGY PICHANUR COIMBATORE has undergone Industrial training program in our firm with the presence of our Site Engineer Mr Mohammed Ashraf PK BUILDERS training was during 05/07/2021 To 04/08/2021

Mohammad Ashraf PK

Place:Cheppur

Date:06-08-2021

MOHAMED ASHRAF. P.K
PEEKEY Builders, Cheppur
Anakkayam (P.O), Mob: 9846 901 859
Licensed Building Supervisor - A
Reg. No. E/2050/08/7905/KKD/131/2015/SA
Department of Urban Affairs
Govt. of Kerala

JCT College of Engineering & Technology Pichanur CBE - 105

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PICHANUR, COIMBATORE - 641 105.

Chamunni Associates

BUILDERS & DESIGNERS

G-15, Panjajanyam, Gandhi Nagar Colony, Chandranagar P.O.
Palakkad - 678 007. Phone : 9447531862

Date : 10.09.2021

This is to certify that ***Mr. Adithyan D.K., Register No. 720918103002,*** *BE Civil Engineering (2018-2022) of JCT College of Engineering and Technology, for the Industrial Training done on the study and practical in basement building and structural development in our concerned firm for 31 days (2.8.2021 to 2.9.2021).*

He has cooperated with us and given his best performance in the field.

For ***Chamunni Associates***

CHAMUNNY. N
REGISTERED SUPERVISOR-B
Reg. No: E-2050/08/16165/KKD/718/2019/SB
Department of Urban Affairs (Govt. of Kerala)
Mob: 9447531862

JCT College of Engineering & Technology
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JCT COLLEGE OF ENGINEERING AND TERCHNOLOGY

PICHANUR, COIMBATORE-641105

NAAC A GRADE

CONSOLIDATED REPORT OF INDUSTRIAL VISIT ATTENDED BY STUDENTS

ACADEMIC YEAR 2021-2022

S.NO.	Department	Total no. Of industries visited by students
1.	Civil Engineering	1
2.	Electronics and Communication Engineering	1
3.	Petroleum Engineering	1
4.	Food Technology	2

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JCT COLLEGE OF ENGINEERING AND TERCHNOLOGY

PICHANUR, COIMBATORE-641105

DEPARTMENT OF CIVIL ENGINEERING

S.NO	NAME	YEAR/SEM	NAME OF THE COMPANY	ATTENDED PERIOD	NO OF DAYS
1	720920103001	ABILASH NARAYANAN.J	Water Intec 2022@CODISSIA	4/9/2022	ONE DAY
2	720920103002	ABISHEK V K			
3	720920103003	AKSHATHA S			
4	720920103004	FATHIMA ROSNA K			
5	720920103005	FELIKS ANTONY A			
6	720920103006	SARATH B			
7	720920103008	VISHNU DAS R			
8	720920103301	AGARSH.U			
9	720920103302	AKHIL RAJ. CS			
10	720920103303	ARAVINTHAN. S			
11	720920103306	DEEKSHITHA.B			
12	720920103307	DHARANYA.D			
13	720920103308	DIVYA.N			
14	720920103309	DIVYA NARAYANAN			
15	720920103310	DODDALA VAISHNAVI			
16	720920103314	BASKER.K			
17	720920103315	LIKESWARA RAO. A			
18	720920103316	MOHAN NARAYANA. J			
19	720920103317	SAI KUMAR. M			
20	720920103318	SELVA PRASATH.S			
21	720920103320	SOORYADAS.H			
22	720920103325	YAMUNA.B			
23	720920103327	GOUTHAMKRISHNA.U			
24	720919103002	ANAGHA KP			
25	720919103004	BHAGYA.S			
26	720919103006	NITHISHKUMAR J			
27	720919103007	RAJAGOPALT			
28	720919103008	VISHNUMAYA KP			
29	720919103009	VISHWA A			
30	720919103301	EFAKKILM			
31	720919103302	GODWIN PETER			
32	720919103303	KAPILS			
33	720919103304	PRADEEPM			
34	720919103305	VISHNU			
35	720919103307	BALAJIR			
36	720919103308	KAVIYASELVANK			
37	720919103309	SUHAILO Y			

STAFF COORDINATOR

HOD

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Pichanur, Coimbatore – 641 105

DEPARTMENT OF CIVIL ENGINEERING

07/04/2022
Coimbatore – 641105.

From

The Head of the Department,
Department of Civil Engineering,
JCT College of Engineering and Technology,
Coimbatore – 641105.

Permitted.

To

The Principal,
JCT College of Engineering and Technology,
Coimbatore – 641105.

Respected Sir,

Subject: Water Intec 2022 @ CODISSIA visit on 9th April 2022 – Reg.

In our Civil Engineering department, we are planned to go for "Water Intec 2022" in CODISSIA on 9th April 2022 for 2nd and 3rd year students. This visit is very useful to our students, they are studying Water and Waste Water Engineering subjects. Hence, I kindly request you to permit them to visit this exhibition and provide transportation facility.

IInd Year Students – 15Boys + 8 Girls = 23 (including 9 hostellers)

IIIrd Year Students – 9 Boys + 3 Girls = 12 (including 4 hostellers)

Total no. Of Students are 35.

Thanking you,

Yours Sincerely,

HOD/CIVIL

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

MAIN PROJECT LIST

S.NO	REG NO	NAME	BATCH	TITLE	PROJECT GUIDE
1.	720918105002	Adwaith.N	I	IoT Based Solar Powered Agri Spraying Robot Using Lora	A.Kavyalakshmi
2.	720918105003	Afhas Ali P M			
3.	720918105007	Ansar Mohamed.S			
4.	720918105008	Arunkumar.J			
5.	720918105004	Ajayraj.R	II	IoT Based Home Automation Using Android	Angel Joseph.P
6.	720918105006	Amal.S			
7.	720918105017	Sreeraj.M			
8.	720918105018	Thilagesh.T			
9.	720918105009	Dawn Shaju	III	Wireless Electric Vehicle Battery Charging System	S.Umarmuktar
10.	720918105013	Muhammed Ansari.J			
11.	720918105016	S.Mohammed Haneefa			
12.	720918105302	Rishikesh K P			
13.	720918105010	Gomathi.M	IV	IoT Assert Tracking System	D.Nagarajan
14.	720918105011	Kannan.S			
15.	720918105012	Karthikeyan M			
16.	720918105901	Vasantharaja A			
17.	720918105014	Muralidharan R	V	IoT Based Gas Pipe Leakage Detector Using Insect Rbot	P.Sam Jasper
18.	720918105015	Pugazhenthi S			
19.	720918105019	Vivek M			
20.	720918105303	Subash A			

PROJECT COORDINATOR

Dr. K.GEETHA, M.E.,Ph.D.,
Dean - Academics & Research
JCT College of Engineering And Technology
COIMBATORE - 641 105

PRINCIPAL
JCT College of Engineering and Technology
PICHANUR, COIMBATORE - 641 105.

IoT BASED SOLAR POWERED AGRI SPRAYING ROBOT USING LORA

A PROJECT REPORT

Submitted by

ADWAITH.N	720918105002
AFHAS ALI.P.M	720918105003
ANSAR MOHAMED.S	720918105007
ARUNKUMAR.J	720918105008

In partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

In

ELECTRICAL AND ELECTRONICS ENGINEERING

JCT COLLEGE OF ENGINEERING AND TECHNOLOGY,

PICHANUR, COIMBATORE –641105

ANNA UNIVERSITY: CHENNAI 600025

JUNE 2022

ANNA UNIVERSITY: CHENNAI 600025

BONAFIDE CERTIFICATE

Certified that this project report "**IoT BASED SOLAR POWERED AGRI SPRAYING ROBOT USING LORA**" is the bonafide work of "**ADWAITH.N, AFHAS ALI.P.M, ANSAR MOHAMED.S, ARUNKUMAR.J**" who carried out the project work under my supervision.

