V. V. Sangha's

Rao Bahadur Y. Mahabaleswarappa Engineering College

Cantonment, Ballari – 583104, Karnataka

Department of Electronics & Communication Engineering

Academic Year

2020 - 2021 (ODD) EMW

COURSE FILE

Academic Year: 20 -21 ✓ **(ODD/EVEN)**

Faculty Name	Dr. S. Prabhavathi			
Course Name	EMW			
Course Code	18EC55			
Sem/Sec	A			
Verified By				

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department Electronics And communication Engineering

CONTENT

VISION AND MISSION OF THE INSTITUTE AND DEPARTMENT

VISION OF THE INSTITUTION

To Produce Professionally Excellent, Knowledgeable, Globally Competitive and Socially Responsible Engineers and Entrepreneurs.

MISSION OF THE INSTITUTION

M1	To Provide Quality Education in Engineering and Management.
M2	To Establish a Continuous Industry-Institute Interaction, Participation and Collaboration to Contribute Skilled Engineers.
M3	To Develop Human Values, Social Values, Entrepreneurship Skills and Professional Ethics among the Technocrats.
M4	To Focus on Innovation and Development of Technologies by Engaging in Cutting Edge Research areas.

VISION OF THE DEPARTMENT

To Produce Professionally Excellent, Knowledgeable, Globally Competitive and Socially Responsible Electronics and Communication Engineers and Entrepreneurs.

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M4	To Focus on Innovation and Development of Technologies by Engaging in Electronics and Communication Research areas.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Graduates of Electronics & Communication Engineering course will have successful professional career.
PEO2	Graduates of Electronics & Communication Engineering course will pursue higher education or to become an Entrepreneur.
PEO3	Graduates of Electronics & Communication Engineering course will have ability for lifelong learning and to serve the society.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1	Ability to Design, Develop and Test the Electronics Circuits & Communication Systems.
PSO 2	Ability to Develop Excellent Programming and Problem Solving skills in the field of Embedded System.

PROGRAM OUTCOMES (PO)

PO 1	Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem Analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	Design/ Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS &COMMUNICATIONENGINEERING

Name of the Staff: Dr. Prabhavathi S, Mrs. Vani H				
Course Name: Electromagnetic Waves				
Course Code: 18EC55	**Sem:**	**5**	**Year**	**2020-21**

COURSE OUTCOME STATEMENTS	
	At the end of the course, students will be able to ….
C305.1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
C305.2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
C305.3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configuration
C305.4	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
C305.5	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

CO-PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C305.1	3	3										3	3	2
C305.2	3	3										3	3	2
C305.3	3	3										3	3	2
C305.4	3	3										3	3	2
C305.5	3	3										3	3	2
AVG	3	3										3	3	2

Course Coordinator

Staff Signature

CO-PO JUSTIFICATION

CO	PO	Mapping	Justification
C305.1	PO1	3	CO1 is mapped to PO1 because strong knowledge of basic concepts is required to Evaluate problems on of electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume
	PO2	3	CO1 is mapped to PO2 As the knowledge of of basic concepts is required to Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume are required to solve problems in engineering science.
	PSO1	3	CO1 is mapped to PSO1 Because basic concepts of electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume are used in designing some electronic circuits.
	PSO2	2	CO1 is mapped to PSO2 Because problem solving skills are very much required.
C305.2	PO1	3	CO2 is mapped to PO1 because knowledge of Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem are widely used in solution of electronic engineering problems.
	PO2	3	CO2 is mapped to PO2 As the knowledge of Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem are required to solve problems in engineering science.
	PSO1	3	CO2 is mapped to PSO1 Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem are used in Testing the circuit.
	PSO2	2	CO2 is mapped to PSO2 Because problem solving skills are very much required.
C305.3	PO1	3	CO3 is mapped to PO1 because knowledge of basic concepts To Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configuration are widely used in solution of electronic engineering problems.
	PO2	3	CO3 is mapped to PO2 As the knowledge of basic concepts To Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and

			Ampere's laws for evaluating Magnetic field for different current configuration are required to solve problems in engineering science.
	PSO1	3	CO3 is mapped to PSO1 Because the basic concepts To Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configuration used in Testing the circuit.
	PSO2	2	CO3 is mapped to PSO2 Because problem solving skills are very much required.
C305.4	PO1	3	CO4 is mapped to PO1 because knowledge of magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits are widely used in solution of electronic engineering problems.
	PO2	3	CO4 is mapped to PO2 As the knowledge of magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.are required to solve problems in engineering science.
	PSO1	3	CO4 is mapped to PSO1 because magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits are used in Testing the circuit.
	PSO2	2	CO4 is mapped to PSO2 Because problem solving skills are very much required
	PO1	3	CO5 is mapped to PO1 because knowledge of Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem are widely used in solution of electronic engineering problems.
	PO2	3	CO5 is mapped to PO2 As the knowledge of Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem.are required to solve problems in engineering science.
	PSO1	3	CO5 is mapped to PSO1 because Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem are used in Testing the circuit.
	PSO2	2	CO5 is mapped to PSO2 Because problem solving skills are very much required

Course Coordinator

Staff Signature

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS &COMMUNICATIONENGINEERING

Name of the Staff: Dr. Prabhavathi S, Mrs. Vani H				
Course Name: Electromagnetic Waves				
Course Code: 18EC55	Sem:	5	Year	2020-21

CO Analysis

CO	Description
C305.1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume. **Action:** Evaluate **Knowledge:** electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume **Condition:** To solve problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume **Criterion:** None
C305.2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem. **Action:** Apply **Knowledge:** Gauss Law **Condition**: To evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem. **Criterion:** None
C305.3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configuration **Action:** Determine **Knowledge:** Potential and energy with respect to point charge and capacitance using Laplace equation **Condition:** To Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configuration **Criterion:** None
C305.4	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits. **Action:** Calculate **Knowledge:** Magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits. **Condition:** None **Criterion:** None
C305.5	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem **Action:** Apply **Knowledge** Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem **Condition:** Using Poynting theorem **Criterion:** None

Tentative Academic Calendar of VTU, Belagavi for ODD Semester of 2020-2021

	I Sem B. E. / B. Tech. / B. Arch./B.Plan	I sem M.Tech./MBA /MCA/M.Arch.	III, V & VII Sem B. E. /B. Tech./B.Plan/ B.Arch & IX Sem B. Arch.	III & V Sem MCA	III Sem MBA	III Sem M. Tech.	III Sem M. Arch.
Commencement of ODD Semester	Will be announced later	Will be announced later	01.09.2020	01.09.2020	01.09.2020	01.09.2020	01.09.2020
Last Working day of ODD Semester			17.12.2020	17.12.2020	17.12.2020	17.12.2020	17.12.2020
Practical Examinations			21.12.2020 To 31.12.2020	21.12.2020 To 31.12.2020	21.12.2020 To 31.12.2020	21.12.2020 To 31.12.2020	21.12.2020 To 31.12.2020
Theory Examinations			04.01.2021 To 23.01.2021	04.01.2021 To 23.01.2021	04.01.2021 To 23.01.2021	04.01.2021 To 23.01.2021	04.01.2021 To 23.01.2021
Internship Viva-Voce			-	-	-	25.01.2021 To 08.02.2021	-
Professional training / Organization study			-	-	-		-
Commencement of EVEN Semester			08.02.2021	08.02.2021	08.02.2021	22.02.2021	08.02.2021

NOTE

- VII Semester B. E / B. Tech students shall have to undergo INTERNSHIP as per circular of University **VTU/Aca/2019-20/85, dated 12.05.2020.**
- I Semester B. E/ B. Tech / B. Arch Students shall compulsorily undergo Induction Program for a period of 3 Weeks as per the schedule given by VTU Belagavi
- The classroom sessions for all the higher semesters would be commencing from 01.09.2020(Tentative) in ONLINE mode until further orders.
- The Institute needs to function for six days a week with additional hours.
- The faculty/staff shall be available to undertake any work assigned by the university.
- If any of the above date is declared to be a holiday then the corresponding event will come into effect on the next working day.
- Notification regarding Calendar of Events relating to the conduct of University Examinations will be issued by the Registrar (Evaluation) from time to time.
- **Academic Calendar may be modified based on guidelines/directions issued in future by MHRD/UGC/AICTE/State Government.**

12.9.2020.

REGISTRAR

V.V. Sangha's
ರಾವ್ ಬಹದ್ದೂರ್ ವೈ. ಮಹಾಬಲೇಶ್ವರಪ್ಪ ಇಂಜಿನಿಯರಿಂಗ್ ಕಾಲೇಜ್, ಬಳ್ಳಾರಿ
Rao Bahadur Y. Mahabaleswarappa Engineering College, Ballari
Cantonment, Ballari-583104. Tel: 08392-244809. Fax: 08392-242148

ACADEMIC CALENDAR 2020-21 (ODD SEM)

MONTH	DAY	DATE	EVENT	DESCRIPTION
September	Tuesday	01-09-2020	Commencement of ODD Semester	UG:-III,V,VII Sem Commencement of Classes.
	Tuesday	01-09-2020		PG:- III Sem Commencement of Classes.
	Monday	07-09-2020	Submission of Workload	Submit Final Faculty Teaching Workload.
	Saturday	19-09-2020	Parents Meet	Parents Meet should be arranged only for 3rd & 5th Sem Students
	Monday	21-09-2020	Course File Verification	Verification of Course plan & CO,PO Mapping
October	[illegible]			
	Saturday	24/10/2020	Submit I-IA Marks	Enter I-IA Marks in RYMEC Online Portal on or Before said Date.
	Tuesday	27/10/2020	IA Reports to Parents	Dispatch of I-IA Marks , Attendance % through SMS to Parents on or Before said Date.
	Wednesday	28/10/2019	First Assignment Submission	Student should submit 1st Assignment on or before said date.
	Thursday	29/10/2020	Interaction with Parents	Interaction with Parents & Students Performance Review
November	Monday	02-11-2020	Verifying the Course file	Verifying the Assessment Strategies
	[illegible]			
	Wednesday	25-11-2020	Submit II-IA Marks	Enter II-IA Marks in RYMEC Online Portal Before said Date.
	Saturday	26-11-2020	IA Reports to Parents	Dispatch of II-IA Marks , Attendance % through SMS to Parents on or Before said Date.
	Monday	27-11-2020	First Assignment Submission	Student should submit 2nd Assignment on or before said date.
	Saturday	05-12-2020	Interaction with Parents	Interaction with Parents & Students Performance Review
	Monday	07-12-2020	Verifying the Course file	Verifying the Assessment Strategies
December	[illegible]			
	Wednesday	18/12/2020	Submit III-IA Marks	Enter III-IA Marks in RYMEC Online Portal Before said Date.
	Thursday	19/12/2020	IA Reports to Parents	Dispatch of III-IA Marks, Attendance % & Final Average Marks through SMS to Parents on or Before said Date.
	Thursday	17-12-2020	Last Working Day of Odd Sem 2020-21	UG:-III,V,VII Sem Last Working Day
	Thursday	17-12-2020		PG:-III Sem Last Working Day

RaoBahadur Y Mahabaleswarappa Engineering College, Ballari
Department of Electronics and Communication Engineering

Academic Calendar of Events
ODD Semester 2020-21(SEP 2020-March 2021)

	III, V& VII Sem B.E/B.Tech	III Sem M.Tech
Pre Placement Training	For VI Semester Students of all Branches from 20th to 25th Sep2020	
Commencement of ODD Semester	1st SEP 2020	
Admission Publicity in and around Ballari	SEP & OCT 2020	
I Internal Assessment Test	17th, 18th & 19th OCT 2020 (Sat, Sun & Mon-Online)	
One day Online FDP on **"Virtual Lab"** organized by VTU in collaboration with NITKSuratkal by Dr. K.V. Gangadharan	21st OCT 2020	
Last date for sending IA Marks (SMS)	27th OCT 2020	
Parents Meet	29th OCT 20220	
II Internal Assessment Test	1st, 2nd & 3rd DEC 2020 (Tue, Wed & Thu-Online)	
Last date for sending IA Marks (SMS)	6th DEC 2020	
Parents Meet	9th DEC 2020	
Fresher's Day & First Year Student Induction Programme through Digital Platform	17th DEC 2020	
Student Induction Programme **UHV Session-2** through Digital Platform for 1st Year Students	19th DEC 2020	
One day Seminar On **"FUTURE READY: Industry 4.0"** by Mr. MKHH Jilani, Investment banker & Strategic advisor, KBN, university.	23rd DEC 2020	
III Internal Assessment Test	11th,12th &13th JAN 2021(Thu, Fri & Sat-Offline)	
Webinar on **Introduction to Remote Sensing & Image Processing by** Dr. P. M Shivakumar Swamy Professor, JSSTE, Bangalore	12th JAN 2021	
Last date for sending IA Marks (SMS)	23rd JAN 2021	
PG **Freshers's Day & Inaugural** Function	23rd JAN 2021	
Parents Meet	25th JAN 2021	
Webinar on **Interpersonal Skills** by Ms. Sonu Prakash Chand, Manager IT Solutions, Eli Lily & Company	25th JAN 2021	
Quiz on **Intellectual Property Rights**	27th JAN 2021	
External NBA Audit By on Mrs. Sowmyashree M.S, BMSIT, Bengaluru	29th JAN 2021	
Internal NBA Audit	19th FEB 2021	
IEEE VTools webinar titled **"Automation in Electronics Engineering"** jointly organized by IEEE Bangalore Section, RYMEC Ballari, by Ramachandra Gambheer Member of IEEE, Western USA	28th FEB 2021	
Webinar on **"Academic and Administrative Audit Process "** under EDP in association with IQAC	4th March 2021	

