Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BEC403 Electromagnetic Fields and Waves

Fourth Semester, 2016-17 (Even Semester)

Course (catalog) description

To understand and gain complete knowledge on Theorem, Laws, Principle & Applications of Static Electromagnetic Fields, Static Magnetic Field, parameters of Electric Field in Dielectrics,
Time Varying Electric and Magnetic Fields.

Compulsory/Elective course : Compulsory for ECE students

Credit & contact hours : 4 & 60
Course Coordinator : Dr. S.Arulselvi, Professor

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Dr.S. Arulselvi	II year ECE	SA block		arulselvi.ece@bharathuniv.ac.in	12.30 - 1.30PM

Relationship to other courses:

Pre –requisites : BMA301- Engineering Mathematics-III

Assumed knowledge : The students will have a mathematics background obtained at a high school (or equivalent) level. In particular, working knowledge of basic mathematics including differentiations and integrations, basic electrical knowledge about Electric field and magnetic field required.

Following courses : BEC701 Fiber Optic Communication
BEC703 Microwave Engineering
BEC704 Antennas and Wave Propagation
BEC503Transmission lines, Networks and Waveguides
BEC003 Satellite Communication

Syllabus Contents

UNIT I STATIC ELECTROMAGNETIC FIELDS **12 HOURS**

Introduction to co-ordinate system, Gradient, Divergence, Curl, Divergence Theorem, Stokes's Theorem, Coulomb's Law, Electric field Intensity, Principle of superposition, Electric Scalar potential, Line charge distribution by Moment method, Electric flux Density, Gauss's Law and its applications, Field Computations and Problems.

UNIT II STATIC MAGNETIC FIELD **12 HOURS**

Magnetic field of a current carrying element, Ampere's Force law, The Biot-Savart Law, Magnetic Flux density, Gauss law for magnetic fields, Torque on a loop, Magnetic moment, Ampere's Law and Magnetic field intensity, Magneto motive force, Field cells and permeability, Vector potential, Field computation and problems.

UNIT III ELECTRIC FIELD IN DIELECTRICS **12 HOURS**

Permittivity, Polarization, Boundary relation, Capacitance, Dielectric strength, Energy and energy density, Poisson's and Laplace equations and applications, Electric Current, Current Density, Ohms law at a point, Resistance and Conductance, Continuity relations for current problems.

UNIT IV MAGNETIC FIELD IN FERROMAGNETIC MATERIALS **12 HOURS**

Magnetic materials, Magnetic dipoles, Loops and Solenoids, Magnetization, Inductance, Energy in an Inductor and Energy Density, Boundary relations, Ferro magnetism, Hysteresis, Reluctance and Permeance, Problems.

UNIT V TIME VARYING ELECTRIC AND MAGNETIC FIELDS **12 HOURS**

Faraday's Law, Transformer and Motional Induction, Maxwell's equation from Faraday's Law, Self and Mutual Inductance, Displacement current, Maxwell's equation from Ampere's Law and its in-consistency, Boundary relation, Poynting Vector, Comparison of field and circuit theory, Circuit Application of pointing Vector.

TOTAL : 60 HOURS

TextBooks:

1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics",Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008
2. Sadiku MH,"Principles of Electromagnetics", Oxford University PressInc, NewDelhi,2009
3. David K Cheng, "Field and Wave Electromagnetics", Pearson EducationInc,Delhi,2004

References:

1. John D Kraus and Daniel A Fleisch,"Electromagnetics with Applications" ,McGrawHil Book Co,2005
2. Karl E Longman and SavaV Savov,"Fundamentals of Electromagnetics",Prentice Hall of India,NewDelhi,2006
3. Ashutosh Pramanic,"Electromagnetism", Prentice Hall of India,NewDelhi,2006

4 .www.Wiley.com

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Electromagnetic Fields and Waves | Communications network |Transmission lines |Antenna propagation