SIGNATURE

Dr. K. GEETHA M.E. ,Ph. D

HEAD OF THE DEPARTMENT

Department of EEE

JCT College of Engg&Tech

Pichanur, Coimbatore-641105.

SIGNATURE

Ms. A. KAVYALAKSHMI. M.E.

SUPERVISOR

Department of EEE

JCT College of Engg&Tech

Pichanur,Coimbatore-641105.

Submitted for the Project viva-voce held on 23-06-2022

23/6/22

INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

A majority of the population of developing countries is associated with agriculture directly or indirectly. The liaison of engineering technology and Sustainable Development Goals (SDGs) can build a bridge for farmers to enhance their skills regarding advancements through future generation agriculture trends. The next-generation trends include better soil preparation, intelligent irrigation systems, advanced methods of crop nutrient inspection, smart fertilizers applications, and multi-cropping practices. This work proposes a smart Decision Support System (DSS) that acquires the input parameters based on real-time monitoring to optimize the yield that realizes sustainability by improving per hectare production and lessening water seepage wastage in agribusiness. The proposed model comprises three basic units including an intelligent sensor module, smart irrigation system and controlled fertilizer module. The system

has integrated sensors, cloud employing decision support layers, and networking based DSS to recommend cautions for optimum sustainable yield. The intelligent sensors module contains a temperature and humidity sensor, NPK sensor, soil moisture sensor, soil conductivity sensor,

and pH sensor to transmit the statistics to the cloud over the internet via Long Range (LoRa) using Serial Peripheral Interface (SPI) communication protocol. Moreover, an android application has been developed for real-time data monitoring according to GPS location and node information (accessed remotely). Furthermore, the DSS contemplates the accessible information from sensors, past patterns, monitoring climate trends and creating cautions required for sustainable fertilizer consumption. The presented results and comparison validate

the novelty of the design as it embraces smart irrigation with smart control and smart decision-making based on accurate real-time field data. It is better than existing systems as it transmits the data over the LoRa that is an open-source communication with long-range transmission ability up to several kilometres. The sensor nodes helped in advancing the yield of crops, which resulted in achieving inclusive and sustainable economic goals.

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

The prototype of the project has shown that the farmer is able to spray the pesticides to the crops by this robotic model without any harm. This project solves real time crucial problem faced in agriculture. This system is quite affordable and feasible and also is adjusted according to the need of varieties of crop to spray pesticide. This project is economical and can be easily implemented in real time, thus balancing both the cost and benefits.

In future, this proposed model can be enhanced by adopting new advanced computer technology, we can make a full automatic spray. And implementing the telescopic nozzle we can adjust the length of the spray required . Also using the hydraulics system to the wheel, helps in varying the ground clearance.

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NBA NAAC A GRADE

CONSOLIDATED MINI PROJECT LIST

ACADEMIC YEAR (2021-2022)

S.NO	NAME OF THE DEPARTMENT	NO OF BATCHES
1	Civil Engineering	4
2	Electrical and Electronics Engineering	4

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

MODEL LIST

S.NO	BATCH NO	REG NO	NAME OF THE STUDENT	TITLE	GUIDE NAME
1	I	720919105019	Dhiraj Kumar Pandit	IoT based door lock system	MR.NAGARAJAN.D,AP/EE
2		720919105006	Sathish Kumar R		
3		720919105004	Madhavan V		
4		720919105005	Praveen Kumar P		
5	II	720919105001	Akilan M	Load frequency of two areas power system	MR.LOHESWARAN.S, AP/EEE
6		720919105003	Lino K V		
7		720919105301	Harihara Sudhan M		
8		720919105305	Vibin M		
9	III	720919105302	Mohmmed Imran J	Comparison of algorithm in PV system	MS.KAVYALAKSHMI.A,AP/EEE
10		720919105024	Hari Kishor Kumar		
11		720919105303	Maris Rahul K		
12		720919105304	Varun Ps		
13	IV	720919105029	Mantu Kumar	Half wave rectifier with filter circuits	MR.PRASANTH.R.K/AP/EEE
14		720919105007	Syam S		
15		720919105008	Vimal A		
16		720919105009	Vishnuraj C		

PROJECT COORDINATOR

HOD

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Dr. K.GEETHA, M.E.,Ph.D.,
Dean - Academics & Research
JCT College of Engineering And Technology
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PICHANUR, COIMBATORE - 641 105.

ANNA UNIVERSITY: CHENNAI 600025

BONAFIDE CERTIFICATE

Certified that this project report "**COMPARISON OF ALGORITHMS IN PV SYSTEM**" is the bonafide work of "**HARI KISHOR KUMAR, MOHMMED IMRAN J, MARIS RAHUL K, VARUN PS**" who carried out the project work under my supervision.

SIGNATURE
Dr. K. GEETHA M.E., Ph.D.,
HEAD OF THE DEPARTMENT
Department of EEE
JCT college of Engg & Tech
Pichanur, Coimbatore-641105

SIGNATURE
A. KAVYALAKSHMI M.E
ASSISTANT PROFESSOR
Department of EEE
JCT college of Engg & Tech
Pichanur, Coimbatore-641105

Submitted for the project viva-voce held on 25-06-2022

INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

In the photovoltaic system the load connected is nonlinear which creates harmonics in the panel during the maximum power point tracking (MPPT). This is one among the main causes for the efficiency drop in maximum power point tracking (MPPT). There is a wide spectrum or discrete frequencies of harmonics produced by the inverter. If the harmonics created by the inverter are reduced, the efficiency of PV panel can be maintained. At constant duty cycle, applying fast sampling rate will increase the system efficiency and also increases the harmonics production with increased output voltage.

In the proposed system, perturb and observe algorithm and incremental conductance algorithms are used to reduce the harmonics in the PV system, in order to maintain the efficiency of the photovoltaic system. In perturb and observe algorithm, the voltage is perturbed in forward direction and then in reverse directions towards maximum power point. In incremental conductance algorithm, the voltage and current is taken as feedback to achieve maximum power. By employing random sampling interval between slow and fast, the interharmonics can be effectively reduced. The performance and effectiveness are validated experimentally based on the reduced level of harmonics and efficiency of MPPT in PV system.

CHAPTER 7

CONCLUSION

The disadvantage of Perturb and Observe method to track the peak power accurately under fast varying atmospheric conditions is overcome by incremental conductance method. The output voltage of Incremental Conductance is high. Total Harmonic Distortion created is low while using Incremental Conductance MPPT Algorithm when compared with P&O algorithm. By implementing random samplings the interharmonics are reduced. The efficiency is also maintained by the usage of Incremental conductance algorithm.