Dr. T. Hanumantha Reddy & Dr. Veeragangadhar Swamy .		
External Academic Audit (IQAC-NAAC) Dr. Prakash M Prof, SDM Engineering College, Dharwad	6th MARCH 2021	
Last Working Day	**16/01/2021**	
Practical Examination	21/01/2021 to 02/02/2021	21/01/2021 to 27/01/2021
Theory Examination	08/02/2021 to 25/03/2021	28/01/2021 to 10/02/2021
Commencement of EVEN Semester	**19/04/2021**	19/02/2021

HOD ECE

Head of the Department
Electronics & Communication Eng
R. Y. M. Engineering College,
(Formerly Vijayanagar Engg. College)
BELLARY-583 104

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
Department of Electronics and Communication Engineering

INDIVIDUAL TIME TABLE 2020-21

Name: Dr-S Prabhavathi	Sem: 5th Sec: A
Course Name EMW	Course Code: 18EC55
Lab Name	Code:

Day	9am-9:55am	9.55-10.50am	10.50am-11.00am	11.00am-11.55am	11.55am-12.50pm	12.50pm-2.15pm	2.15pm-3.10pm	310pm-4.05pm	4.05pm-5pm
Monday			BREAK	EMW		BREAK			
Tuesday									
Wednesday									
Thursday									
Friday	EMW								
Saturday		EMW							

COURSE EVALUATION AND ASSESSMENT SCHEME-2018

	What		To Whom	When/ Where (Frequency in the course)	Max Marks	Evidence Collected
Direct Assessment Methods	IA	Internal Assessment Tests	Students	Thrice(Average of three IA Tests)	30	Blue Books
		Assignment		Thrice(Before IA Test and average of 3 is taken)	10	Assignment Books
		Practical Assessment		Once	40	Practical evaluation
	FE	Final Examination		End of Course (Answering One of two questions from five Modules	100	Result sheet
		Practical Examination		One question from lot	100	Result sheet
Indirect Assessment Methods	Students Feedback		Students	End of the course	-	Questionnaire
	Course Exit Survey					

Questions for IA and FE will be designed to evaluate the various educational components (Bloom's taxonomy)

B. E. (EC / TC)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – V

ELECTROMAGNETIC WAVES

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

CREDITS – 03

Course Learning Objectives: This course will enable students to:

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

Module-1	**RBT Level**
Revision of Vector Calculus – **(Text 1: Chapter 1)** **Coulomb's Law, Electric Field Intensity and Flux density**: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**	**L1, L2, L3**
Module -2	
Gauss's law and Divergence: Gauss 'law, Application of Gauss' law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ▼ and divergence theorem, Numerical Problems **(Text: Chapter 3.2 to 3.7).** **Energy, Potential and Conductors**: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and 4.6).**Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**	**L1, L2, L3**
Module-3	
Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation **(Text: Chapter 7.1 to 7.3)** **Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems. **(Text: Chapter 8.1 to 8.6)**	**L1, L2, L3**
Module -4	
Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).** **Magnetic Materials**: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems **(Text: Chapter 9.6 to 9.7).** Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**	**L1, L2, L3**
Module -5	
Maxwell's equations Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)** **Uniform Plane Wave**: Plane wave, Uniform plane wave, Derivation of plane wave equations from	**L1, L2, L3**

Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (γ, α, β, η) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**

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

- Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
- Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
- Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
- Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
- Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Question paper pattern:

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

Text Book:

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

Reference Books:

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

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
Department of Electronics and Communication Engineering

COURSE PLAN 2020-21 (ODD SEM)

Staff Name:Dr.Prabhavathi S	**Course Type: Core/ Elective(Open/Professional)**	**Sem / Sec: 5th A**
Course Name: Engineering Electromagnetics	**Course Code: 18EC55**	**Total Number of Lecture Hours:40**
Max marks: 100	**Prerequisites: Physics, Vector Algebra**	

Sl.No	Module Name	Lecture Hours Required
01	**Coulomb's Law and electric field intensity& Electric flux density**	**8**
02	**Gauss' law and divergence, Energy and potential**	**8**
03	**Poisson's and Laplace's equations, The steady magnetic field**	**8**
04	**Magnetic forces, Magnetic materials**	**8**
05	**Time varying fields and Maxwell's equations**	**8**

Sl.No	Date	Time	Topic to be Covered
1	4/9/2020	9.30-10.30am	**Introduction** :Scalars and vectors
2	7/9/2020	2.30-3.30pm	**Describe** Cartesian coordinate system
3	11/9/2020	9.30-10.30am	**Describe** Cylindrical coordinate system
4	12/9/2020	11-12pm	**Describe** Spherical coordinate system
5	14/9/2020	2.30-3.30pm	**Solve** Dot and cross product
6	18/9/2020	9.30-10.30am	**Module 1:a. Coulomb's Law and electric field intensity& Electric flux density**: **Describe** Experimental law of Coulomb.
7	19/9/2020	11-12pm	**Describe** Electric field intensity.
8	21/9/2020	2.30-3.30pm	**Describe** Field due to continuous volume charge distribution, Field of a line charge.
9	25/9/2020	9.30-10.30am	**Solve** Field of a line charge.Electric flux density,Problems
10	26/9/2020	11-12pm	**Describe** Electric flux density,Problems
11	28/9/2020	2.30-3.30pm	**Module 2: Gauss' law and divergence:** Gauss' law
12	3/10/2020	9.30-10.30am	**Describe** Divergence, Continued….
13	5/10/2020	11-12pm	**Solve** Maxwell's First equation(Electrostatics),

14	9/10/2020	2.30-3.30pm	**Use** Vector operator ∇and divergence theorem
15	10/10/2020	9.30-10.30am	**Energy and potential :**Energy expended in moving a point charge in an electric field.
16	12/10/2020	11-12pm	**Explain** The line integral, Definition of potential difference and Potential.
17	23/10/2020	9.30-10.30am	**Describe** The potential field of a point charge and system of charges.
18	2/11/2020	2.30-3.30pm	**Explain** Current and current density, Continuity of current
19	6/11/2020	9.30-10.30am	**Module 3: Poisson's and Laplace's equations:** Derivations of Poisson's and Laplace's Equations.
20	7/11/2020	11-12pm	**Explain** Uniqueness theorem.
21	9/11/2020	2.30-3.30pm	**Solve** Examples of the solutions of Laplace's and Poisson's equations.
22	13/11/2020	9.30-10.30am	**The steady magnetic field:** Biot-Savart law, Ampere's circuital law.
23	20/11/2020	11-12pm	**Explain** Curl, Stokes' theorem,
24	21/11/2020	2.30-3.30pm	**Solve** scalar and Vector magnetic potentials.
25	23/11/2020	9.30-10.30am	**Explain** magnetic flux and flux density
26	27/11/2020	11-12pm	**Module 4: Magnetic forces:** Force on a moving charge and differential current element.
27	28/11/2020	11-12pm	Continued…
28	30/11/2020	2.30-3.30pm	**Explain** Force between differential current elements
29	4/12/2020	9.30-10.30am	**Solve** problems
30	5/12/2020	11-12pm	**Solve** Problems
31	7/12/2020	2.30-3.30pm	**Magnetic materials:** Magnetization and permeability.
32	11/12/2020	9.30-10.30am	**Explain** Magnetic boundary conditions, Magnetic circuit.
33	12/12/2020	11-12pm	**Explain** Potential energy and forces on magnetic materials.
34	14/12/2020	2.30-3.30pm	**Solve** Problems

35	18/12/2020	9.30-10.30am	**Solve** Problems
36	19/12/2020	11-12pm	**Module 5: Time varying fields and Maxwell's equations**: Faraday's law.
37	21/12/2020	2.30-3.30pm	**Explain** displacement current, Maxwell's equation in point and Integral form.
38	26/12/2020	9.30-10.30am	Continued…
39	28/12/2020	11-12pm	Continued…
40	1/01/2021	2.30-3.30pm	**Uniform plane wave:** Wave propagation in free space and dielectrics.
41	2/01/2021	9.30-10.30am	Continued….
42	4/01/2021	2.30-3.30pm	**Explain** Poynting's theorem and wave power
43	8/01/2021	9.30-10.30am	Continued….
44	9/01/2021	11-12pm	**Explain** propagation in good conductors – (skin effect).
45	11/01/2021	2.30-3.30pm	**Solve** Problems
46	12/01/2021	9.30-10.30am	**Solve** Problems
47	15/01/2021	11-12pm	**Solve** Problems
48	16/01/2021	11-12pm	**Solve** Problems

Teaching and Learning Tools: Blackboard/PowerPoint presentation/webinar/lab.

Text Books: W H Hayt & J A Buck-Engineering Electromagnetics,8TH Edition,Tata-MC-GRAW HILL-2014 ISBN 978-93-392-0327-6

Reference Books:

1.Elements Of Electromagnetics-Matthew N O, Oxford University,4th Edition
2.Electromagnetic Waves And Radiating Systems-E CJordon&K G Balmain,PHI,2nd Edn

Innovative Practices:

1. Quiz Test
2. Problem Solving Skill Development

Staff Signature

HOD

Rao Bahadur .Y. Mahabaleshwarappa Engineering College Bellary

Dept ECE	200 - 200	Title: Report on Syllabus Status

REPORT ON SYLLABUS STATUS

Semester	Branch	Subject	Section	Name of the Staff
5th	ECE	EMW	A	Dr. S. Prabhavathi

Sl.No	Date	Period	Topics Covered	Remarks
1	4/9/20	9.30	Introduction to EMW	
2	5/9	11	Cartesian Co-ordinate Systems.	
3	7/9	2.30	Cylindrical Co-ordinate System	
4	11/9	9.30	Spherical Co-ordinate system	
5	11/9	11	Scalar & Vector representation.	
6	12/9	11	Coulombs Law in Scalar & Vector	MOD1
7	14/9	2.30	Electric field Intensity	
8	18	9.30	Charge Distribution.	
9	19	11	E due to various charge Distr	
10	21	2.30	Problems due line, Circular	
11	22	2.30	Infinite sheet of charge.	
12	25	11	Problems.	
13	26	11	Problems continued	
14	28	2.30	Electric flux & flux density	MOD2
15	3/10	11	D due to point charge.	(Part1)
16	5/10	2.30	flux density due line, Surface	
17	9	9.30	Volume charge	
18	10	11	Gauss law, Application	
19	12	2.30	Point, Infinite, Co-axial.	
20	23	9.30	Sheet of charge & spherical.	
21	24	11	Divergence, theorem & Problems	
22	28	9.30	Div in different Co-ordinate	
23	2/11	2.30	Maxwell's First equation.	
24	4/11	9.30	Poisson's and laplace equation.	MOD 3
25	6	9.30	Uniqueness theorem, Problems.	(Part1)
26	7	11	Capacitance Using laplace eqn	
27	9	2.30	laplace in different Co-ordinate	
28	12	9.30	Problems.	
29	13	9.30	Biot Savart law, Ampere ckt law	(Part 2)

Signature
Staff In-charge

Name of the Staff Dr. S. Prabhavathi

Signature
Head of the Department

Rao Bahadur .Y. Mahabaleshwarappa Engineering College Bellary

Dept ECE	200 - 200	Title: Report on Syllabus Status

REPORT ON SYLLABUS STATUS

Semester	Branch	Subject	Section	Name of the Staff
5th	ECE	EMW	A	Dr.S. Prabhavathi

Sl.No	Date	Period	Topics Covered	Remarks
30	18	2.30	Curl, Stokes, magnetic flux	
31	19	9.30	Flux density, Problems	
32	20	11	Magnetic Scalar & Vector	
33	21	11	Problems.	
34	28	12.30	Time Varying Fields → Continuity	MOD 5
35	27	9.30	equation, Ampere's Law.	(Part 1)
36	28	11	Displacement & Conduction Current	
37	30	2.30	Problems	
38	9/12	4	Derivation of maxwell's in Point	
39	7	2.30	Integral form, Problems	
40	3	11	Maxwell in different media.	
41	4	9.30	Uniform Plane wave.	MOD 5
42	7	11-11.55	Derivation of Plane wave	(Part 2)
43	8	11.55	Relationship b/w E & H.	
44	9	11.55	Wave propagation in free space	
45	9	4.05	Wave Propagation in η, α, β, n	
46	14	11	good conductors, skin depth.	
47	15	11.55	Poynting theorem	
48	16	11.55	Problems.	
49	16	4.05	Magnetic force : diff current,	(MOD 4)
50	21	11.	Force b/w & on . Problems.	
51	22	11.55	Problems.	
52	23	11.55	Problems	
53	23	4.05	Problems.	