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 2nd week	Session 1 to 14	2 Periods
2	Cycle Test-2	March 2nd week	Session 15 to 28	2 Periods
3	Model Test	April 3rd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To understand and gain complete knowledge about Theorem, Laws, Principle & Applications of Static Electromagnetic Fields, Various Laws of Static Magnetic Field, Various relation & parameters of Electric Field in Dielectrics, Magnetic Field with different structure in Ferromagnetic Materials, Time Varying Electric And Magnetic Fields . This course emphasizes:	Correlates to program outcome		
	H	**M**	**L**
1. To understand the Theorem, Laws, Principle and their related problems over Static Electromagnetic Fields	a	d,f	-
2. To learn the basic laws in Static Magnetic Field and able to find various parameters with the related problems	j	a,b,c,g	-
3. To know how the Electric Field is applied in Dielectrics with various equations and applications	-	a	g
4. To understand how the Magnetic field works with Ferromagnetic Materials	e	g,i,j	_
5. To analyze how the Time is Varying in both Electric And Magnetic Fields with various Derivation	_	c,d,i	b
6. To understand, and analyze the electromagnetic field distribution which forms the basis for advanced subjects related to electromagnetic field.	e,f,i	a	-

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I - STATIC ELECTROMAGNETIC FIELDS			
1.	Introduction to co-ordinate system	No	[T1] Chapter -2,3, [R1]Chapter-1 [R1]Chapter-2
2.	Divergence Theorem, Stokes's Theorem,	Yes	
3.	Electric field Intensity	No	
4.	Principle of superposition	Yes	
5.	Line charge distribution by Moment method	No	
6.	Electric flux Density	No	
7.	Gauss's Law and its applications	No	
8.	Field Computations and Problems	Yes	
9.	Field Computations and Problems	Yes	
UNIT II - STATIC MAGNETIC FIELD			
10.	Magnetic field of a current carrying element	No	[T1] Chapter -8,9 [R1]Chapter-8,9
11.	Ampere's Force law, The Biot-Savart Law	Yes	
12.	Magnetic Flux density	Yes	
13.	Gauss law for magnetic fields	Yes	
14.	Torque on a loop	Yes	
15.	Magnetic moment	Yes	
16.	Ampere's Law and Magnetic field intensity	Yes	
17.	Field cells and permeability	No	
18.	Field computation and problems	Yes	
UNIT III - ELECTRIC FIELD IN DIELECTRICS			
19.	Permittivity, Polarization	No	[T1] Chapter -6,7 [R1]Chapter-11,12,13
20.	Boundary relation, Capacitance	No	
21.	Energy and energy density	No	
22.	Message Authentication	No	
23.	Poisson's and Laplace equations and applications	Yes	
24.	Poisson's and Laplace equations and applications	Yes	
25.	Ohms law at a point	No	
26.	Resistance and Conductance	No	
27.	Continuity relations for current problems	No	

UNIT IV MAGNETIC FIELD IN FERROMAGNETIC MATERIALS			
28.	Magnetic materials, Magnetic dipoles, Loops	No	[T1] Chapter -9 [R1]Chapter - 7
29.	Magnetization	No	
30.	Energy in an Inductor	No	
31.	Inductor Energy Density	No	
32.	Boundary relations	No	
33.	Ferro magnetism	No	
34.	Hysteresis	No	
35.	Reluctance and Permeance, Problems.	Yes	
36.	Problems.	No	
UNIT V TIME VARYING ELECTRIC AND MAGNETIC FIELDS			
37.	Faraday's Law	No	[T1] Chapter -11, [R2]Chapter -5
38.	Transformer and Motional Induction	No	
39.	Maxwell's equation from Faraday's Law	No	
40.	Self and Mutual Inductance	No	
41.	Displacement current	No	
42.	Maxwell's equation from Ampere's Law	No	
43.	Boundary relation	No	
44.	Poynting Vector	No	
45.	Comparison of field and circuit theory	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignments/Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Dr.S.Arulselvi , Professor , Department of ECE **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate:

a) An ability to apply knowledge of mathematics, science, and engineering
b) An ability to design and conduct experiments, as well as to analyze and interpret data
c) An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d) An ability to function on multidisciplinary teams
e) An ability to identify, formulate, and solve engineering problems
f) An understanding of professional and ethical responsibility
g) An ability to communicate effectively
h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i) A recognition of the need for, and an ability to engage in life-long learning
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION
Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE
Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL
Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS
Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	Signature
Dr.S.ARUL SELVI	

Course Coordinator **HOD/ECE**