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PICHANUR, COIMBATORE-641105

PEER GROUP LEARNING

Academic Year (2021-22)

S.No	Name of the Department	Total no of groups
1	Automobile Engineering	4
2	Civil Engineering	7
3	Computer science and Business Systems	3
4	Computer science Engineering	14
5	Electronics and Communication Engineering	8
6	Electrical and Electronics Engineering	12
7	Mechanical Engineering	18
8	Food technology	22
9	Petro Chemical Engineering	27
10	Petroleum Engineering	17

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PARTICIPATIVE LEARNING (GROUP/PEER LEARNING)

VENUE: II EEE CLASSROOM **DATE:11.04.2022** **TIME:3.45PM**

Class Coordinator: Mr.D.Nagarajan **Academic Year: 2021-2022 (Even)**

S.No	Register No	Name of the student	Group Leader
1	720920105003	Chhotu Kumar	PG 1
2	720920105014	Ritik Kumar	PG 2
3	720920105312	GudipatiManasa	PG 3
4	720920105313	Anumala Venkata Santhosh	PG 4

S.No	Points Discussed	Action taken
1	Group Formation and changes	Informed to form peer group by their own interest-Group Finalized
2	Attendance Maintenance-Daily attendance needs maintenance	Class advisor meeting arranged in the class to avoid late comers, absentees and maintenance proper attendance
3	Exam Results- Reducing total arrears	Concentration on 2 Marks and 16 Marks of previous year and presentation in university exams.
4	Difficulty in facing current semester subjects	Important questions with answers, short notes will be given and additional classes will be arranged
5	Slip test- Give time to study half an hour	Time given 20 minutes to study in the class
6	Internal test-Need help from staff during study hour	Staffs are informed to be present in class to help the students before the exam starts for their subjects.
7	Project domain, project group	Guidelines given to the students to choose the domain as well as project guide based on domain.

HOD

Dr. K.GEETHA, M.E.,Ph.D.,
Dean - Academics & Research
JCT College of Engineering And Technology
COIMBATORE - 641 105

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PICHANUR, COIMBATORE-641105

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CLASS GROUP LIST

S.NO	PEER GROUP	NAME OF THE STUDENT
1	PG I	CHHOTU KUMAR/ PG 1 LEADER Abdul Karim Ansari Jarwan Kumar Jayaprakash A Lakhindar Kumar
2	PG 2	RITIK KUMAR /PG 2 LEADER Mridhul Raju Prince Kumar Gupta Sanoj Kumar
3	PG 3	GUDIPATI MANASA/PG 3 LEADER Vishnu B Amarnath M Ashiq S Aswin R Ayyappadas Km Dikul
4	PG 4	ANUMALA VENKATA SANTHOSH / PG 4 LEADER Fuhad K Harikrishnan T Reshma G Srikanth M

HOD

Dr. K.GEETHA, M.E.,Ph.D.,
Dean - Academics & Research
JCT College of Engineering And Technology
COIMBATORE - 641 105

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PICHANUR, COIMBATORE-641105

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PARTICIPATIVE LEARNING (GROUP/PEER LEARNING)

Venue: III EEE CLASSROOM **Date:11.04.2022** **Time:3.45PM**

Class Coordinator: Sam Jasper.P **Academic Year: 2021-2022 (Even)**

S.No	Register No	Name of the student	Group Leader
1	720919105008	Vimal A	PG 1
2	720919105001	Akilan M	PG 2
3	720919105003	Lino K V	PG 3
4	720919105004	Madhavan V	PG 4

S.No	Points Discussed	Action taken
1	Group Formation and changes	Informed to form peer group by their own interest-Group Finalized
2	Attendance Maintenance-Daily attendance needs maintenance	Class advisor meeting arranged in the class to avoid late comers, absentees and maintenance proper attendance
3	Exam Results- Reducing total arrears	Concentration on 2 Marks and 16 Marks of previous year and presentation in university exams.
4	Difficulty in facing current semester subjects	Important questions with answers, short notes will be given and additional classes will be arranged
5	Slip test- Give time to study half an hour	Time given 20 minutes to study in the class
6	Internal test-Need help from staff during study hour	Staffs are informed to be present in class to help the students before the exam starts for their subjects.
7	Project domain, project group	Guidelines given to the students to choose the domain as well as project guide based on domain.

HOD

Dr. K.GEETHA, M.E.,Ph.D.,
Dean - Academics & Research
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CLASS GROUP LIST

S.NO	PEER GROUP	NAME OF THE STUDENT
1	PG I	VIMAL A/ PG 1 LEADER Akilan M Lino K V Madhavan V Vimal A
2	PG 2	HARI KISHOR KUMAR/ PG 2 LEADER Praveen Kumar P Sathish Kumar R Syam S
3	PG 3	VARUN PS/ PG 3 LEADER Vishnuraj C Dhiraj Kumar Pandit Mantu Kumar Varun Ps
4	PG 4	VIBIN M/ PG 4 LEADER HariharaSudhan M Mohmmed Imran J Maris Rahul K Vibin M

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PARTICIPATIVE LEARNING (GROUP/PEER LEARNING)

Venue: IV EEE CLASSROOM **Date:11.04.2022** **Time:3.45PM**

Class Coordinator: Umar Muktar **Academic Year: 2021-2022 (Even)**

S.No	Register No	Name of the student	Group Leader
1	720918105016	S.MohammedHaneefa	PG 1
2	720918105018	Thilagesh.T	PG 2
3	720918105019	Vivek.M	PG 3
4	720918105303	Subash A	PG 4

S.No	Points Discussed	Action taken
1	Group Formation and changes	Informed to form peer group by their own interest-Group Finalized
2	Attendance Maintenance-Daily attendance needs maintenance	Class advisor meeting arranged in the class to avoid late comers, absentees and maintenance proper attendance
3	Exam Results- Reducing total arrears	Concentration on 2 Marks and 16 Marks of previous year and presentation in university exams.
4	Difficulty in facing current semester subjects	Important questions with answers, short notes will be given and additional classes will be arranged
5	Slip test- Give time to study half an hour	Time given 20 minutes to study in the class
6	Internal test-Need help from staff during study hour	Staffs are informed to be present in class to help the students before the exam starts for their subjects.
7	Project domain, project group	Guidelines given to the students to choose the domain as well as project guide based on domain.

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CLASS GROUP LIST

S.NO	PEER GROUP	NAME OF THE STUDENT
1	PG I	**S.MOHAMMED HANEEFA / PG1 LEADER** Adwaith.N Afhas Ali P M Ajayraj.R Amal. S
2	PG 2	**THILAGESH.T/ PG2 LEADER** Anzar Mohamed S Arunkumar J Dawn Shaju Gomathi M
3	PG 3	**VIVEK.M / PG 3 LEADER** Kannan.S Karthikeyan M Muhammed Ansari.J Muralidharan R
4	PG 4	**SUBASH A/ PG 4 LEADER** Pugazhenthi S Sreeraj.M Rishikesh K P Vasantharaja A

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
COACHING CLASS SCHEDULR
ACADEMIC YEAR (2021-2022)

Day/Year	II YEAR	III YEAR	IV YEAR
Monday	Electrical Machines II/ D.nagarajan	Intellectual Property Rights/A.kavyalakshmi	Micro Controller Based Sysrem Design/Dr.K.Geetha
Tuesday	Control Syatem/Umar Muktar	Protection and Switch Gear/D.nagarajan	Electric Energy Generation, Utilization and Conservation/Umar Muktar
Wednesday	Numerical Methods/ Senthil Prabhu.T	Embedded System/S.Loheswaran	NIL
Thursday	Transmission and Distribution/ A.kavyalakshmi	Special electrical Machines/Umar Muktar	NIL
Friday	Linear Integrated Circuits and Applications/P.Angel Joseph	Solid State Drives/P.Sam Jasper	NIL
Saturday	Measurements and Instrumentation/P.Sam Jasper	NIL	NIL