Signature
Staff In-charge

Name of the Staff

Signature
Head of the Department

COURSE EVALUATION AND ASSESSMENT SCHEME-2018

	What		To Whom	When/ Where (Frequency in the course)	Max Marks	Evidence Collected
Direct Assessment Methods	IA	Internal Assessment Tests	Students	Thrice(Average of three IA Tests)	30	Blue Books
		Assignment		Thrice(Before IA Test and average of 3 is taken)	10	Assignment Books
		Practical Assessment		Once	40	Practical evaluation
	FE	Final Examination		End of Course (Answering One of two questions from five Modules	100	Result sheet
		Practical Examination		One question from lot	100	Result sheet
Indirect Assessment Methods	Students Feedback		Students	End of the course	-	Questionnaire
	Course Exit Survey					

Questions for IA and FE will be designed to evaluate the various educational components (Bloom's taxonomy)

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

ASSIGNMENT-I (20-21 Odd Sem)

Staff Name : Dr Prabhavathi.S /Vani H	Sem/Sec:5TH /A & B	Max Marks:10
Course Name : EMW	Course Code : 18EC55	

Q No	QUESTIONS	CO	BTL	PO
1	Define Coulombs law and demonstrate coulombs law in Vector form.	1	L1	1,2, 12
2	Define Electric field intensity and Electric flux density.	1	L1	1,2, 12
3	Develop EFI due to number of point charges.	1	L3	1,2, 12
4	Point charges of 50nC each are located at A(1,0,0) B(-1,0,0) C(0,1,0) & D(0,-1,0) in free space. Find total force on charge at A.	1	L1	1,2, 12
5	Two point charges of 20μC and -20μC are located at A(2,-3,2) &B(4, 3,-2) respectively in free space . Find magnitude of force on charge at A.	1	L1	1,2, 12
6	A point charge Q1=25nC located at A(4,-2,7) & charge Q2=60nC at B(-3,4,-2). Find E at C(1,2,3) & find the direction of E.	1	L1	1,2, 12
7	Develop an expression for Electric field intensity due to infinite line charge.	1	L3	1,2, 12
8	Q1 and Q2 are the point charges located at (0,-4,3) & (0,1,1). If Q1 is 2nC, find Q2 such that the force on a test charge at(0,-3,4) has no Z-component.	1	L1	1,2, 12
9	A line charge of total charge 1μC is placed between A(0,0,1) & B(0,0,2)m. Find Electric field intensity at i) P_1(0,0,0)m ii)P_2(0,1,1)m.	1	L1	1,2, 12
10	Solve for D in Cartesian coordinate system at P (6,8,-10) due to point charge of 40mC at origin and a uniform line charge of ρ_L= 40μC/m on the z axis.	1	L3	1,2, 12
11	Two uniform line charges of infinite lengths with ρ_L= 4nC/m & 6nC/m lies in x=0 plane at y=5m & y=-6m respectively. Solve E at (4,0,5) in air.	1	L3	1,2, 12
12	Define & describe Coloumbs law & electric field intensity.	1	L1	1,2, 12
13	A line charge of 2nC/m lies along y-axis while surface charge densities of 0.1 and -0.1nC/m^2 exist on the plane Z=3 and Z=-4m respectively. Find the Electric field intensity at a point (1,-7,2).	1	L1	1,2, 12

Co-ordinator

Faculty Incharge

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS &COMMUNICATION ENGINEERING

Continuous Internal Evaluation -I (20-21 Odd Sem)

Staff Name: Dr.Prabhavathi S/Mrs.Vani H	**Sem: V Sec: A/B**	**Date: 19 /10/2020 Time:9.15-10.45am**
Sub: Electromagnetic Waves	**Course Code: 18EC55**	**Total Contact Hours: 50**
Max marks:50	**Prerequisites: Physics, Vector algebra & Calculus**	

QUESTIONS	Marks	BTL	CO	PO
1. Define Coulombs law and demonstrate coulombs law in Vector form. **OR** 2. i) Define Electric field intensity and Electric flux density. ii) Develop EFI due to number of point charges.	10	L1 L3	1	1,2, 12
3. Q1 and Q2 are the point charges located at (0,-4,3) & (0,1,1). If Q1 is 2nC, find Q2 such that the force on a test charge at(0,-3,4) has no Z-component. **OR** 4. Two point charges of 20μC and -20μC are located at A(2,-3,2) & B(4, 3,-2) respectively in free space . Find magnitude of force on charge at A.	10	L1	1	1,2, 12
5. A point charge Q1=25nC located at A(4,-2,7) & charge Q2=60nC at B(-3,4,-2). Find E at C(1,2,3) & find the direction of E. **OR** 6. Develop an expression for Electric field intensity due to infinite line charge.	10	L1 L3	1	1,2, 12
7. A line charge of total charge 1μC is placed between A(0,0,1) & B(0,0,2)m. Find Electric field intensity at i) P_1(0,0,0)m ii)P_2(0,1,1)m. **OR** 8. A line charge of 2nC/m lies along y-axis while surface charge densities of 0.1 and -0.1nC/m^2 exist on the plane Z=3 and Z=-4m respectively. Find the Electric field intensity at a point (1,-7,2).	10	L1	1	1,2, 12
9. Solve for D in Cartesian coordinate system at P (6,8,-10) due to point charge of 40mC at origin and a uniform line charge of ρ_L= 40μC/m on the z axis. **OR** 10. Two uniform line charges of infinite lengths with ρ_L= 4nC/m & 6nC/m lies in x=0 plane at y=5m & y=-6m respectively. Solve E at (4,0,5) in air.	10	L3	1	1,2, 12

IA Coordinator

Staff-in-Charge

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS &COMMUNICATION ENGINEERING

SCHEME OF EVALUATION INTERNAL ASSESSMENT TEST-I (20-21 Odd Sem)

Staff Name: Dr.Prabhavathi S/Mrs.Vani H	Sem: V Sec: A/B	Date: 19/10/2020	Time: 9:15 - 10:45AM
Sub: Electromagnetic Waves	Course Code: 18EC55	Total Contact Hours: 50	
Max marks:50	Prerequisites: Physics, Vector algebra & Calculus		

Prabha

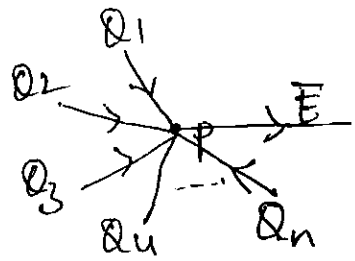
1. $\bar{F}_2 = \frac{Q_1 Q_2}{4\pi\epsilon_0 R_{12}^2}\bar{a}_{12}$ $\quad \bar{a}_{12} = \frac{\bar{R}_{12}}{|\bar{R}_{12}|}$ → (7M)

Defination of coulombs law → (3M)

2 (1) Electric field Intensity is $E = F/Q = \frac{Q_1}{4\pi\epsilon_0 R_{12}^2}\bar{a}_{R12}$ — (2½)

Electric flux Density $\bar{D} = Q/4\pi R^2 \bar{a}_R$ → (2½)

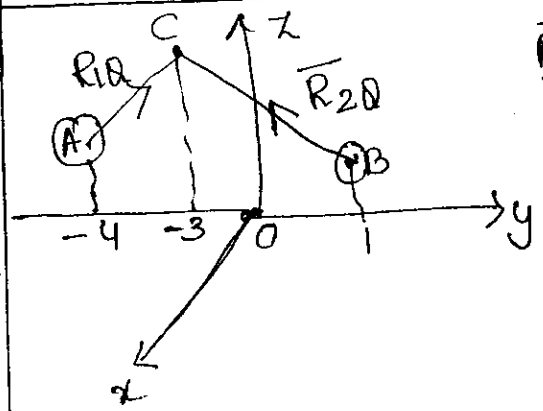
(2)



$\bar{E} = \frac{1}{4\pi\epsilon_0}\sum_{i=1}^{n}\frac{Q_i}{R_i^2}\bar{a}_{Ri}$ → Fig (3M), Deriv (4M)

Fig

(3)



$\bar{A} = -4\bar{a}_y + 3\bar{a}_z$, $\bar{B} = \bar{a}_y + \bar{a}_z$

$\bar{C} = -3\bar{a}_y + 4\bar{a}_z$

$|R_{1Q}| = \sqrt{2}$, $|R_{2Q}| = 5$ → 4M

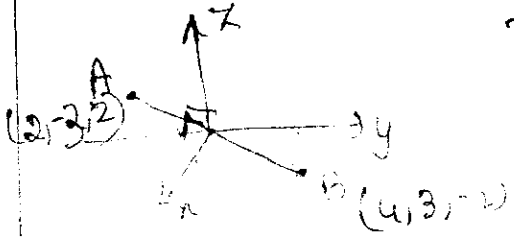
$F = F_1 + F_2$

$F_1 = \frac{Q Q_1}{4\pi\epsilon_0 R_{1Q}^2}\bar{a}_{1Q}$, $F_2 = \frac{Q Q_2}{4\pi\epsilon_0 R_{2Q}^2}\bar{a}_{2Q}$

$Q = -29.462\,nC$ → 6M

(4)

$F_2 = \frac{Q_1 Q_2}{4\pi\epsilon_0 R_{12}^2}\bar{a}_{12} = \frac{20\times -20\times 10^{-12}}{4\pi\epsilon_0(\sqrt{56})^2} \times \frac{2\bar{a}_x + 6\bar{a}_y + 4\bar{a}_z}{\sqrt{56}}$ → 7M



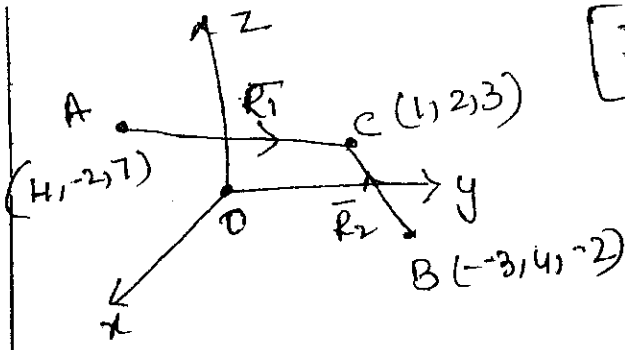
$\bar{R}_{BA} = \bar{B} - \bar{A}$

$= (4-2)\bar{a}_x + (3+3)\bar{a}_y + (-2-2)\bar{a}_z$

$\bar{R}_{BA} = 2\bar{a}_x + 6\bar{a}_y - 4\bar{a}_z$

$|\bar{R}_{BA}| = \sqrt{2^2+6^2+4^2} = \sqrt{56}$ → 3M

(5)



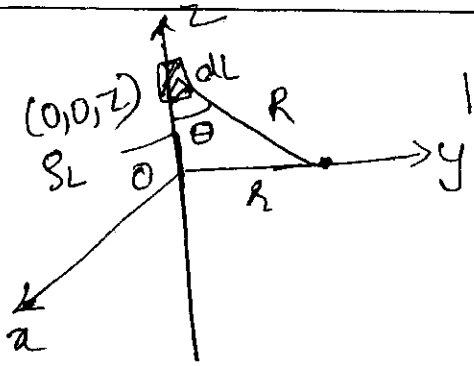
$\bar{R}_1 = \sqrt{41}$ $\bar{R}_2 = \sqrt{45}$ — 3M

$E = \bar{E}_1 + \bar{E}_2$ at C

$E = 4.578\bar{a}_x - 0.149\bar{a}_y + 5.501\bar{a}_z$ — 5M

$\bar{a}_R = \frac{\bar{E}}{|E|} = 0.639\bar{a}_x - 0.021\bar{a}_y + 0.768\bar{a}_z$ — 2

(6)



$|\bar{R}| = \sqrt{\rho^2+z^2}$, $\bar{a}_R = \frac{\rho\bar{a}_y - z\bar{a}_z}{\sqrt{\rho^2+z^2}}$ — 2

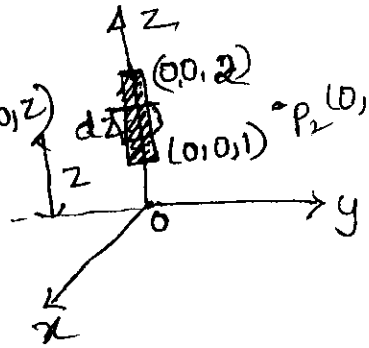
$d\bar{E} = \frac{dQ}{4\pi\epsilon_0 R^2}\bar{a}_R = \frac{\rho_L d_z}{4\pi\epsilon_0(\sqrt{\rho^2+z^2})}\cdot\frac{\rho\bar{a}_y}{\sqrt{\rho^2+z^2}}$ — 2M

$z = \rho\tan\theta$, $\rho = z/\tan\theta$ — 2M

$dz = \rho\sec^2\theta\, d\theta$

$E = \frac{\rho_L}{2\pi\epsilon_0\rho}\bar{a}_y$ V/M — 4M

(7)



$L = 2-1 = 1$M. — 2M

$\rho_L = Q/L = 1/1 = 1$ MC/M.

