ELECTROMAGNETIC THEORY		Semester	
Course Code	BEC401	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	THEORY		

Course objectives:

Thiscoursewillenablestudentsto:

- Study the different coordinate systems, Physical significance of Divergence, Curl andGradient.
- UnderstandtheapplicationsofCoulomb'slawandGausslawtodifferentchargedistributionsand the applications of Laplace's and Poisson's Equations to solve real time problems oncapacitanceofdifferent chargedistributions.
- Understand the physical significance of Biot-Savart's, Ampere's Law and Stokes' theoremfordifferent current distributions.
- Infertheeffectsofmagneticforces,materialsandinductance.
- KnowthephysicalinterpretationofMaxwell'sequationsandapplicationsforPlanewavesforthe irbehavior in different media.
- AcquireknowledgeofPoyntingtheorem anditsapplicationofpower flow

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

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1. Lecturemethod (L)doesnot meanonlytraditionallecturemethod,butdifferenttypesofteachingmethodsmaybe adopted todeveloptheoutcomes.
2. Encouragecollaborative (Group) Learningintheclass.
3. AskatleastthreeHOTS (HigherOrderThinking) questionsintheclass,whichpromotescriticalthinking.
4. Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skillssuchastheabilityto evaluate,generalize,and analyzeinformationratherthansimplyrecallit.
5. Topicswillbeintroducedinamultiplerepresentation.
6. Showthedifferentwaystosolvethesameproblemandencouragethestudentstocomeupwithcreati ve ways to solvethem.
7. Discusshoweveryconceptcanbeappliedtothereal world andwhenthat'spossible,ithelpsimprovethe student'sunderstanding.
8. Adopt the Flipped class technique by sharing the materials/Sample Videos before the class and having discussionson thetopicinthesucceedingclasses.

Module-1

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) RBT Level:** 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 expended or work done in moving a point charge in anElectric field, The line integral ((**Text: Chapter 4.1 and 4.2**) Current and Current density, Continuity of current. (**Text: Chapter 5.1, 5.2**) **RBT Level:** L1, L2, L3

Module-3

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Examples of the solution of Laplace's equation, Numerical problems on Laplace's equation
(**Text: Chapters 7.1 and 7.3**)
Steady Magnetic Field: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density.
(**Text: Chapters 8.1 to 8.5**) **RBT Level:** 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, problems (**Text: Chapter 9.6 to 9.8**) **RBT Level:** L1, L2, L3

Module-5

Faraday's law of Electromagnetic Induction –Integral form and Point form, Numerical problems. 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: Chapter10.1 to10.4**)
Uniform Plane Wave: Wave propagation in free space, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations,Poynting's Theorem and wave power, Skin effect or Depth of penetration, Numerical problems. (**Text: Chapter 12.1, 12.3, 12.4**) **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
2. Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
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 configurations
4. Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
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

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Book:

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

Reference Books:

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford University press, 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.
4. N. Narayana Rao, —Fundamentals of Electromagnetics for Engineering, Pearson

Web links and Video Lectures (e-Resources):

- NPTEL Video lectures : https://youtu.be/pGdr9WLto4A
- NPTEL Video lectures: https://youtu.be/xn2IpxI991M

ActivityBasedLearning(SuggestedActivitiesinClass)/Practical-Based Learning

- Group Discussion/Quiz
- Demonstration of Electromagnetic concepts.
- Case Study on Medical Imaging devices.

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