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ATTENDANCE LIST
ACADEMIC YEAR (2021-2022)/ II YEAR
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DATE			11/4	12/4	13/4	18/4	19/4	20/4	21/4	22/4	23/4	25/4	26/4	27/4
S.NO	REG NO	NAME OF THE STUDENT												
1	720920105001	Abdul Karim Ansari	/	/	/	/	/	a	/	/	/	/	/	/
2	720920105004	Jarwan Kumar	/	/	/	/	/	/	/	/	/	/	/	/
3	720920105005	Jayaprakash A	/	/	/	/	/	/	a	/	/	/	/	/
4	720920105007	Lakhindar Kumar	/	/	/	/	/	/	/	/	/	/	/	/
5	720920105010	Md Saddam Hussain	/	/	/	/	/	/	/	/	/	a	/	/
6	720920105011	Mridhul Raju	/	/	/	/	/	/	/	/	/	/	/	/
7	720920105012	Prince Kumar Gupta	a	/	/	/	/	/	/	a	/	/	/	/
8	720920105015	Sanoj Kumar	/	/	/	a	/	/	a	a	/	/	/	a
9	720920105016	Saravanan B	/	/	/	a	/	/	/	/	/	/	/	/
10	720920105017	Sarvesh Kumar	/	/	/	/	/	/	/	/	/	a	/	/
11	720920105018	Shahabuddin Mansuri	/	/	/	/	/	/	/	/	/	/	/	/
12	720920105019	Sijil Johnson	/	/	/	/	/	/	/	/	/	/	/	/
13	720920105021	Vishnu B	/	/	/	/	/	/	/	/	/	/	/	/
14	720920105301	Amarnath M	a	/	/	/	/	a	/	/	/	/	/	/
15	720920105302	Ashiq S	/	/	/	/	a	/	/	/	/	/	/	/
16	720920105303	Aswin R	/	/	/	/	/	/	/	/	/	/	/	/
17	720920105304	Ayyappadas Km	/	/	/	/	/	/	/	/	a	/	/	/
18	720920105305	Dikul	/	/	a	/	/	/	/	/	/	/	/	/
19	720920105306	Fuhad K	/	/	/	/	/	/	/	/	/	/	/	/
20	720920105308	Harikrishnan T	/	/	/	/	/	/	/	/	/	/	/	/
21	720920105310	Reshma G	/	a	/	/	/	/	/	/	/	/	/	/

22	720920105311	Srikanth M	/	/	/	/	/	/	/	/	/	/	/	/	/	
23	720920105003	Chhotu Kumar	/	/	/	/	a	/	/	/	/	a	/	/		
24	720920105014	Ritik Kumar	a	/	/	/	/	/	/	/	/	a	/	/		
25	720920105312	Gudipati Manasa	/	/	/	/	/	/	/	/	/	/	/	/		
26	720920105313	Anumala Venkata Santhosh	/	/	/	/	/	/	/	a	/	/	/	/		

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S.No	Name of the student	Year/ sem	Name of the Event	Name of the topic	Date
1	Hari Kishore Kumar	III/V	Seminar	I.D.E.A- Sustainable solar challenge 2022	31.05.2022
2	Hari Kishore Kumar	III/V	Seminar	Smart Meter implementation survey	6.8.2021
3	Vibin	III/V	Seminar	Smart Meter implementation survey	6.8.2021
4	Syam	III/V	Seminar	Smart Meter implementation survey	6.8.2021
5	Lino	III/V	Seminar	Smart Meter implementation survey	6.8.2021
6	Vivek.M	IV/VII	Seminar	Smart Meter implementation survey	6.8.2021
7	Muhammed Ansari.J	IV/VII	Seminar	Smart Meter implementation survey	6.8.2021
8	Pugazhenthi S	IV/VII	Seminar	Smart Meter implementation survey	6.8.2021
9	Hari Kishore Kumar	III/V	National level Quiz	Python Programming	10.09.2021
10	Mantu kumar	III/V	National level Quiz	Python Programming	10.09.2021
11	Sanoj Kumar	III/V	National level Quiz	Python Programming	10.09.2021
12	Ritik Kumar	III/V	National level Quiz	Python Programming	10.09.2021
13	Md Saddan Hussain	III/V	National level Quiz	Python Programming	10.09.2021
14	Hari Kishor Kumar	III/V	International Webinar	Electrifying Everything	8.10.2021
15	Mantu kumar	III/V	International Webinar	Electrifying Everything	8.10.2021
16	Saravanan	II/III	International Webinar	Electrifying Everything	8.10.2022
17	Hari Kishor Kumar	III/V	Online Quiz	Electromagnetic Field Theory	9.10.2021

18	Marris Rahul	III/V	Online Quiz	Electromagnetic Field Theory	9.10.2021
19	Vibin	III/V	Online Quiz	Electromagnetic Field Theory	9.10.2021
20	Syam	III/V	Online Quiz	Electromagnetic Field Theory	9.10.2021
21	Varun	III/V	Online Quiz	Electromagnetic Field Theory	9.10.2021
22	Akilan	III/V	Online Quiz	Electromagnetic Field Theory	9.10.2021
23	Madhavan	III/V	Online Quiz	Electromagnetic Field Theory	9.10.2021
24	Hari Kishor Kumar	III/V	Quiz	Energy Conservation	22.10.2021
25	Marris rahul	III/V	Quiz	Energy Conservation	22.10.2021
26	Varun	III/V	Quiz	Energy Conservation	22.10.2021
27	Madhavan	III/V	Quiz	Energy Conservation	22.10.2021
28	Mantu kumar	III/V	Quiz	Energy Conservation	22.10.2021

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Perambalur - 621212, Tamilnadu

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

This is to certify that Akilan in 3rd EEE of Jct college of engineering and technology has actively participated in ONLINE QUIZ on "ELECTROMAGNETIC FIELD THEORY" Organized by DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING, DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE(AUTONOMOUS), PERAMBALUR on 09.10.2021.

Co-ordinator
(Mrs.K.PREETHA)

HOD/EEE
(Dr.K.ANBARASAN)

PRINCIPAL
(Dr.S.DURAIRAJ)

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Certificate

OF PARTICIPATION

This is to Certify that **Md Saddam Hussain** has participated and successfully completed online **'National Level Quiz on Python Programming'** Organized by **Sigma Institute of Engineering**, Vadodara, Gujarat.

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Dr. Sheshang Degadwala
Head of the Department

Dr. Priyesh P. Gandhi
Principal

Dr. Harsh Shah

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Department of Electrical and Electronics Engineering
CERTIFICATE OF PARTICIPATION

This is to Certify that

Varun

Jct college of engineering and technology

Has actively participated in the Quiz entitled ***"Energy Conservation "*** organized by Department of Electrical and Electronics Engineering, JCT College of Engineering and Technology, Coimbatore on **22nd October- 2021**

Organizer	Convenor	Principal
Mr.S.Umar Muktar	Dr.Geetha K	Dr. Arulkarthick V J
Assistant Professor/EEE	Dean Academics and Research	JCTCET

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
ACADEMIC YEAR: 2021-2022
TUTORIAL LIST
ODD SEMESTER

S.NO	YEAR	SUBJECT CODE	SUBJECT TITLE	NAME OF THE STAFF
1	II - EEE	EE8391	Electro Magnetic Theory	Anbuchandran S
2	III - EEE	EE8501	Power System Analysis	Stephen
3	IV- EEE	EE8702	Power System Operation and Control	Soshya C

EVEN SEMESTER

S.NO	YEAR	SUBJECT CODE	SUBJECT TITLE	NAME OF THE STAFF
1	II -EEE	EE8411	Electrical Machines -II	D.Nagarajan

HØD

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UNIT-I

ELECTROSTATICS-I.