$dQ = \rho_L dz$

(i) $\int_{z=1}^{z=2} \frac{\rho_L dz}{4\pi\epsilon_0 z^2}(-\bar{a}_z) = -4493.8712\,\bar{a}_z$ — 3M

(ii) $|\bar{R}| = \sqrt{1+(1-z)^2}$, Put $1-z = \tan\theta$, $-dz = \sec^2\theta\, d\theta$ — 5M

Put $[1+(1-z)^2] = u^2$

$(1-z)dz = -u\,du$

$z=1$, $u=1$

$z=2$, $u=\sqrt{2}$

$\bar{E} = 8987.7424\,[0.7071\bar{a}_y - 0.2928\bar{a}_z]$

$\bar{E} = 6355.2326\bar{a}_y - 2631.6109\bar{a}_z$ V/M

(8) Case 1: line charge. $\bar{E}_1 = 7.19\bar{a}_x - 14.38\bar{a}_z$ V/M — 3M

Case 2: $\bar{E}_2 = -56471\bar{a}_z$ V/M. $\left(\frac{\rho_{S1}}{2\epsilon_0}\right)$ — 8M

Case 3: $\bar{E}_3 = -56471\bar{a}_z$ V/M

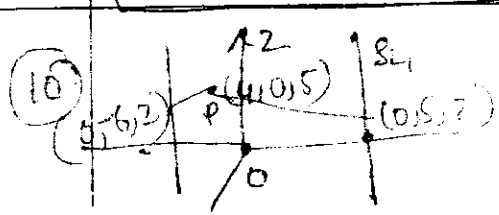
$\bar{E} = E_1 + E_2 + E_3$ — 3M

$= 7.19\bar{a}_x - 25.674\bar{a}_z$ — 1M

(9) $\bar{D} = 6.752\times10^{-6}\bar{a}_x + 9.003\times10^{-6}\bar{a}_z - 11.254\times10^{-6}\bar{a}_z$ C/M2 — 5M

$\bar{D} = 3.819\times10^{-7}\bar{a}_x + 5.092\times10^{-7}\bar{a}_y$ C/M^2 — 5M

(10)



$\bar{E} = \frac{\rho_{L1}\bar{a}_{R_1}}{2\pi\epsilon_0 R_1} + \frac{\rho_{L2}\bar{a}_{R_2}}{2\pi\epsilon_0 R_2}$ — 8M

$\bar{E} = 15.311\bar{a}_x + 3.676\bar{a}_y$ V/M — 7M

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

ASSIGNMENT-I (20-21 Odd Sem)

Staff Name : Dr Prabhavathi.S /Vani H	**Sem/Sec:5TH /A & B**	**Max Marks:10**
Course Name : EMW	**Course Code : 18EC55**	

Q No	QUESTIONS	CO	BTL	PO
1	Define Coulombs law and demonstrate coulombs law in Vector form.	1	L1	1,2, 12
2	Define Electric field intensity and Electric flux density.	1	L1	1,2, 12
3	Develop EFI due to number of point charges.	1	L3	1,2, 12
4	Point charges of 50nC each are located at A(1,0,0) B(-1,0,0) C(0,1,0) & D(0,-1,0) in free space. Find total force on charge at A.	1	L1	1,2, 12
5	Two point charges of 20μC and -20μC are located at A(2,-3,2) &B(4, 3,-2) respectively in free space . Find magnitude of force on charge at A.	1	L1	1,2, 12
6	A point charge Q1=25nC located at A(4,-2,7) & charge Q2=60nC at B(-3,4,-2). Find E at C(1,2,3) & find the direction of E.	1	L1	1,2, 12
7	Develop an expression for Electric field intensity due to infinite line charge.	1	L3	1,2, 12
8	Q1 and Q2 are the point charges located at (0,-4,3) & (0,1,1). If Q1 is 2nC, find Q2 such that the force on a test charge at(0,-3,4) has no Z-component.	1	L1	1,2, 12
9	A line charge of total charge 1μC is placed between A(0,0,1) & B(0,0,2)m. Find Electric field intensity at i) $P_1(0,0,0)$m ii)$P_2(0,1,1)$m.	1	L1	1,2, 12
10	Solve for D in Cartesian coordinate system at P (6,8,-10) due to point charge of 40mC at origin and a uniform line charge of ρ_L= 40μC/m on the z axis.	1	L3	1,2, 12
11	Two uniform line charges of infinite lengths with ρ_L= 4nC/m & 6nC/m lies in x=0 plane at y=5m & y=-6m respectively. Solve E at (4,0,5) in air.	1	L3	1,2, 12
12	Define & describe Coloumbs law & electric field intensity.	1	L1	1,2, 12
13	A line charge of 2nC/m lies along y-axis while surface charge densities of 0.1 and -0.1nC/m^2 exist on the plane Z=3 and Z=-4m respectively. Find the Electric field intensity at a point (1,-7,2).	1	L1	1,2, 12

Co-ordinator

Faculty incharge

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Electronics and Communication Engineering

IA-1PERFORMANCE ANALYSIS 20-21 odd

Internal Assessment1

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
CO mapping	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1
Max Marks /Question	10	10	10	10	10	10	10	10	10	10
Total marks of class /question	290	70	310	50	290	70	310	50	300	60
No. of students attended	29	7	31	5	29	7	31	5	30	6
No of students scored > 60% of marks/Question	29	7	31	5	29	7	31	5	30	6
Percentage of students scored>60% of marks/Question	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Mark range	0-10	11 to 20	21-30	31-40	41-50
No. Of Students	0	0	0	0	36

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

ASSIGNMENT-II (20-21 Odd Sem)

Staff Name : Dr Prabhavathi.S /Vani H	Sem/Sec:5TH /A & B	Max Marks:10
Course Name : EMW	Course Code : 18EC55	

Q No	QUESTIONS	CO	BTL	PO
1	Evaluate both sides of Gauss Divergence theorem for the field D= 4x a_x + $3y^2a_y$+ 2z3 a_z c/m^2. The region is defined by $1\leq x\leq 2$, $2\leq y\leq 3$, $3\leq z\leq 4$.	2	3	1,2 12
2	Develop Poisson's and Laplace's equation, Write Laplace equation in Cartesian, cylindrical & spherical co-ordinate systems.	3	2	1,2 12
3	Given V= $[Ar^4 + Br^{-4}]\sin 4\Phi$ volts. a) Show that V satisfies laplace equation. b)bevaluate A & B so that so that V=100V, |E| =500V/m at r=1m, $\Phi=22.5^0$, z = 2	3	3	1,2 12
4	Applying Laplace's equation, state and prove uniqueness theorem.	3	1	1,2 12
5	Solve the Laplace euation for the potential field in the homogeneous region between the two concentric conducting spheres with radii a & b, such that b>a if potential V=0 at r=b and $V=V_o$ at r=a. and find the capacitance between the two concentric spheres.	3	3	1,2 12
6	Find potential V as a function of r using Gauss law and line integral.	2	1	1,2 12
7	Develop an expression for H due to finite straight long conductor using Biot-Savart's law.	3	3	1,2 12
8	Find the magnetic field intensity at (1.5,2,3) due to a conductor carrying current of 24A along z-axis extremely from z=0 to z=6.	3	1	1,2 12
9	A point charge of Q=-1.2C has velocity V=$5a_x$ +$2a_y$ -$3a_z$ m/s. Determine the magnitude of the force exerted on the charge if i)E =-$18a_x$ +$5a_y$ -$10a_z$ V/m ii)B= -$4a_x$ +$4a_y$ +$3a_z$ iii) both present	3	1	1,2 12
10	Three concentric spherical surfaces have radii r=3,5 & 7cm respectively and have uniform charge densities of 200,-50 & p_x $\mu C/m^2$ respectively. Find a) D and E at r=2cm,4cm & 6cm b) Find p_x if D=0 at r=7.32cm.	2	1	1,2 12
11	Make use of Laplace's equation to check the given field satisfies it or not i)V = $2x^2 - 3y^2 + z^2$ ii)V= rcosϕ + z iii)V=$r^2\cos\theta$	3	3	1,2 12
12	Demonstrate Divergence theorem	3	2	1,2 12
13	Develop an expressin for H on the axis of a Circular loop using Amperes Circuital law.	3	3	1,2 12

14	State and prove Stokes theorem.	3	1	1,2 12
15	State and prove Gauss Law	2	1	1,2 12
16	Develop Gauss law in differential form.	2	3	1,2 12

Co-ordinator

Faculty Incharge

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS &COMMUNICATION ENGINEERING

Continuous Internal Evaluation-II (20-21 Odd Sem)

Staff Name: Dr.Prabhavathi S/Mrs.Vani H	**Sem: V Sec: A/B**	**Date:1/12/2020 Time:09:15-10:45AM**
Sub: Electromagnetic Waves	**Course Code: 18EC55**	**Total Contact Hours: 50**
Max marks:30	**Prerequisites: Physics, Vector algebra & Calculus**	

QUESTIONS	Marks	BTL	CO	PO
1. Find total charge in a volume defined by the six planes for which $1\le x\le 2$, $2\le y\le 3$, $3\le z\le 4$ if $D= 4x\, a_x + 3y^2 a_y + 2z3\, a_z$ c/m^2	10	L1	2	1,2,
OR				
2. Demonstrate Divergence theorem	10	L2		12
3.Three concentric spherical surfaces have radii r=3,5 & 7cm respectively and have uniform charge densities of 200,-50 & p_x $\mu C/m^2$ respectively. Find a) D and E at r=2cm,4cm & 6cm	10			
b) Find p_x if D=0 at r=7.32cm.	5	L1 L3	2	1,2 12
OR				
4. a) State and prove Gauss Law. b) Develop Gauss law in differential form.	5			
5. Demonsrate Uniqueness theorem.	10			
OR		L2	3	1,2
6. Develop an expression for H due to finite straight long conductor using Biot-Savart's law.	10	L3		12
7.Find the magnetic field intensity at (1.5,2,3) due to a conductor carrying current of 24A along z-axis extremely from z=0 to z=6.				
OR	10	L2	3	1,2
8. a)State and prove Stokes theorem. b) Develop an expressin for H on the axis of a Circular loop using Amperes Circuital law.	10	L3		12
9. Solve the Laplace euation for the potential field in the homogeneous region between the two concentric conducting spheres with radii a & b, such that b>a if potential V=0 at r=b and $V=V_o$ at r=a. and find the capacitance between the two concentric spheres.	10	L3	3	1,2
OR	10	L3		12
10.Solve Make use of Laplace's equation to check the given field satisfies it or not i)$V = 2x^2 - 3y^2 + z^2$ ii)$V= r\cos\phi + z$ iii)$V=r^2\cos\theta$				

IA Coordinator

Staff-in-Charge

SCHEME OF EVALUATION CONTINUOUS INTERNAL EVALUATION-II (20-21ODD)

Staff Name: Dr.Prabhavathi S/Mrs.Vani H	**Sem: V Sec: A/B**	**Date:1/12/2020 Time:09:15-10:45AM**
Sub: Electromagnetic Waves	**Course Code: 18EC55**	**Total Contact Hours: 50**
Max marks:30	**Prerequisites: Physics, Vector algebra & Calculus**	

Q1) $Q = \oint_S \bar{D} \cdot d\bar{s}$

For front $\bar{D} \cdot d\bar{s} = 4x\,dy\,dz$. top $\bar{D} \cdot d\bar{s} = 2z^3\,dx\,dy$

Back $\bar{D} \cdot d\bar{s} = -4x\,dy\,dz$. bottom $\bar{D} \cdot d\bar{s} = -2z^3\,dx\,dy$.

Right $\bar{D} \cdot d\bar{s} = 3y^2\,dx\,dz$. — 6M

left $\bar{D} \cdot d\bar{s} = -3y^2\,dx\,dz$ — 4M

$Q = +93C$

Q2) Divergence theorem.

$$\oint_S \bar{D} \cdot d\bar{s} = \int_V (\nabla \cdot \bar{D})\, dv$$ — 10M

Proof.

Q3) a) $\bar{D} = \varepsilon_0 \bar{E} = 112.5\, \bar{a}_x\ \mu C/m^2$

$\bar{E}_1 = 5.6471 \times 10^6\, \bar{a}_x\ V/m$ — 5M

$\bar{E}_2 = -3.9216 \times 10^6\, \bar{a}_x\ V/m$

$\bar{E} = \bar{E}_1 + \bar{E}_2 = 1.7255 \times 10^6\, \bar{a}_x\ V/m$

$\bar{D} = \bar{D}_1 + \bar{D}_2 = 15.278\, \bar{a}_x\ mC/m^2$.

b) $\bar{D}_1 = \dfrac{\rho_{s1}(a_1)^2}{(x)^2}\bar{a}_x$ $\bar{D}_2 = \dfrac{\rho_{s2}(a_2)^2}{(x)^2}\bar{a}_x$ $\bar{D}_3 = \dfrac{\rho_x(a_3)^2}{(x)^2}\bar{a}_x$

$\rho_x = -11.2244\ \mu C/m^2$ — 5M

Q4) a) Gauss law $\psi = Q = \oint_S \bar{D} \cdot d\bar{s} = \int_V \rho_v\, dv$ — 5M

b) Gauss law in differential volume.

