SARVAJANIK UNIVERSITY
SarvajanikCollege of Engineering and Technology
Bachelor of Technology

B.Tech. Semester III

Subject Name: Engineering Electromagnetics **Subject Code: BTEL13302**

Type of course: BSC
Prerequisite: Physics
Rationale:
Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	50
2	1	0	3	70	20	10	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Review of Vector Analysis** Introduction, scalars and vectors, unit vector, vector addition and subtraction, position and distance vectors, dot product, cross product, scalar triple product, vector triple product, components of a vector, Cartesian co-ordinate system, Circular cylindrical co-ordinate system, Spherical co-ordinate system, transformation from one co-ordinate to other co-ordinate systems	4	10%
2.	**Static Electric Fields** Coulomb's law, Electric field intensity, Electric field due to point and line charges, surface and volume charge distributions, Gauss' law and its applications, Divergence theorem, Absolute Electric potential, Potential difference, Potential gradient, Calculation of potential difference for different configurations, Electric dipole, Electrostatic energy and energy density	9	20%
3.	**Conductors, Dielectrics and Capacitance** Current and current density, Ohm's law in point form, Continuity equation, Conductor-dielectric boundary condition,	6	15%

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	Dielectric-dielectric boundary condition, Polarization in dielectrics, Capacitance, Capacitance of two wire line		
4.	**Poisson's and Laplace's equations** Poisson's equation, Laplace's equation, Uniqueness theorem, Solution of Poisson's and Laplace's equation, Application of Poisson's and Laplace's equations	**3**	**5%**
5.	**Steady Magnetic Fields** Biot Savart's law, Ampere's law, Curl operation, Stoke's theorem, Magnetic flux and magnetic flux density, Scalar and vector magnetic potentials, Steady magnetic field produced by current carrying conductors	**8**	**20%**
6.	**Magnetic forces, materials and inductance** Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and Permeability, Magnetic boundary conditions, Magnetic circuit, Inductance and mutual inductances	**8**	**15%**
7.	**Time varying fields and Maxwell's equations** Faraday's law, Transformer and motional electromotive forces, Displacement current, Maxwell's equations in integral and point form, Time varying potentials Poynting theorem: Energy stored and radiated power, Complex poynting vector, Properties of conductor and dielectrics, Wave equations for free space, Wave equations for conductors. Uniform Plane Waves: Introduction, Uniform plane wave propagation: Wave equations, Transverse nature of uniform plane waves, Perpendicular relation between E and H, EM waves in charge free, Current free dielectric, Reflection by ideal conductor: Normal incidence, reflection and transmission with normal incidence at another dielectric.	**6**	**15%**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**30**	**20**	**10**	**10**	**00**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

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Note: This specification table shall be treated as a general guideline for students andteachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Engineering Electromagnetics	W. H. Hayt, J. A. Buck	McGraw Hill Education		
2.	Principles of Electromagnetics	M.N.O. Sadiku, S.V. Kulkarni	Oxford University Press		6th edition
3.	Electromagnetism-Theory and Applications	A Pramanik	PHI Learning Pvt. Ltd. ,New Delhi	2009	
4.	Electromagnetism-Problems with Solutions	A. Pramanik	PHI Learning Pvt. Ltd. ,New Delhi	2012	
5.	Elements of Electromagnetic fields	S.P. Seth	Dhanpat Rai & Co	2013	

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Apply vector calculus to electric and potential fields due to various charge distributions	30
CO-2	Compute potential, Electric fields, Electric flux density, Capacitance using Poisson's and Laplace's equations	25
CO-3	Derive forces and torques in magnetic fields, forces due to current carrying conductors and their inter-relationship with magnetic field	35
CO-4	Analyze Maxwell's equations in different forms (point & integral) and apply them to diverse engineering problems	10

List of Open Source/learning website:

Suggested learning material and Assignments/Tutorials are available on the following links:

- https://nptel.ac.in/downloads/108104087/ by Prof. Pradeep Kumar, IIT, Kanpur
- https://nptel.ac.in/downloads/115101005/ by Prof. D.K. Ghosh, IIT , Bombay
- https://nptel.ac.in/downloads/115104088/ by Prof. Manoj K. Harbola, IIT, Kanpur
- https://nptel.ac.in/courses/108106073/Transcripts and video lectures of Prof. Harishankar

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Ramachandran, IIT, Madras