Electromagnetic field is a physical field produced by electrically charged particles. This field is the combination of electric field and magnetic field.

Vector analysis:-

Any physical quantity can be represented either as a scalar or vector. "A quantity is characterised only by magnitude is called scalar.

Eg:- mass, time, temperature and electric potential.

A quantity that is characterised both by magnitude and direction is called vector.

Eg:- Force, velocity, electric field intensity and electric flux density.

A vector can be represented geometrically by an arrow whose direction is appropriately chosen. If at each point of a region there is corresponding value of some physical function, the region is called field.

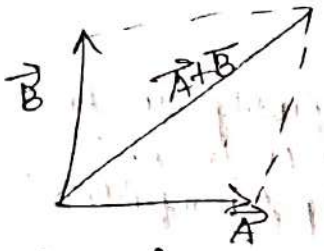
If a scalar quantity is specified in a region then the region is said to be scalar field.

Eg:- Atmospheric temperature and pressure.

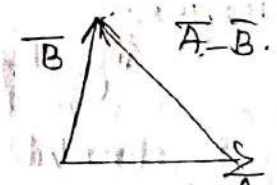
If a vector quantity is specified in a region then the region is said to be vector field.

Eg:- Gravitational force and wind velocity

Sum and difference of two vectors:-



Summation of two vectors.



Difference of two vectors.

Let vectors A and B are represented in three dimensional axes.

$$\overline{A} = A_x \overline{a}_x + A_y \overline{a}_y + A_z \overline{a}_z$$

$$\overline{B} = B_x \overline{a}_x + B_y \overline{a}_y + B_z \overline{a}_z$$

$$\text{Sum} \Rightarrow \overline{A} + \overline{B} = (A_x + B_x)\overline{a}_x + (A_y + B_y)\overline{a}_y + (A_z + B_z)\overline{a}_z$$

$$\text{Difference} \Rightarrow \overline{A} - \overline{B} = (A_x - B_x)\overline{a}_x + (A_y - B_y)\overline{a}_y + (A_z - B_z)\overline{a}_z$$

Multiplication of scalar and vector:-

When a vector is multiplied by a scalar a new vector is produced whose direction is same as the original vector and magnitude is the product of

magnitudes of vector and scalar.

$\bar{A} = a\bar{B}$

where A is new vector
B is given vector
a is given scalar.

Scalar Multiplication :-

When a vector is multiplied by a scalar a new

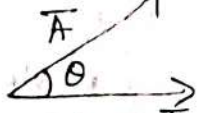
Scalar multiplication :-

Scalar quantity whose magnitude is the product of magnitudes of vectors multiplied by the cosine of angle between them. It is referred as dot product.

Let $\bar{A}$ and $\bar{B}$ be two vectors.

Vector product (dot product) is given by

$$\bar{A} \cdot \bar{B} = AB\cos\theta.$$



It obey's commutative law

$$\bar{A} \cdot \bar{B} = \bar{B} \cdot \bar{A}$$

Let $\bar{A} = A_x \bar{a}_x + A_y \bar{a}_y + A_z \bar{a}_z$

$\bar{B} = B_x \bar{a}_x + B_y \bar{a}_y + B_z \bar{a}_z$.

$$\bar{A} \cdot \bar{B} = (A_x \bar{a}_x + A_y \bar{a}_y + A_z \bar{a}_z) \cdot (B_x \bar{a}_x + B_y \bar{a}_y + B_z \bar{a}_z)$$

$$= A_x B_x + A_y B_y + A_z B_z.$$

$$\bar{a}_x \cdot \bar{a}_x = \bar{a}_y \cdot \bar{a}_y = \bar{a}_z \cdot \bar{a}_z = 1$$
$$\bar{a}_x \cdot \bar{a}_y = \bar{a}_y \cdot \bar{a}_z = \bar{a}_z \cdot \bar{a}_x = 0.$$

Vector multiplication :-

Defined as vector whose magnitude is the product of magnitudes of two vectors and the sine of angle between them. This multiplication is called "cross product"

Let A and B be two vectors.

$$A = A_x \bar{a}_x + A_y \bar{a}_y + A_z \bar{a}_z$$

$$B = B_x \bar{a}_x + B_y \bar{a}_y + B_z \bar{a}_z.$$

where $\bar{a}_x, \bar{a}_y, \bar{a}_z$ are unit vectors in the direction of x, y and z respectively.

$$|A \times B| = AB\sin.$$

$$A \times B = \begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$$

The vector $B \times A$ has the same magnitude but opposite direction.

$$B \times A = -A \times B.$$

Differentiation :-

The differential vector operator ∇ is called del or nabla defined as

$$\nabla = \frac{\partial}{\partial x}\bar{a}_x + \frac{\partial}{\partial y}\bar{a}_y + \frac{\partial}{\partial z}\bar{a}_z.$$

There are 8 possible operations with ∇.

Gradient :-

The gradient of any scalar function is the maximum space rate of change of that function. If the scalar V represents electric potential, ∇V represents potential gradient.

$$\nabla V = \frac{\partial V}{\partial x}\bar{a}_x + \frac{\partial V}{\partial y}\bar{a}_y + \frac{\partial V}{\partial z}\bar{a}_z .$$

Gradient of a scalar is vector.

2. Divergence :-

The divergence of a vector 'A' at any point is defined as the limit of its surface integrated per unit volume as the volume enclosed by the surface shrinks to zero.

$$\nabla \cdot A = \lim_{v \to 0} \frac{1}{v} \oiint_S A \cdot \bar{n} \cdot ds .$$

It can be expressed as

$$\nabla \cdot A = \left(\bar{a}_x \frac{\partial}{\partial x} + \bar{a}_y \frac{\partial}{\partial y} + \bar{a}_z \frac{\partial}{\partial z}\right)$$

$$\left(\bar{a}_x A_x + \bar{a}_y A_y + \bar{a}_z A_z\right) .$$

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

This operation is called divergence.

$\boxed{\nabla \cdot A = \text{div} A}$

Divergence of a vector is scalar.

Divergence indicates the spreading & diverging of quantity from a point.

Eg ⇒ (i) leaking air from a ballon yields positive divergence.

(ii) Rushing of air into drum under the carriage of train yields negative divergence.

3. Curl :-

The curl of a vector A at any point is defined as, limits of its surface integral of its cross product with normal over a closed surface per unit volume as the volume shrinks to zero.

$$|\text{curl } A| = \lim_{v \to 0} \frac{1}{v} \oiint_S \bar{n} \times A \cdot ds .$$

It can be expressed as

$$\nabla \times A = \left(\frac{\partial A_z}{\partial y} - \frac{\partial A_y}{\partial z}\right)\bar{a}_x + \left(\frac{\partial A_x}{\partial z} - \frac{\partial A_z}{\partial x}\right)\bar{a}_y$$

$$+ \left(\frac{\partial A_y}{\partial x} - \frac{\partial A_x}{\partial y}\right)\bar{a}_z .$$

$$\nabla \times A = \begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ A_x & A_y & A_z \end{vmatrix}$$

This operation is called curl

$\nabla \times A$ = curl A.

curl indicates a measure of the tendency of a vector to rotate or twist.

Eg:- When a leaf floats in sea water and its rotation is about x-axis the curl of $\bar{q}$ velocity is in x direction.

Solenoidal and Irrotational vectors:-

A vector $\bar{A}$ is said to be solenoidal if its divergence is zero.

(i.e) If $\nabla \cdot \bar{A} = 0$, then $\bar{A}$ is said to be solenoidal.