Q = Charge enclosed in volume $\Delta V = \left(\dfrac{\partial D_x}{\partial x} + \dfrac{\partial D_y}{\partial y} + \dfrac{\partial D_z}{\partial z}\right)\Delta V$

— 5M

5) Uniqueness Theorem

Statement & Proof — (10M)

$V_2 = V_1$

7) $d\bar{L} = dz\,\bar{a}_z$

$\bar{H} = -0.9387\,\bar{a}_x + 0.704\,\bar{a}_y$ A/m. — (10M)

8) $\bar{H}$ due to straight conductor of Finite length.

$$\bar{H} = \frac{I}{4\pi r}\left[\sin\alpha_2 - \sin\alpha_1\right]\bar{a}_\phi \text{ A/m}.$$ — (10M)

$$\bar{B} = \mu\bar{H} = \frac{\mu I}{4\pi r}\left[\sin\alpha_2 - \sin\alpha_1\right]\bar{a}_\phi \text{ Wb/m}^2$$

8) a) Stokes Theorem [Statement & Proof] — (5M)

b) $\bar{H}$ on the axis of a circular loop.

$$\bar{H} = \frac{I r^2}{2(r^2+z^2)^{3/2}}\cdot\bar{a}_z \text{ A/m}$$ — (5M)

$$\bar{H} = \frac{I r^2}{2(r^2)^{3/2}}\bar{a}_z = \frac{I}{2r}\bar{a}_z \text{ A/m} \quad \text{at } z=0.$$

9) $\bar{E} = \frac{V_0}{\left(\frac{1}{b}-\frac{1}{a}\right)}\frac{\partial}{\partial r}\left(\frac{1}{r}\right)\bar{a}_r = \frac{-V_0}{\left(\frac{1}{b}-\frac{1}{a}\right)r^2}\cdot\bar{a}_r$ V/m — (10M)

$$\rho_s = \frac{\varepsilon V_0}{\left(\frac{1}{a}-\frac{1}{b}\right)r^2} \text{ C/m}^2 \qquad C = \frac{Q}{V_0} = \frac{\frac{4\pi\varepsilon V_0}{\left(\frac{1}{a}-\frac{1}{b}\right)}}{V_0} = \frac{4\pi\varepsilon V_0}{\left(\frac{1}{a}-\frac{1}{b}\right)} \text{ F}.$$

10) i) Satisfies Laplace equation
ii) Does not Satisfy laplace equation
iii) Does not Satisfy laplace equation.

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Electronics and Communication Engineering

IA-2PERFORMANCE ANALYSIS

20-21 odd

5th A

Internal Assessment2

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
CO mapping	CO2	CO2	CO2	CO2	CO3	CO3	CO3	CO3	CO3	CO3
Max Marks /Question	10	10	10	10	10	10	10	10	10	10
Total marks of class /question	330	20	328	30	300	40	328	20	130	210
No. of students attended	33	2	33	3	30	4	33	2	13	21
No of students scored > 65% of marks/Question	33	2	33	3	30	4	33	2	13	21
Percentage of students scored>65% of marks/Question	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Mark range	0-10	11 to 20	21-30	31-40	41-50
No. Of Students	0	0	0	1	35

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

ASSIGNMENT-III (20-21 Odd Sem)

Q No	QUESTIONS	CO	BTL	PO
1	Demonstrate Maxwell's equations for time varying fields in both point and integral form.	5	2	1,2 12
2	Explain skin depth & skin effect.	5	3	1,2 12
3	Demonstrate poynting theorem.	5	2	1,2 12
4	A 300MHz plane wave travelling through fresh water for which $\sigma=0$, $\mu_r=1$ & $\varepsilon r=78$. Determine β, η, λ & α.	5	1	1,2 12
5	For the given medium $\varepsilon=4x10^{-9}$ & $\sigma=0$. Find k so that the following fields satizsfies maxwell's equations. $E=(20y-kt)a_x$ V/m $H=(y+2 \times 10^6)a_z$ A/m	5	1	1,2 12
6	Develop the solution of wave equation for a uniform plane wave in free space.	5	2	1,2 12
7	An E field in free space is given as $E=800\cos(10^8t-\beta y)a_z$ V/m. Find β, λ and H at P(0.1,1.5,0.4)) at t=8nsec.	5	3	1,2 12
8	The depth of penetration in a certain conducting medium is 0.1m and the frequency of the EM wave is 1.0MHz. Find conductivity of conducting medium.	5	1	1,2 12
9	Develop an expression for force on differential current element placed in a magnetic field.	5	1	1,2 12
10	For the given medium $\varepsilon=4x10^{-9}$ & $\sigma=0$. Determine k so that the following fields satisfies maxwell's equations. $E=(20y-kt)a_x$ V/m $H=(y+2 \times 10^6)a_z$ A/m		3	1,2 12
11	If $B=0.05x\ a_y$ T in a material for which $\chi_m=2.5$.Find μ_r, μ, H, M,J & J_b.	5	1	1,2 12
12	Demonstrate and compare different types of wave propagation.	5	2	1,2 12
13	Explain magnetic forces, materials and inductance.	4	1	1,2 12
14	Demonstrate the expression for continuity of current.	4	2	1,2 12
15	Develop the boundary condition at the interface between two magnetic materials for a normal component.	4	3	1,2 12
16	A ferrite material is operating in linear mode with B=0.05T. Assume $\mu_r=50$. find magnetic susceptibility(χ), magnetization(M) & magnetic field intensity(H)	4	1	1,2 12

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS &COMMUNICATION ENGINEERING

Continuous Internal Evaluation -III (20-21 Odd Sem)

Staff Name: Dr.Prabhavathi S/Mrs.Vani H	**Sem: V Sec: A/B**	**Date: 07 /01/2021 Time:2.30-04.00pm**
Sub: Electromagnetic Waves	**Course Code: 18EC55**	**Total Contact Hours: 50**
Max marks:50	**Prerequisites: Physics, Vector algebra & Calculus**	

QUESTIONS	Marks	BTL	CO	PO
1. Demonstrate Maxwell's equations for time varying fields in both point and integral form. **OR** 2. Explain skin depth & skin effect.	10	L2 L3	5	1,2, 12
3. Demonstrate poynting theorem. **OR** 4. A 300MHz plane wave travelling through fresh water for which $\sigma=0$, $\mu_r=1$ & $\varepsilon r=78$. Determine β, η, λ & α.	10	L2 L1	5	1,2, 12
5. For the given medium $\varepsilon=4x10^{-9}$ & $\sigma=0$. Find k so that the following fields satizsfies maxwell's equations. $E=(20y-kt)a_x$ V/m $H=(y+2 x 10^6)a_z$ A/m. **OR** 6. Demonstrate Uniform plane wave propagating in a good conducting media.	10	L1 L2	5	1,2, 12
7. Develop the solution of wave equation for a uniform plane wave in free space. OR 8. An $\overline{E}$ field in free space is given as $\overline{E}=800\cos(10^8t-\beta y)\overline{a}_z$ V/m. Find β, λ and $\overline{H}$ at P(0.1,1.5,0.4)) at t=8nsec.	10	L3 L1	5	1,2, 12
9. The depth of penetration in a certain conducting medium is 0.1m and the frequency of the EM wave is 1.0MHz. Find conductivity of conducting medium. **OR** 10. Develop an expression for force on differential current element placed in a magnetic field.	10	L1 L3	5	1,2, 12

IA Coordinator **Staff-in-Charge**

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF ELECTRONICS &COMMUNICATION ENGINEERING

SCHEME OF EVALUATION CONTINUOUS INTERNAL EVALUATION-III (20-21 ODD)

Staff Name: Dr.Prabhavathi S/Mrs.Vani H	**Sem: V Sec: A/B**	**Date:1/12/2020 Time:02:30-04:00PM**
Sub: Electromagnetic Waves	**Course Code: 18EC55**	**Total Contact Hours: 50**
Max marks:50	**Prerequisites: Physics, Vector algebra & Calculus**	

1) F.S

Point form : $\nabla \times \bar{E} = -\frac{\partial \bar{B}}{\partial t}$, $\nabla \times \bar{H} = \frac{\partial \bar{D}}{\partial t}$, $\nabla \cdot \bar{D} = 0$

$\nabla \cdot \bar{B} = 0$ — (5M)

Integral form : $\oint \bar{E} \cdot d\bar{L} = -\int_s \frac{\partial \bar{B}}{\partial t} \cdot ds$ $\quad \oint_s \bar{D} \cdot d\bar{s} = 0$

$\oint \bar{H} \cdot d\bar{L} = \int_s \frac{\partial \bar{D}}{\partial t} \cdot ds$ $\quad \oint_s \bar{B} \cdot d\bar{s} = 0$

G.C

Point form : $\nabla \times \bar{E} = -\frac{\partial \bar{B}}{\partial t}$ $\quad \nabla \times \bar{H} = \bar{J}$, $\nabla \cdot \bar{D} = 0$, $\nabla \cdot \bar{B} = 0$ — (5M)

Integral form : $\oint \bar{E} \cdot d\bar{L} = -\int_s \frac{\partial \bar{B}}{\partial t} \cdot d\bar{s}$, $\oint \bar{H} \cdot d\bar{L} = I = \int_s \bar{J} \cdot d\bar{s}$

$\oint_s \bar{D} \cdot d\bar{s} = 0$, $\oint_s \bar{B} \cdot d\bar{s} = 0$

2) Explaination — (5M)

$$\delta = \frac{1}{\alpha} = \frac{1}{\beta} = \frac{1}{\sqrt{\pi f \mu \sigma}} \text{ m}$$

$$\eta = \left(\frac{1}{\sigma\delta} + j\frac{1}{\sigma\delta}\right) = \frac{\sqrt{2}}{\sigma\delta} \angle 45^\circ \ \Omega.$$

$$v = \frac{\omega}{\beta} = \frac{\sqrt{2}(\sqrt{\omega})^2}{\sqrt{\omega\mu\sigma}} \text{ m/s}$$

$$\lambda = \frac{2\pi}{\beta} = 2\pi\delta \text{ m}$$

3) Poynting theorem.

$$\bar{P} = \bar{E} \times \bar{H}$$

$$\bar{P} = \frac{E_m^2}{\eta_0} \cos^2(\omega t - \beta z)\, \bar{a}_z \text{ W/m}^2$$

Power = Power density x Area

$$P_{avg} = \frac{1}{2}\frac{E_m^2}{\eta} \text{ W/m}^2$$

$\beta = 55.52$ $\quad \lambda = 0.113\ m$

$\eta = 42.68$ $\quad \alpha = 0$ — (10M)

5) $\bar{E} = (20y - kt)\bar{a}_x\ V/m \qquad \bar{H} = (y + 2\times10^6 t)\bar{a}_z\ A/m$

$$\nabla \times \bar{H} = \frac{\partial \bar{D}}{\partial t} = \frac{\partial(\varepsilon \bar{E})}{\partial t} = \varepsilon \frac{\partial \bar{E}}{\partial t}$$

$$LHS = \nabla \times \bar{H} = \begin{vmatrix} \bar{a}_x & \bar{a}_y & \bar{a}_z \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ 0 & 0 & (y + 2\times10^6 t) \end{vmatrix}$$ — (10M)

$$= \bar{a}_x$$

$$RHS = \varepsilon \frac{\partial \bar{E}}{\partial t} = -k\varepsilon \bar{a}_x$$

$$K = -\frac{1}{\varepsilon} = 2.5\times10^8$$

6) UPW in Good Conductor.

$$\alpha = \sqrt{\pi f \mu \sigma}\ Np/m, \quad \beta = \sqrt{\pi f \mu \sigma}\ rad/m.$$ — (10M)

$$\eta = \sqrt{\frac{j\omega\mu}{\sigma}}, \quad \eta = \sqrt{\frac{\pi f \mu}{\sigma}}(1+j1)$$

7) UPW in free space.

$$\alpha = 0, \quad \beta = \omega\sqrt{\mu_0 \varepsilon_0}, \quad \eta = \sqrt{\frac{j\omega\mu}{\sigma + j\omega\varepsilon}}\ \Omega.$$

$$\lambda = \frac{2\pi}{\beta} m, \quad V = \lambda \cdot f\ m/s.$$

8) $\beta = 0.3333\ rad/m, \quad \lambda = 18.85\ m.$

$$\bar{H} = 2.122 \cos\left[10^8 (8\times10^{-9}) - (0.3333)(1.5)\right]\bar{a}_x = 2.1219\bar{a}_x\ A/m$$ — (10M)

9) $\alpha = \frac{1}{\sqrt{\pi f \mu \sigma}} \qquad \sigma = 5.0329\ \mho/m$ — (10M)

10) Force on differential current element placed in magnetic field.

$$\bar{F} = \oint I d\bar{L} \times \bar{B}$$

$$F = \oint \bar{I}\bar{L} \times \bar{B}.$$

$F = ILB\sin\theta$ — (10M)

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Electronics and Communication Engineering

IA-3PERFORMANCE ANALYSIS

Internal Assessment3

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
CO mapping	CO4	CO4	CO4	CO4	CO4	CO4	CO5	CO5	CO5	CO5
Max Marks /Question	10	10	10	10	10	10	10	10	10	10
Total marks of class /question	100	248	256	32	30	173	50	138	25	101
No. of students attended	10	25	26	4	3	20	5	14	4	12
No of students scored > 65% of marks/Question	10	25	25	3	3	17	5	14	2	9
Percentage of students scored>65% of marks/Question	100.00	100.00	96.16	75.00	100.00	85.00	100.00	100.00	50.00	75.00

Mark range	0-10	11 to 20	21-30	31-40	41-50
No. Of Students	5	6	7	6	13

Faculty: DR S PRABHAVATHI						
Course Name: EMW						
Course Code: 18EC55						
Academic Year: 2020-21						
Sl. No	USN NO	NAME	CIE	SEE	Total	FOR 40
1	3VC18EC002	AKASH H	34	21	55	39
2	3VC18EC003	AKASH SHASHIDHAR RAMDURG	37		48	33
3	3VC18EC004	ANKITHA N G	40	26	66	40
4	3VC18EC006	AVINASHGOUDA A HIREGOUDAR	40	23	63	39
5	3VC18EC010	BHARGAVI Y	38	33	71	39
6	3VC18EC012	CHANDHANA ND	39	21	60	40
7	3VC18EC017	E VAISHNAVI	40	32	72	40
8	3VC18EC020	GUDIPUTI DHARANI	35		50	31
9	3VC18EC022	HAFSA AFREEN	40	32	72	38
10	3VC18EC023	KADAPPA KADAGOUDAR	36	30	66	38
11	3VC18EC024	KAREESHMA BEGUM	36	21	57	35
12	3VC18EC026	KODI POOJA	35		50	35
13	3VC18EC028	KORI MADHUMOHANKUMAR	32	21	53	33
14	3VC18EC031	MANU NAIKODI	40	28	68	40
15	3VC18EC032	MEHTAJ BANU	40	42	82	38
16	3VC18EC033	N KEERTHI	40	34	74	40
17	3VC18EC037	NAVYA G	38	21	59	35
18	3VC18EC039	NITHYA SANTHOSHI H	40	30	70	40
19	3VC18EC040	PRAJWAL K S	38	29	67	36
20	3VC18EC042	RUMANA ANJUM	40	29	69	40
21	3VC18EC045	SACHIN DHAYAPULE	36		50	34
22	3VC18EC047	SAHANA P KEMBHAVI	36	26	62	36
23	3VC18EC048	SAI KALYAN YADAV B	38	21	59	35
24	3VC18EC049	SANDHYA P	29	26	55	34
25	3VC18EC051	SHINEY	39	32	71	40
26	3VC18EC053	SHIVAKUMAR C K	36		52	35
27	3VC18EC054	SHIVANI H	34		40	35
28	3VC18EC064	VAISHNAVI A	40	21	61	36
29	3VC18EC065	VASUDEV T M	33	21	54	37
30	3VC18EC067	VINAY JANGADI	34	2	55	34

31	3VC17EC001	AEJAZ AHMED	32	21	53	35
32	3VC17EC040	NITISH KUMAR M R	36	A	36	33
33	3VC17EC059	SAI DHEERAJ	32		47	34
34	3VC18EC021	H SHIVARAM REDDY	34	21	55	33
35	3VC18EC058	SUMALATHA	38		53	33
36	3VC16EC081	SHREENIVASA G P	35	21	56	33
37	0	0				
38	0	0				
39	0	0				
40	0	0				
41	0	0				
42	0	0				
43	0	0				
44	0	0				
64						
65						
Number of students scoring >= 23 in				**15**		

EXTERNAL EXAM

Number of students appeared for the exam	**35**		-
Number of students scoring >= 45% in	**15**		-
Percentage	**0.43**		-
Achieved target:	**43%**		
ATTAINMENT LEVEL	2		

Rao Bahadur Y Mahabaleswarappa Engineering College

Dept. of Electronics & Communication Engineering

Semester :5TH A **AY 2020-21**

Questionnaires for EMW

	Are you able to define & describe Coloumbs law & electric field intensity.
	Are you able to define & explain electric flux density,Gauss law & Divergence.
	Are you able to describe energy and potential along with concepts of current and conductors.
	Are you able to describe Poisonns & Laplace equations, & Uniqueness theorem.
	Are you able to define & describe basic concepts of magnetostatics by studying various laws,Stokes thm & scalar and vector
	Are you able to explain magnetic forces,materials and inductance.
	Are you to describe the concepts of time varying fields and develop maxwells equations in point & integral form.
	Are you able to describe and compare different types of wave propagation.

Course Exit Survey Guidelines: Excellent – 5, Very Good – 4, Good – 3,Average – 2, Below Average - 1

3VC18EC002	AKASH H	4	5	4	5	4	4	5	5	AKH
3VC18EC003	AKASH SHASHIDHAR RAMDURG	5	4	5	4	5	4	5	5	AKSH
3VC18EC004	ANKITHA N G	5	5	5	5	4	4	4	4	ANITHA
3VC18EC006	AVINASHGOUDA A HIREGOUDAR	5	4	5	5	4	4	5	4	GOUDA
3VC18EC010	BHARGAVI Y	5	4	4	5	4	5	4	4	Bhav
3VC18EC012	CHANDHANA ND	4	5	5	5	5	4	5	4	Chand
3VC18EC017	E VAISHNAVI	5	4	5	5	5	5	5	5	Vais
3VC18EC020	GUDIPUTI DHARANI	5	5	4	5	4	4	5	4	DHARA
3VC18EC022	HAFSA AFREEN	4	4	5	4	5	4	4	5	HAF
3VC18EC023	KADAPPA KADAGOUDAR	4	4	5	4	5	4	4	4	Gouda
3VC18EC024	KAREESHMA BEGUM	5	4	5	4	5	4	4	4	KAR
3VC18EC026	KODI POOJA	5	5	5	4	4	4	5	5	Pooja
3VC18EC028	KORI MADHUMOHANKUMAR	4	5	5	4	4	5	5	5	K.M
3VC18EC031	MANU NAIKODI	5	5	4	5	5	5	4	4	MN
3VC18EC032	MEHTAJ BANU	4	5	4	5	5	4	5	4	MBK
3VC18EC033	N KEERTHI	5	4	5	4	4	4	5	4	Keerthi

3VC18EC037	NAVYA G	4	5	4	4	5	5	4	4	NAVYA
3VC18EC039	NITHYA SANTHOSHI H	5	4	4	5	4	5	4	5	Santhu
3VC18EC040	PRAJWAL K S	4	5	4	5	4	4	4	4	PKS
3VC18EC042	RUMANA ANJUM	5	4	4	4	5	5	5	5	RUMA
3VC18EC045	SACHIN DHAYAPULE	5	4	5	4	5	4	5	4	SACHI
3VC18EC047	SAHANA P KEMBHAVI	5	4	4	5	5	5	4	5	SPK
3VC18EC048	SAI KALYAN YADAV B	4	5	5	4	5	4	5	4	Sai
3VC18EC049	SANDHYA P	5	5	4	5	4	5	4	4	Sandya
3VC18EC051	SHINEY	5	4	4	5	4	5	4	5	S
3VC18EC053	SHIVAKUMAR C K	4	5	5	5	5	4	4	5	SCK
3VC18EC054	SHIVANI H	5	4	5	4	5	4	4	4	Shivani
3VC18EC064	VAISHNAVI A	5	4	5	4	4	5	5	5	Vaishu
3VC18EC065	VASUDEV T M	5	4	5	4	5	4	5	4	V
3VC18EC067	VINAY JANGADI	5	4	5	5	4	5	5	5	Vinay
3VC17EC001	AEJAZ AHMED	5	5	5	5	5	5	5	5	AA
3VC17EC040	NITISH KUMAR M R	4	4	5	4	4	5	4	5	NITISH
3VC17EC059	SAI DHEERAJ	5	5	5	5	4	4	5	5	Sai
3VC18EC021	H SHIVARAM REDDY	5	4	5	5	4	5	4	5	SHIVARAM
3VC18EC058	SUMALATHA	4	5	4	5	4	5	5	4	Suma
3VC16EC081	SHREENIVASA G P	5	4	5	5	4	4	5	5	AGP

Prabha

[Dr. S. Prabhavathi]

Rao Bahadur Y Mahabaleswarappa Engineering College

Dept. of Electronics & Communication Engineering

Semester :5TH A **AY 2020-21**

Course exit survey for EMW

C305.1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
C305.2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
C305.3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configuration
C305.4	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
C305.5	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Course Exit Survey Guidelines: Excellent – 5, Very Good – 4, Good – 3,Average – 2, Below Average - 1

3VC18EC002	AKASH H	4	4	5	5	4	Akash
3VC18EC003	AKASH SHASHIDHAR RAMDURG	5	4	5	5	5	Akash
3VC18EC004	ANKITHA N G	5	4	5	5	5	Ankitha
3VC18EC006	AVINASHGOUDA A HIREGOUDAR	5	4	4	4	5	Vinay
3VC18EC010	BHARGAVI Y	5	5	5	5	5	Bhargavi
3VC18EC012	CHANDHANA ND	4	4	4	5	5	Chandh
3VC18EC017	E VAISHNAVI	5	5	5	5	4	Vaishna
3VC18EC020	GUDIPUTI DHARANI	4	5	5	5	5	Gud
3VC18EC022	HAFSA AFREEN	5	5	4	4	4	Hafsa
3VC18EC023	KADAPPA KADAGOUDAR	4	4	4	4	4	K K
3VC18EC024	KAREESHMA BEGUM	4	5	4	4	5	KAREE
3VC18EC026	KODI POOJA	4	5	4	5	4	Pooja
3VC18EC028	KORI MADHUMOHANKUMAR	5	5	5	4	5	Kori
3VC18EC031	MANU NAIKODI	5	5	5	4	5	MANU
3VC18EC032	MEHTAJ BANU	5	5	5	4	5	banu
3VC18EC033	N KEERTHI	4	5	5	5	5	Keerthi
3VC18EC037	NAVYA G	5	4	5	4	5	Navya
3VC18EC039	NITHYA SANTHOSHI H	4	5	4	5	4	Nithya
3VC18EC040	PRAJWAL K S	4	5	4	5	4	Pra
3VC18EC042	RUMANA ANJUM	4	5	5	5	5	Rumana
3VC18EC045	SACHIN DHAYAPULE	4	5	5	5	5	S
3VC18EC047	SAHANA P KEMBHAVI	4	5	4	4	4	Sahana
3VC18EC048	SAI KALYAN YADAV B	4	5	5	5	5	Sai
3VC18EC049	SANDHYA P	4	5	4	4	4	Sandhya

3VC18EC051	SHINEY	5	4	5	4	5	Shiney.
3VC18EC053	SHIVAKUMAR C K	4	5	4	5	5	S.C.K
3VC18EC054	SHIVANI H	5	4	5	4	5	Shiv
3VC18EC064	VAISHNAVI A	5	5	4	5	5	VA
3VC18EC065	VASUDEV T M	4	4	4	4	4	V.Vasu.T.M
3VC18EC067	VINAY JANGADI	5	5	5	5	5	Vinay
3VC17EC001	AEJAZ AHMED	4	4	4	4	4	Ahmd.
3VC17EC040	NITISH KUMAR M R	5	4	5	4	5	Nitish
3VC17EC059	SAI DHEERAJ	5	4	4	5	5	Sai Dh
3VC18EC021	H SHIVARAM REDDY	4	5	4	4	5	Reddy.
3VC18EC058	SUMALATHA	4	4	5	4	4	Sumalatha
3VC16EC081	SHREENIVASA G P	5	4	4	5	5	SGP

Prabha

[Dr. S. Prabhavathi]

RAO BAHADUR Y MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARIDEPARTMENT OF ELECTRONICS COMMUNICATION ENGNEERING

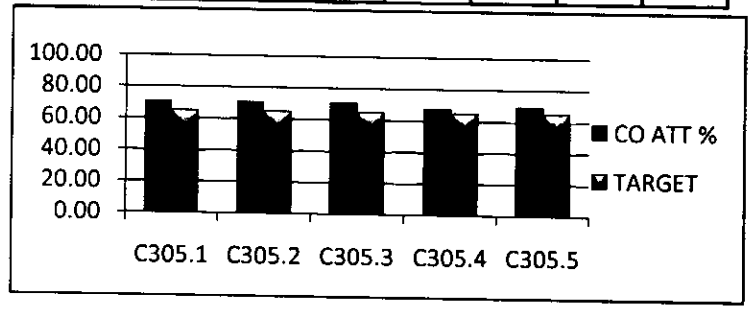
DIRECT & INDIRECT ATTAINMENT 2020-21

Faculty: DR S PRABHAVATHI					
Course Name: EMW					
Course Code: 18EC55	**Sem**	**5**	**Sec**	**A**	
C305.1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.				
C305.2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.				
C305.3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and				
C305.4	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and				
C305.5	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate				