A vector $\bar{A}$ is said to be irrotational if its curl is zero.

(i.e) If $\nabla \times \bar{A} = 0$, then $\bar{A}$ is said to be irrotational.

PROBLEMS.

1. Given that $A = \bar{a}_x + \bar{a}_y$, $B = \bar{a}_x + 2\bar{a}_z$ and $C = 2\bar{a}_y + \bar{a}_z$, find $\bar{A} \cdot (\bar{B} \times \bar{C})$ and $(\bar{A} \times \bar{B}) \cdot \bar{C}$.

Given data:-

$A = \bar{a}_x + \bar{a}_y$

$B = \bar{a}_x + 2\bar{a}_z$

$C = 2\bar{a}_y + \bar{a}_z$

To find:-

$\bar{A} \cdot (\bar{B} \times \bar{C})$,

$(\vec{A} \times \bar{B}) \cdot \bar{C}$.

Solution:-

$$\bar{B} \times \bar{C} = \begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ 1 & 0 & 2 \\ 0 & 2 & 1 \end{vmatrix}$$

$$= \bar{a}_x(0-4) - \bar{a}_y(1-0) + \bar{a}_z(2-0)$$

$$= \bar{a}_x(-4) - \bar{a}_y(1) + \bar{a}_z(2)$$

$$\bar{B} \times \bar{C} = -4\bar{a}_x - \bar{a}_y + 2\bar{a}_z$$

$$\bar{A} \cdot (\bar{B} \times \bar{C}) = (\bar{a}_x + \bar{a}_y) \cdot (-4\bar{a}_x - \bar{a}_y + 2\bar{a}_z)$$

$$= -4 - 1 + 0$$

$\bar{a}_x \cdot \bar{a}_x = \bar{a}_y \cdot \bar{a}_y = \bar{a}_z \cdot \bar{a}_z = 1$

$$\boxed{\bar{A} \cdot (\bar{B} \times \bar{C}) = -5}$$

(ii) $(\bar{A} \times \bar{B}) \cdot \bar{C}$.

$$\bar{A} \times \bar{B} = \begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ 1 & 1 & 0 \\ 1 & 0 & 2 \end{vmatrix}$$

$$= \bar{a}_x(2-0) - \bar{a}_y(2-0) + \bar{a}_z(0-1)$$

$$\boxed{\bar{A} \times \bar{B} = 2\bar{a}_x - 2\bar{a}_y - \bar{a}_z}$$

$$(\bar{A} \times \bar{B}) \cdot \bar{C} = (2\bar{a}_x - 2\bar{a}_y - \bar{a}_z)(2\bar{a}_y + \bar{a}_z)$$

$$= 0 - 4 - 1$$

$$\boxed{(\bar{A} \times \bar{B}) \times \bar{C} = -5}$$

$$\boxed{\bar{A} \cdot (\bar{B} \times \bar{C}) = (\bar{A} \times \bar{B}) \cdot \bar{C} = -5}$$

2. Show that the vectors $\bar{A} = 4\bar{a}_x - 2\bar{a}_y + 2\bar{a}_z$ and $\bar{B} = -6\bar{a}_x + 3\bar{a}_y - 3\bar{a}_z$ are parallel to each other.

Parallel $\Rightarrow \bar{A} \times \bar{B}$

Given data:-

$\bar{A} = 4\bar{a}_x - 2\bar{a}_y + 2\bar{a}_z$

$\bar{B} = -6\bar{a}_x + 3\bar{a}_y - 3\bar{a}_z$

Solution:-

The condition for two vectors A and B to be parallel is given by.

$\bar{A} \times \bar{B} = 0$

$$\bar{A} \times \bar{B} = \begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ 4 & -2 & 2 \\ -6 & 3 & -3 \end{vmatrix}$$

$= \bar{a}_x(6-6) - \bar{a}_y(-12+12) + \bar{a}_z(12-12)$

$\boxed{\bar{A} \times \bar{B} = 0}$

Vectors $\bar{A}$ and $\bar{B}$ are parallel to each other.

3. Show that the vectors $\bar{A} = 6\bar{a}_x + 2\bar{a}_y - 5\bar{a}_z$ and $\bar{B} = 5\bar{a}_x - 5\bar{a}_y + 4\bar{a}_z$ are perpendicular to each other.

$\perp r \Rightarrow \bar{A} \cdot \bar{B}$

Given data:-

$\bar{A} = 6\bar{a}_x + 2\bar{a}_y - 5\bar{a}_z$

$\bar{B} = 5\bar{a}_x - 5\bar{a}_y + 4\bar{a}_z$

Solution:-

The condition for two vectors A and B to be perpendicular is given by

$\boxed{\bar{A} \cdot \bar{B} = 0}$

$\bar{A} \cdot \bar{B} = (6\bar{a}_x + 2\bar{a}_y - 5\bar{a}_z) \cdot (5\bar{a}_x - 5\bar{a}_y + 4\bar{a}_z)$

$= 30 - 10 - 20$

$\boxed{\bar{A} \cdot \bar{B} = 0}$

Vector $\bar{A}$ and $\bar{B}$ are perpendicular to each other.

4. Two vectorial quantities $\vec{A} = 4\hat{i} + 3\hat{j} + 5\hat{k}$ and $\vec{B} = \hat{i} - 2\hat{j} + 2\hat{k}$ are known to be oriented in two unique directions. Determine the angular separation between them.

Given data:-

$\vec{A} = 4\hat{i} + 3\hat{j} + 5\hat{k}$

$\vec{B} = \hat{i} - 2\hat{j} + 2\hat{k}$

To find:- angular separation (θ).

Formula used:-

From definition of dot product

$$\cos\theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}| \cdot |\vec{B}|}$$

Solution:-

$$\cos\theta = \frac{(4\hat{i} + 3\hat{j} + 5\hat{k})(\hat{i} - 2\hat{j} + 2\hat{k})}{\sqrt{4^2 + 3^2 + 5^2} \cdot \sqrt{1^2 + 2^2 + 2^2}}$$

$$= \frac{4 - 6 + 10}{\sqrt{16 + 9 + 25} \cdot \sqrt{1 + 4 + 4}}$$

$= \frac{8}{\sqrt{30} \cdot \sqrt{9}}$

$\cos\theta = \frac{8}{21.21}$

$\cos\theta = 0.3771$

$\theta = \cos^{-1}(0.3771)$

$\boxed{\theta = 67.844^\circ}$

5. Given $\vec{A} = 5\vec{a}_x$, $\vec{B} = 4\vec{a}_x + t\vec{a}_y$, find t such that the angle between $\vec{A}$ and $\vec{B}$ is 45°.

Given data:-

$\vec{A} = 5\vec{a}_x$

$\vec{B} = 4\vec{a}_x + t\vec{a}_y$

$\theta = 45^\circ$

TO find:-

$t = ?$

Solution:-

$$\cos\theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}| \cdot |\vec{B}|}$$

$$\cos 45^\circ = \frac{5\vec{a}_x (4\vec{a}_x + t\vec{a}_y)}{\sqrt{5^2} \cdot \sqrt{4^2 + t^2}}$$

$$0.707 = \frac{20}{25(16+t^2)} \quad \text{or} \quad \frac{1}{\sqrt{2}} = \frac{20}{25(16+t^2)}$$

$$[25(16+t^2)] \times 0.707 = 20.$$

$$(400 + 25t^2) \times 0.707 = 20$$

$$282.8 + 17.675t^2 = 20$$

$$17.675t^2 = 20 - 282.8$$

$$\frac{1}{2} = \frac{20 \times 20}{25(16+t^2)}$$

$$\frac{1}{2} = \frac{400}{25(16+t^2)}$$

$$25(16+t^2) = 800$$

$$400 + t^2 \times 25 = 800$$

$$25t^2 = 800 - 400$$

$$25t^2 = 400$$

$$t^2 = \frac{400}{25}$$

$$t^2 = 16$$

$$\boxed{t = 4}$$

6. Find the divergence of vector function.

$$A = x^2\bar{a}_x + (xy)^2\bar{a}_y + 24x^2y^2z^3\bar{a}_z.$$

Solution:-

$$\nabla \cdot A = \left(\bar{a}_x \frac{\partial}{\partial x} + \bar{a}_y \frac{\partial}{\partial y} + \bar{a}_z \frac{\partial}{\partial z}\right) \left[x^2\bar{a}_x + (xy)^2\bar{a}_y + 24x^2y^2z^3\bar{a}_z\right]$$

$$= \frac{\partial}{\partial x} x^2 + \frac{\partial}{\partial y} (xy)^2 + \frac{\partial}{\partial z} 24x^2y^2z^3$$

$$= 2x + 2x^2y + 24x^2y^2(3z^2)$$

$$\boxed{\nabla \cdot A = 2x + 2x^2y + 72x^2y^2z^2.}$$

7. If $F = x^2 \bar{a}_x + y^2 \bar{a}_y + z^2 \bar{a}_z$ then find divergence of F and curl of F.

solution:-

$$\text{Div } F = \nabla \cdot F$$

$$\nabla \cdot F = \left(\bar{a}_x \frac{\partial}{\partial x} + \bar{a}_y \frac{\partial}{\partial y} + \bar{a}_z \frac{\partial}{\partial z}\right) \cdot (x^2 \bar{a}_x + y^2 \bar{a}_y + z^2 \bar{a}_z)$$

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

$$\nabla \cdot F = 2x + 2y + 2z.$$

$$\boxed{\nabla \cdot F = 2(x+y+z).}$$

$$\text{curl } F = \nabla \times F = \begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ x^2 & y^2 & z^2 \end{vmatrix}$$

$$= \bar{a}_x \left[\frac{\partial}{\partial y}(z^2) - \frac{\partial}{\partial z}(y^2)\right] - \bar{a}_y \left[\frac{\partial}{\partial x}(z^2) - \frac{\partial}{\partial z}(x^2)\right] + \bar{a}_z \left[\frac{\partial}{\partial x}(y^2) - \frac{\partial}{\partial y}(x^2)\right]$$

$$= \bar{a}_x (0) - \bar{a}_y (0) + \bar{a}_z (0).$$

$$\boxed{\nabla \times F = 0}$$

8. If $\bar{r} = 5x\bar{i} + 2y\bar{j} - 3z\bar{k}$. Find div $\bar{r}$.

solution:-

$$\text{div } \bar{r} = \nabla \cdot \bar{r}$$

$$= \left[\frac{\partial}{\partial x}\bar{i} + \frac{\partial}{\partial y}\bar{j} + \frac{\partial}{\partial z}\bar{k}\right](5x\bar{i} + 2y\bar{j} - 3z\bar{k})$$

$$= \frac{\partial}{\partial x}(5x) + \frac{\partial}{\partial y}(2y) - \frac{\partial}{\partial z}(3z)$$

$$= 5 + 2 - 3$$

$$\boxed{\nabla \cdot \bar{r} = 4}$$

9. Evaluate the divergence of function $v = xy\bar{i} + 2yz\bar{j} + 3zx\bar{k}$ at point $(-1, -1, 2)$.

solution:-

$$\nabla \cdot v = \left[\frac{\partial}{\partial x}\bar{i} + \frac{\partial}{\partial y}\bar{j} + \frac{\partial}{\partial z}\bar{k}\right](xy\bar{i} + 2yz\bar{j} + 3zx\bar{k})$$

$$= \frac{\partial}{\partial x}(xy) + \frac{\partial}{\partial y} 2yz + \frac{\partial}{\partial z} 3zx$$

$$\boxed{\nabla \cdot v = y + 2z + 3x}$$

Divergence at $(-1, -1, 2)$ is given by sub. these values for x, y, z in $\nabla \cdot v$

$$\nabla \cdot v = -1 + 2(2) + 3(-1)$$

$$= -1 + 4 - 3$$

$$\boxed{\nabla \cdot v\big|_{(-1,-1,2)} = 0.}$$

10. Find the nature of the field given by determining the divergence and curl $F_1 = 30\bar{I}_x + 2xy\bar{I}_y + 5xz^2\bar{I}_z$.

Solution:-

$F_1 = 30\bar{I}_x + 2xy\bar{I}_y + 5xz^2\bar{I}_z$.

Div $F_1 = \nabla \cdot F_1$.

$= \frac{\partial}{\partial x}(30\bar{I}_x) + \frac{\partial}{\partial y}(2xy\bar{I}_y) + \frac{\partial}{\partial x}(5xz^2\bar{I}_z)$,

$= 0 + 2x + 10xz$

$\boxed{\nabla \cdot F_1 = 2x + 10xz}$

Divergence exist. so field is non-solenoidal.

curl $F_1 = \nabla \times F_1$.

$$\nabla \times F_1 = \begin{vmatrix} \bar{I}_x & \bar{I}_y & \bar{I}_z \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ 30 & 2xy & 5xz \end{vmatrix}$$

$= \bar{I}_x(0) - \bar{I}_y\left[\frac{\partial}{\partial x}(5xz^2) - 0\right] + \bar{I}_z\left[\frac{\partial}{\partial x}2xy\right]$

$= -\bar{I}_y[5z^2] + \bar{I}_z[2y]$

$\boxed{\nabla \times F_1 = -5z^2\bar{I}_y + 2y\bar{I}_z}$

curl exist. so field is rotational.

11. Determine the divergence of these vector fields.

(i) $P = x^2yz\,\bar{a}_x + xz\,\bar{a}_z$

(ii) $Q = \rho^2 \sin\phi\,\bar{a}_\rho + \rho^2 z\,\bar{a}_\phi + z\cos\phi\,\bar{a}_z$

(iii) $T = \left(\frac{1}{r^2}\right)\cos\theta\,\bar{a}_r + r\sin\theta\cos\phi\,\bar{a}_\theta + \cos\theta\,\bar{a}_\phi$.

Solution:-

(i) $\nabla \cdot P = \frac{\partial P_x}{\partial x} + \frac{\partial P_y}{\partial y} + \frac{\partial P_z}{\partial z}$ (Rectangular)

$= \frac{\partial}{\partial x}(x^2yz) + 0 + \frac{\partial}{\partial z}(xz)$

$\boxed{\nabla \cdot P = 2xyz + x}$

(cylindrical)

(ii) $\nabla \cdot Q = \frac{1}{\rho}\frac{\partial}{\partial \rho}(\rho Q_\rho) + \frac{1}{\rho}\frac{\partial}{\partial \phi} + \frac{\partial}{\partial z}Q_z$

$= \frac{1}{\rho}\frac{\partial}{\partial \rho}(\rho^2\sin\phi) + \frac{1}{\rho}\frac{\partial}{\partial \phi}(\rho^2 z) + \frac{\partial}{\partial z}(z\cos\phi)$.

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

$\boxed{\nabla \cdot Q = 2\sin\phi + \cos\phi}$.