CO-PO/PSO Mapping

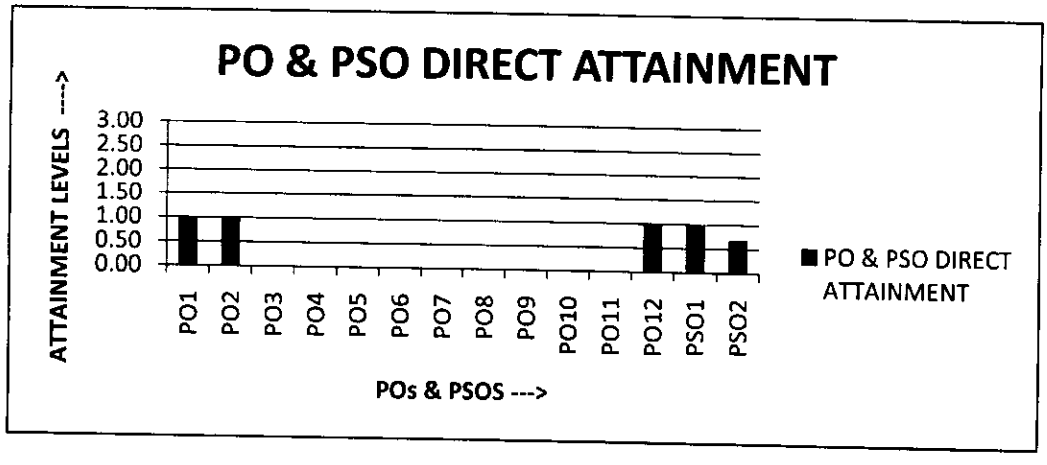
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C305.1	3	3										3	3	2
C305.2	3	3										3	3	2
C305.3	3	3										3	3	2
C305.4	3	3										3	3	2
C305.5	3	3										3	3	2
AVG	2.25	2.00										3.00	2.00	2.00

	CO AT	TARGET
C305.1	70.27	65
C305.2	70.49	65
C305.3	70.49	65
C305.4	66.91	65
C305.5	69.31	65



	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PO ATT	1.00	1.00										1.00	1.00	0.67

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
PO ATT	3.00	3.00										3.00	3.00	2.00



CO ATTAINMENT GAP ANALYSIS 2020-21 (ODD)

Course Outcomes	CO Attainment	CO Target	CO Attainment Gap	CO Attainment Level
C305.1	70.27	65	NO GAP	3
C305.2	70.49	65	NO GAP	3
C305.3	70.49	65	NO GAP	3
C305.4	66.91	65	NO GAP	2
C305.5	69.31	65	NO GAP	2

ACTION REPORT ON GAP ANALYSIS

Course Outcomes	Action proposed to bridge the gap	Modification of target if achieved
C305.1	—	70
C305.2	—	70
C305.3	—	70
C305.4	—	70
C305.5	—	70

INSTRUCTOR REPORT: 2019-20

Impact of Delivery Methods (state the delivery methods used and its effectiveness):

- **Blended method**: This subject was taught in blended mode both in offline and online mode due to COVID-19 pandemic; offline teaching method was effective compared to online teaching. In online teaching shared presentations, done live class sand digital notes on high priority in Google classrooms, Gmeet and Zoom platforms.
- **Teaching-Learning**: After teaching each module students are assigned with video assignments and positively students made video lessons which is outcome based knowledge i.e student rather than just remembering the concepts and reproducing in exams now student started thinking and applying, the knowledge analyzing and presenting skills are improved.
- **Digital Platforms:** Few of the critical problems were discussed on digital learning platforms like YouTube and Telegram.

Course Outcome Attainment Remarks: All Course outcomes are attained even after increasing attainment level from 60 to 65.

Instructor Feedback: Overall the subject Engineering electromagnetic waves is problematic with statistical way of solving problems. Hence student's centric approach is adapted to exhibit teaching methodologies.

Scope for improvement: Overall this subject attainment increases if we use outcome based student centric approach which reflects in securing good score as well gaining knowledge which is directly proportional to improvements in attainment levels.

CBCS Scheme

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

15EC36

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

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

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

OR

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

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

Module-2

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

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

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

OR

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

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

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

Module-3

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

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

OR

6 a. Find the potential and volume charge density at P(0.5, 1.5, 1)m in free space given the potential field $V = 6\rho\phi Z$ volts. **(08 Marks)**

b. Explain the concepts of scalar and vector magnetic potential. **(08 Marks)**

Module-4

7 a. Derive an equation for the magnetic force between two differential current elements. **(06 Marks)**

b. Find the magnetization in a material where : i) $\mu = 1.8 \times 10^{-5}$ H/m and H = 120 A/m ii) $\mu_r = 22$. There are 8.3×10^{28} atom/m^3 and each atom has a dipole moment of 4.5×10^{-27} A/m^2. iii) B = 300 μT and $X_{on} = 15$. **(06 Marks)**

c. A conductor 4m long lies along the y axis with a current of 10A in the $\overline{ay}$ direction. Find the force on the conductor if the field in the region is $\overline{B} = 0.005\overline{ax}$ Tesla. **(04 Marks)**

OR

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

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

Module-5

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

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

$\overline{H} = (y + 2\times10^6 t)\overline{az}$ A/m **(08 Marks)**

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

OR

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

b. Find the amplitude of displacement current density in the free space within a large power distribution transformer where $\overline{H} = 10^6 \cos(377t + 1.2566\times10^{-6} z)\hat{ay}$ A/m. **(05 Marks)**

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

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CBCS SCHEME

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15EC36

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. State and explain Coulomb's law. **(04 Marks)**

b. A charge $Q_A = -20\ \mu c$ is located At $(-6, 4, 7)_m$ and $Q_B = 50\ \mu c$ at $B(5, 8, -2)_m$ in free space. Find the force exerted on Q_A by Q_B? **(05 Marks)**

c. Define electric field intensity and electric flux density. **(03 Marks)**

d. Calculate the total charge within the volume
$0 \le \rho \le 0.1$, $0 \le \phi \le \pi$, $2 \le z \le 4$, $\rho_v = \rho^2 z^2 \sin 0.6\phi$ **(04 Marks)**

OR

2 a. Obtain an expression for electric field due to infinite line charge. **(06 Marks)**

b. A charge of $-0.3\mu c$ is located at A(−25, 30, 15)cm and a second charge of 0.5 μc is at B(−10, 8, 12)cm. Find E at the origin. **(06 Marks)**

c. A uniform line charge of 2 μc/m is located on the z-axis. Find E in rectangular coordinates at P(1, 2, 3) if the charge exists from $-\infty < z < \infty$. **(04 Marks)**

Module-2

3 a. State and prove Gauss law and derive first Maxwell's equations from it. **(05 Marks)**

b. Given a 60 μc point charge located at the origin. Find the total electric flux passing through the closed surface defined by $\rho = 26$ cm and $z = \pm 26$ cm. **(04 Marks)**

c. State and prove the Divergence theorem. **(05 Marks)**

d. Given the electric flux density $D = 0.3r^2 \hat{a}_r$ nc/m^2 in free space. Find E at the point P(r = 2, θ = 25°, ϕ = 90°). **(02 Marks)**

OR

4 a. Prove that the work done in moving a charge in the electric field is

$$W = -Q \int_{\text{initial}}^{\text{final}} E.dl$$ **(06 Marks)**

b. Calculate the work done in moving a 4C charge from B(1, 0, 0) to A(0, 2, 0) along the path $y = 2 - 2x$, $\tau = 0$ in the field $E = (5x\, a_x + 5y\, a_y)$ V/m. **(05 Marks)**

c. Show that $\nabla \cdot J = -\frac{\partial \rho_v}{\partial t}$ with usual notations. **(05 Marks)**

Module-3

5 a. Starting from Gauss law, derive Poisson's and Laplace's equations. **(04 Marks)**

b. Calculate ρ_v at point P in free space, if $V = 5\rho^2 \cos 2\phi$ at $P(3, \pi/3, 2)$ **(06 Marks)**

c. State uniqueness theorem. **(02 Marks)**

d. By using Laplace's equation, derive an expression for the capacitance of a parallel plate capacitor. **(04 Marks)**

OR

6 a. State and explain Biot-Savart's law. **(04 Marks)**

b. By using Ampere's law, derive an expression for $\vec{H}$, magnetic field intensity due to a coaxial cable. **(06 Marks)**

c. Evaluate both sides of Stokes theorem for the field, $H = \left(6ay\hat{a}_x - 3y^2 a_y\right)$ A/m and the rectangular path around the region $2 \le x \le 5$, $-1 \le y \le 1$, $z = 0$. Let the positive direction of ds be a_z. **(06 Marks)**

Module-4

7 a. The field $B = (-2a_x + 3a_y + 4\hat{a}_z)$mT is present in free space. Find the vector force exerted on a straight wire carrying a current of 12A in the a_{AB} direction. Given A(1, 1, 1,) and B(2, 1, 1). **(04 Marks)**

b. Two differential current elements, $I_1\Delta L_1 = 3\times10^{-6}$ A-m at $P_1(1, 0, 0)$ and $I_2\Delta L_2 = 3\times10^{-6}\left(-0.5\hat{a}_x + 0.4\hat{a}_y + 0.3\hat{a}_z\right)$A-m at $P_2(2, 2, 2)$ are located in free space. Find the vector force exerted on $I_2\Delta L_2$ by $I_1\Delta L_1$. **(06 Marks)**

c. Find the magnetization in a magnetic material where

(i) $\mu = 1.8\times10^{-5}$ H/m and H = 120 A/m.

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

(iii) $B = 300\ \mu T \times \chi_m = 15$. **(06 Marks)**

OR

8 a. Derive the Magnetic Boundary Condition? **(06 Marks)**

b. Let the permittivity is 5 μH/m in the region 1 where $x < 0$ and 20 μH/m in the region 2 where $x > 0$, and if $H = \left(300a_x - 400a_y + 500\hat{a}_z\right)$ A/m and if there is a surface current density $K = \left(150\hat{a}_y - 200\hat{a}_z\right)$A/m at $x = 0$.

Find (i) $|H_{t_1}|$ (ii) $|H_{N_1}|$ (iii) $|H_{t_2}|$ (ii) $|H_{N_2}|$ **(06 Marks)**

c. Derive the expression for the energy density in a magnetic field? **(04 Marks)**

Module-5

9 a. State Faraday's laws of electromagnetic induction. Further derive Maxwell's equation from it. **(04 Marks)**

b. Find the amplitude of the displacement current density due to an automobile antenna where the magnetic field intensity of an FM signal is $H_x = 0.15\cos[3.12(3\times10^8 t - y)]$ A/m. **(06 Marks)**

c. State Maxwell's equation in both Point form and in Integral form. **(06 Marks)**

OR

10 a. Derive the wave equation in one dimension for an EM wave travelling in free space. **(06 Marks)**

b. The electric field amplitude of the uniform plane wave in the a_z direction is 250 V/m. If $E = E_x a_x$ and $\omega = 1.00$ Mrad/s, find (i) the frequency (ii) the wavelength (iii) the period (iv) the amplitude of H. **(04 Marks)**

c. State and prove Poynting's theorem. **(06 Marks)**

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CBCS SCHEME

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

17EC36

Third Semester B.E. Degree Examination, June/July 2019
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State and explain Coulomb's law of force between two point charges in vector form. **(06 Marks)**

b. Identical point charges of 3μC are located at four corners of the square of 5 cm side. Find the magnitude of the force on any charge. **(08 Marks)**

c. Define Electric Field Intensity. Derive the electric field intensity due to 'n' number of point charges. **(06 Marks)**

OR

2 a. Derive the expression for the electric field intensity due to infinite line charge. **(06 Marks)**

b. Obtain the expression for an electric field intensity due to charged circular ring of radius 'r' placed in x-y plane, at a point (0, 0, z), having uniform line charge density of ρ_L (c/m). **(06 Marks)**

c. A uniform line charge $\rho_L = 25$ nC/m lies on the line x = −3m and y = 4m in free space. Find the electric field intensity at a point (2, 3, 15) **(06 Marks)**

Module-2

3 a. State and explain Gauss's law and prove Gauss's law as applied to point charge. **(06 Marks)**

b. Given that the field $\vec{D} = \frac{5\sin\theta\cos\phi}{r}\ \vec{a}_r$ (c/m^2). Find volume charge density. **(06 Marks)**

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

OR

4 a. Explain the concept of work and potential and obtain the expression for potential difference between two points due to an electric field produced by a point charge. **(06 Marks)**

b. Obtain the point form of continuity equation. **(06 Marks)**

c. Given the current density $\vec{J} = \frac{2}{r^2}\cos\theta\,\vec{a}_r + 20e^{-2r}\sin\theta\,\vec{a}_\theta - r\sin\theta\cos\phi\,\vec{a}_\phi$ (A/m^2)

i) Find $\vec{J}$ at r = 3m, θ = 0°, φ = π.

ii) Find the total current passing through spherical surface r = 3m, 0 < θ < 20°, 0 < φ < 2π. **(08 Marks)**

Module-3

5 a. From point form of Gauss's law, derive Poisson's and Laplace's equation. **(05 Marks)**

b. State and prove uniqueness theorem. **(08 Marks)**

c. Applying Laplace's equation, obtain the expression for capacitance of a parallel plate capacitor. The distance between two plates are 'd' and the area of plate is 'A'. **(07 Marks)**

OR

6 a. Using Biot - Savart law obtain the expression for magnetic field intensity at a point due to infinitely long straight conductor. **(08 Marks)**

b. Given the magnetic field $\vec{H} = 2r^2(z+1)\sin\phi\, \vec{a}_\phi$. Verify stokes theorem for the portion of a cylindrical surface defined by r = 2, $\frac{\pi}{4} \le \phi \le \frac{\pi}{2}$, $1 \le z \le 1.5$ and for its perimeter. Given vector magnetic potential. **(08 Marks)**

c. $\vec{A} = x^2 \vec{a}_x + 2yz\vec{a}_y - x^2 \vec{a}_z$. Find the magnetic flux density. **(04 Marks)**