(iii) $\nabla \cdot T = \frac{1}{r^2}\frac{\partial}{\partial r}(r^2 T_r) + \frac{1}{r\sin\theta}\frac{\partial}{\partial \theta}(\sin\theta\, T_\theta) + \frac{1}{r\sin\theta}\frac{\partial T_\phi}{\partial \phi}$ (Spherical).

$= \frac{1}{r^2}\frac{\partial}{\partial r}\left[r^2 \cdot \left(\frac{1}{r^2}\cos\theta\right)\right] + \frac{1}{r\sin\theta}\frac{\partial}{\partial \theta}\left[\sin\theta \cdot (r\sin\theta\cos\phi)\right] + \frac{1}{r\sin\theta}\frac{\partial}{\partial \phi}\left[\cos\theta\right]$

$= \frac{1}{r^2}\frac{\partial}{\partial r}\cos\theta + \frac{1}{r\sin\theta}\frac{\partial}{\partial \theta}\left[\sin\theta(r\sin\theta\cos\phi)\right] + \frac{1}{r\sin\theta}\cdot\frac{\partial}{\partial \phi}\left[\cos\theta\right]$

$= 0 + \frac{1}{r\sin\theta}\cdot\frac{\partial}{\partial \theta}(r\cos\phi\sin^2\theta) + 0$

$= \cos\phi\,\frac{\partial}{\partial \theta}(\sin^2\theta)$

$= \cos\phi \cdot 2 \cdot \sin\theta\cos\theta$

$\boxed{\nabla \cdot T = 2\cos\phi\sin\theta\cos\theta}$

12. Find curl $\vec{H}$. If $\vec{H} = (2\rho\cos\phi\,\vec{a_\rho} - A\rho\sin\phi\,\vec{a_\phi} + 8\vec{a_z})$.

Solution:-

$$\nabla \times H = \begin{vmatrix} \frac{1}{\rho}\vec{a_\rho} & \vec{a_\phi} & \frac{1}{\rho}\vec{a_z} \\ \frac{\partial}{\partial \rho} & \frac{\partial}{\partial \phi} & \frac{\partial}{\partial z} \\ \vec{H_\rho} & \rho\vec{H_\phi} & \vec{H_z} \end{vmatrix}$$

$= \frac{1}{\rho}\vec{a_\rho}\left[\left(\frac{\partial}{\partial \phi}H_z\right) - \left(\frac{\partial}{\partial z}\rho H_\phi\right)\right] - \vec{a_\phi}\left[\left(\frac{\partial H_\rho}{\partial z}\right) - \left(H_\rho\frac{\partial}{\partial \phi}\right)\right] + \vec{a_z}\frac{1}{\rho}\left[\frac{\partial \rho H_\phi}{\partial \rho} - \frac{\partial H_\rho}{\partial \phi}\right]$

$\vec{H} = 2\rho\cos\phi\,\vec{a_\rho} - A\rho\sin\phi\,\vec{a_\phi} + 8\vec{a_z}$

$\nabla \times H = \vec{a_z}\frac{1}{\rho}\left[A\rho\sin\phi\,\vec{a_\phi} + 2\rho\sin\phi\,\vec{a_\rho}\right]$

$\boxed{\nabla \times H = A\sin\phi\,\vec{a_\phi}\,\vec{a_z} + 2\sin\phi\,\vec{a_\rho}\,\vec{a_z}}$

13. Show that the vector $E = (6xy + z^3)\vec{a_x} + (3x^2 - z)\vec{a_y} + (3xz^2 - y)\vec{a_z}$ is irrotational and find its scalar potential.

Solution

Given data:-

$E = (6xy + z^3)\vec{a_x} + (3x^2 - z)\vec{a_y} + (3xz^2 - y)\vec{a_z}$

To find:-

Scalar potential, irrotational.

Solution:-

For irrotational $\nabla \times E = 0$.

$$\nabla \times E = \begin{vmatrix} \vec{a_x} & \vec{a_y} & \vec{a_z} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ (6xy + z^3) & (3x^2 - z) & (3xz^2 - y) \end{vmatrix}$$

$$\bar{a}_x\left[\frac{\partial}{\partial y}(3xz^2-y)-\frac{\partial}{\partial z}(3x^2-z)\right]-\bar{a}_y\left[\frac{\partial}{\partial x}(3xz^2-y)-\frac{\partial}{\partial z}(6xy+z^3)\right]+\bar{a}_z\left[\frac{\partial}{\partial x}(3x^2-z)-\frac{\partial}{\partial y}(6xy+z^3)\right]$$

$$\bar{a}_x[-1-(-1)]-\bar{a}_y[3x^2-3x^2]+\bar{a}_z[6x-6x]$$

$$\boxed{0=0.}$$

Hence it is irrotational.

$$-\nabla\cdot V=E=(6xy+z^3)\bar{a}_x+(3x^2-z)\bar{a}_y+(3xz^2-y)\bar{a}_z$$

$$-\left[\bar{a}_x\frac{\partial}{\partial x}+\bar{a}_y\frac{\partial}{\partial y}+\bar{a}_z\frac{\partial}{\partial z}\right]=(6xy+z^3)\bar{a}_x+(3x^2-z)\bar{a}_y+(3xz^2-y)\bar{a}_z$$

Equating on both sides.

$$-\frac{\partial V}{\partial x}=6xy+z^3$$

$$\partial V=(6xy+z^3)\partial x$$

$$-V=\int(6xy+z^3)\partial x$$

$$V=3x^2y+xz^3+C_1$$

C_1 is constant

$$-\frac{\partial V}{\partial y}=3x^2-z$$

$$-\partial V=\partial y(3x^2-z)$$

$$-V=\int(3x^2-z)\partial y$$

$$-V=3x^2y-yz+C_2$$

where C_2 is constant

$$-\frac{\partial V}{\partial z}=3xz^2-y$$

$$-\partial V=(3xz^2-y)\partial z$$

$$-V=\int(3xz^2-y)\partial z$$

$$-V=xz^3-yz+C_3$$

C_3 is constant

By adding the values of C we get

$$V=(3x^2y+xz^3+3x^2y-yz+xz^3-yz)+C$$

$$=(3x^2y+3x^2y+xz^3+xz^3-yz-yz)+C$$

$$=(6x^2y+2xz^3-2yz)+C$$

$$\boxed{V=2(3x^2y+xz^3-yz)+C.}$$

14. Prove that $\nabla\cdot\nabla\times H=0$.

Solution :-

Let the vector $\bar{H}=\bar{a}_xH_x+\bar{a}_yH_y+\bar{a}_zH_z$.

$$\nabla\times H=\begin{vmatrix}\bar{a}_x & \bar{a}_y & \bar{a}_z\\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z}\\ H_x & H_y & H_z\end{vmatrix}$$

$$=\bar{a}_x\left[\left(\frac{\partial}{\partial y}H_z\right)-\left(\frac{\partial}{\partial z}H_y\right)\right]-\bar{a}_y\left[\frac{\partial}{\partial x}H_z-\frac{\partial}{\partial z}H_x\right]+\bar{a}_z\left[\frac{\partial}{\partial x}H_y-\frac{\partial}{\partial y}H_x\right].$$

Take div on both sides.

$$\nabla\cdot\nabla\times H=\frac{\partial}{\partial x}\left[\frac{\partial H_z}{\partial y}-\frac{\partial H_y}{\partial z}\right]-\frac{\partial}{\partial y}\left[\frac{\partial H_z}{\partial x}-\frac{\partial H_x}{\partial z}\right]+\frac{\partial}{\partial z}\left[\frac{\partial H_y}{\partial x}-\frac{\partial H_x}{\partial y}\right]$$