Module-4

7 a. Derive the expression for the force acting on a differential current element placed in a magnetic field. **(06 Marks)**

b. A point charge Q = −1.2 (C) has velocity $\vec{V} = 5\vec{a}_x + 2\vec{a}_y - 3\vec{a}_z$ m/s. Find the magnitude of the force exerted on the charge if

i) $\vec{E} = -18\vec{a}_x + 5\vec{a}_y - 10\vec{a}_z$ (V/m)

ii) $\vec{B} = -4\vec{a}_x + 4\vec{a}_y + 3\vec{a}_z$ (T) **(06 Marks)**

c. A current element $I_1 dL_1 = 10^{-4}\, \vec{a}_z$ (A.m) is located at $P_1(2, 0, 0)$ and another current element $I_2\, dL_2 = 10^{-6}(\vec{a}_x - 2\vec{a}_y + 3\vec{a}_z)$ (A.m) is located at $P_2(-2, 0, 0)$. Find the force exerted on $I_1 dL_1$ by $I_2 dL_2$. **(08 Marks)**

OR

8 a. Discuss the magnetic boundary conditions as applicable to $\vec{B}$ and $\vec{H}$ at the interface between two different magnetic materials. **(10 Marks)**

b. Write short notes on :

i) Energy Density in magnetic field   ii) Forces on magnetic materials. **(10 Marks)**

Module-5

9 a. List Maxwell's equations in integral form and derive the point form of Maxwell's equation for time varying fields. **(12 Marks)**

b. Show that in a capacitor the conduction current density is equal to displacement current density for applied voltage $V(t) = V_o \cos wt$. **(08 Marks)**

OR

10 a. What is Uniform plane wave? Derive the expression of uniform plane wave travelling in free space. **(10 Marks)**

b. State and prove Poynting theorem. Also show that average power

$$P_{avg} = \frac{1}{2}\frac{E_m^2}{\eta}\ (\text{W/m}^2).$$ **(10 Marks)**

* * * * *

CBCS SCHEME

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

17EC36

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State and explain Coulomb's law in complete form. **(06 Marks)**

b. Two particles having charges 2nc and 5nc are spaced 80cm apart. Determine the $\overline{E}$ at a point is situated at a distance of 0.5m from each of the two particles. Use $\varepsilon_r = 5$. (Use Bakelite medium). **(06 Marks)**

c. Identical point charges of 5μc are located at the four corners of the square of 5cm side, find the magnitude of the force on any one charge? **(08 Marks)**

OR

2 a. Derive expression for E due to infinite line charge from first principle. **(08 Marks)**

b. Two uniform line charges of density 4n c/m and 6n c/m lie in x = 0 plane at y = +5m and −6m respectively. Find E at $(4, 0, 5)^m$. **(06 Marks)**

c. Define E and D, Hence establish the relation between D and E. **(06 Marks)**

Module-2

3 a. State and prove Gauss divergence theorem. **(06 Marks)**

b. If $D = \frac{5r^2}{4}\hat{a}_r\ c/m^2$. (in spherical system) then evaluates both sides of the divergence theorem for the volume enclosed by r = 4m, and θ = π/4 radians. **(08 Marks)**

c. Prove that $\rho_v = \nabla \cdot D$. **(06 Marks)**

OR

4 a. Establish relation $E = -\nabla v$ **(06 Marks)**

b. Electrical potential at an arbitrary point in free space is given as $V = (x+1)^2 + (y+2)^2 + (z+3)^2$ Volts at p(2, 1, 0). Find :
i) V ii) $\overline{E}$ iii) $|\overline{E}|$ iv) $|\overline{D}|$ v) ρ_v **(08 Marks)**

c. Derive continuity of current equation. **(06 Marks)**

Module-3

5 a. Derive Laplace and Poisson's equations and write Laplace Equation in all 3 co-ordinate systems. **(08 Marks)**

b. State and prove uniqueness theorem. **(07 Marks)**

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

OR

6 a. An assembly of two concentric spherical shells is considered. The inner spherical shell is at a distance of 0.1m and is at a potential of 0 volts. The outer spherical shell is at a distance of 0.2m and at a potential of 100V. The medium between them is a free space. Find $\overline{E}$ and $\overline{D}$ using spherical co-ordinate system. **(06 Marks)**

b. State and prove Ampers circuital law. **(08 Marks)**

c. At a point P(x, y, z) the components of vector magnetic potential $\overline{A}$ are given as

$Ax = 4x + 3y + 2z$

$Ay = 5x + 6y + 3z$ and

$Az = 2x + 3y + 5z$

Determine $\overline{B}$ at point P and state its nature. **(06 Marks)**

Module-4

7 a. Derive an expression for the force on a differential current element placed in a magnetic field and deduce the result for straight conductor in a uniform magnetic field. **(08 Marks)**

b. A point charge Q = 18nc has a velocity of 5×10^6 m/s in the direction $\overline{a}_v = 0.6\hat{a}_x + 0.75\hat{a}_y + 0.3\hat{a}_z$.

Calculate the magnitude of the force exerted on the charge by the field

i) $\overline{E} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ K v/m

ii) $\overline{B} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ MT

iii) $\overline{B}$ & $\overline{E}$ acting together. **(06 Marks)**

c. State and explain Lorentz force equation. **(06 Marks)**

OR

8 a. Define : i) Magnetization ii) Permeability. **(04 Marks)**

b. If $\overline{B} = 0.05$ x $\hat{a}_y$ T in a material for which magnetic susceptibility $X_m = 2.5$. Find

i) μ_r ii) μ iii) $\overline{H}$ iv) $\overline{M}$ v) $\overline{J}$ vi) $\overline{J}_b$ **(08 Marks)**

c. Discuss the boundary conditions at the interface between two media of different permiabities? **(08 Marks)**

Module-5

9 a. Derive Maxwell's Equations in point form and Integral form for Time varying fields. **(08 Marks)**

b. For a lossy dielectric $\sigma = 5$ s/m, $\varepsilon_r = 1$ the electric filed intensity is E = 100 sin 10^{10} t. Find J_c and J_d and frequency at which both have Equal Magnitudes. **(04 Marks)**

c. Starting from Maxwell's Equation Derive the wave equation for a uniform plane wave travelling in free space. **(08 Marks)**

OR

10 a. State and prove Poynthing theorem. **(08 Marks)**

b. Deduce the expressions for α and β for a uniform plane wave propagation in good conducting medium. **(06 Marks)**

c. Wet Marshy soil is characterized by $\sigma = 10^{-2}$ s/m, $\varepsilon_r = 15$ and $\mu_r = 1$. At the frequencies 60Hz, 1 MHz, 100 MHz and 10 GHz indicate whether the soil may be considered a conducting dielectric or neither. **(06 Marks)**

Rao Bahadur Y. Mahabaleswarappa Engineering College Ballari
Department of Electronics & Communication Engineering

Report

On

Industrial Visit

To Airport

On

Antenna & RADAR Application

BY,

DR. Prabhavathi S

Mrs. Vani H

HOD ECE

CONTENT BEYOND SYLLABUS

STAFF NAME: DR. Prabhavathi S & Mrs. Vani H

Sub & Code : Engineering Electromagnetics / 17EC36

Title: Antenna & RADAR Application

At the end of the Visit, students will be able to	
CO1	Recognize the process units of Secondary RADAR Communication system
CO2	To build a good relationship with industries, which helps students to get better job
C03	Understand the concept of DMU Secondary RADAR, Antennas and power supply system.
CO4	Experience the importance of working safety

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3		3	3				3		3	2	
CO2						3		3	3	3		3	2	
CO3	3		3		3	3				3		3	2	
CO4						3		3	3	3		3	2	

GAP IDENTIFIED: Antenna & RADAR Application using Engineering Electromagnetic theory

ACTION TAKEN: Industrial Visit to Airport Authority of India on Antenna & RADAR Application

SL.NO	Course with Code	Gap identified	PO/PSO
1.	Engineering Electromagnetics 17EC36	Antenna & RADAR Application using Engineering Electromagnetic theory	PO1,PO3,PO5,PO6,PO8, PO9,PO10,PO12,PSO1

SL.NO	Gap	Action Taken	Date-Month-Year	Resource Person with designation	% of students attended	Relevance to Po's, PSO's
1.	Antenna & RADAR Application using Engineering Electromagnetic theory	Industrial Visit to Airport Authority of India on Antenna & RADAR Application	17/11/2018	R.VEERA REDDY ASST MANAGER	80%	PO1,PO3,PO5,PO6,PO8, PO9,PO10,PO12,PSO1

Report on : Industrial Visit To Airport On Antenna & RADAR Application

Date of Conduction: 17/11/2018

Venue: Airport Authority of India

Presence: ECE students and Staff

Total No of students attended: 70

Report prepared by: DR. Prabhavathi S & Mrs. Vani H

Knowledge of the aircraft's position is a basic requirement for air navigation and one means of satisfying this requirement is to present the pilot with bearing and distance information. Bearing information may be derived in a variety of ways, some of which are via VOR or ADF systems. Distance information may be derived from radar or by DME, which is a form of radar .In primary radar a short pulse is transmitted and the time interval from transmission to reception of the reflected pulse is measured. As the speed of an electromagnetic pulse through the atmosphere is 300000 kilometers per second, or one nautical mile in 6.2 micro-seconds, the distance between the transmitter and the target can be calculated. In the case of radar sited on the ground an aircraft target may be easily identified and the distance measured readily due to its relative freedom from other reflecting objects. If radar is installed in an aircraft, precise identification of specific ground targets, for all practical purposes, is very difficult to effect due to mass reflection from surrounding objects. Hence primary radar is supplemented by additional equipment at the target to enable distance to be reliably measured to the necessary degree of accuracy. When primary radar is supplemented to accomplish this task it then becomes a form of secondary radar. In secondary radar, pulses known as interrogation pulses are transmitted and when received at the target they are passed through a 'gate' and then trigger transmission of reply pulses back to the initial source where the time interval may be measured and displayed as distance. The 'gate' in the target receiver is an electronic device which is preset to receive only matching pulses.

In the DME system the interrogating equipment, known as the 'Interrogator', is installed in the aircraft and the target, located on the ground, is referred to as the 'Transponder' or' Ground Beacon'.

DME complies with the standards prescribed by the International Civil Aviation Organization (ICAO) and is installed at all international airports, at all capital city airports and many regional airports in Australia and along routes serving international traffic. It was developed from a composite distance and bearing facility known as 'Tactical Air Navigation' (TACAN) which was designed in the USA as an aid to military aircraft. The VOR fulfills the bearing requirements for civil aviation navigation; hence this

component of the TACAN system is not used to assist civil air operations. A combined VOR/TACAN installation is commonly referred to as 'VORTAC'. Where TACAN is not installed for military purposes then a DME, manufactured to the same specifications as the DME portion of TACAN, is installed. This is referred to as VOR/DME.

Industrial Visit Objectives: Students are able

1. Make students aware process units of Secondary RADAR Communication system.
2. Increase practical awareness of concept of DMU Secondary RADAR, Antennas and power supply system.
3. Acquaint students with interesting facts and newer technologies.
4. Practical application of instruments handled during course curriculum

Industrial Visit Outcomes:

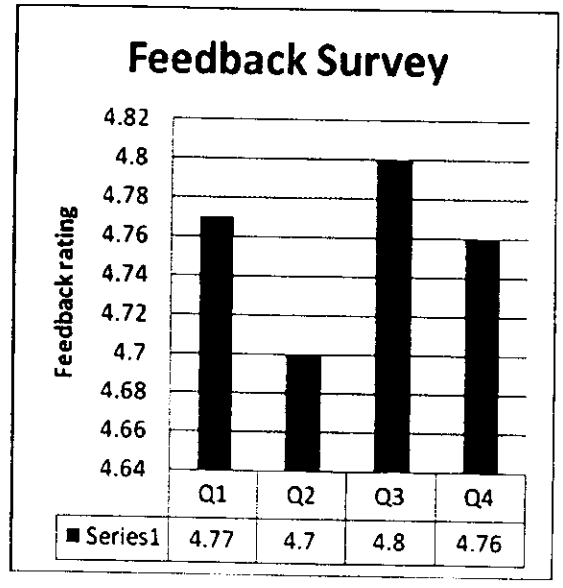
At the end of the Visit, students will be able to	
CO1	Recognize the process units of Secondary RADAR Communication system
CO2	To build a good relationship with industries, which helps students to get better job
CO3	Understand the concept of DMU Secondary RADAR, Antennas and power supply system.
CO4	Experience the importance of working safety

Following are the suggestions/comments given by students during the feedback session.

- Workshop is really excellent to gain knowledge
- Good interaction with students and knowledgeable.
- Got most things /information which is useful in getting exposure
- Excellent exposure to outside world.
- Gained knowledge on DMU Secondary RADAR, Antennas and power supply system.
- Experienced the importance of working safety

Feedback Analysis report

Total No of Feedback forms collected: 70



Course exit survey