NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI

DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme and specialization	**MSc Physics, Physics department**		
Course Title	**ELECTROMAGNETIC THEORY**		
Course Code	**PH652**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**Jan 2023**	**Section (if, applicable)**	**-**
Name of Faculty	**Dr. Venkata Suryanarayana Mummidi**	**Department**	**Physics**
Official Email	**venkata@nitt.edu**	**Telephone No.**	
Name of Course Coordinator(s) (if, applicable)	**Dr. A Chandra Bose**		
Official E-mail	**acbose@nitt.edu**	**Telephone No.**	
Course Type (please tick appropriately**)**	☑ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

Electrostatics

Electric field – divergence and curl – electric potential – work and energy – conductor and capacitance – Laplace's equation – uniqueness theorems – separation of variables:Cartesian and spherical coordinates – multipole expansion – field of an electric dipole: Polarization–field of polarized object – electric displacement and Gauss's law – linear dielectrics – electrostatic energy density – boundary value problems.

Magnetostatics

Maxwell's equations Lorentz force – magnetic induction – electric current – equation of continuity – Biot-Savart law –magnetic potential – magnetization – Ampere's law in magnetized material – linear and non-linear media. Faraday's law – inductance and magnetic energy –– boundary conditions- generalization of Ampere's law – Maxwell's equations– scalar and vector potentials – gauge invariance –electromagnetic energy – Poynting's theorem – conservation of momentum.

Electromagnetic Waves

Electromagnetic wave equation (without source) – solution of 3D wave equation – propagation of EM waves in non-conducting media – waves in conducting media – polarization of EM waves.

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Waves in Bounded Region

Reflection and refraction at the boundary of non-conducting media – Fresnel's coefficients –Brewster's angle and critical angle – reflection from a conducting plane– wave guide – TE and TM waves – rectangular wave guide.

Textbooks

1. D. J. Griffiths, Introduction to Electrodynamics, Prentice Hall of India, 4th edition (2015).
2. J.D. Jackson, Classical Electrodynamics, Wiley-India, (2020).

Reference Books

1. J.R. Reitz., F.J. Milford and R.W. Christy, Foundations of Electromagnetic Theory,4th edition, Pearson (2010).
2. E.C. Jordon and K.G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd edition, Prentice Hall of India (1998).

3. W. Greiner, Classical Electrodynamics, 3rd edition, Springer (2010).

COURSE OBJECTIVES

To understand the nature of electric and magnetic force fields and the intricate connection between them.

MAPPING OF COs with POs

Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
On completion of this course, the students will be able to, 1. **Describe** the basic mathematical concepts related to electromagnetic vector fields. And **relate** it to several variable calculus. 2. **Apply** the principles of electrostatics to **solve** problems relating to electric field and electric potential. 3. **Apply** the principles of magneto statics to **solve** problems relating to magnetic field and magnetic potential. 4. **Find** solutions of Maxwell's equations in vacuum, in polarisable medium. And **describe** and **analyse** the propagation of EM waves in transmission lines	

COURSE PLAN – PART II			
COURSE OVERVIEW			
COURSE TEACHING AND LEARNING ACTIVITIES			**(** Add more rows)
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	Week-1,2	Inverse square law, Gauss law, Electrostatic potential and energy, discontinuity of electric field due to a surface charge	Chalk and board
2	Week-3,4	Conductors, method of images, uniqueness theorems. Boundary value problems-Cartesian, spherical and cylindrical geometries and Greens function method	Chalk and board
3	Week-5,6,7	Amperes law, vector potential, Biot savarts law, magnetic dipoles, magnetic forces. Conservation laws.	Chalk and board
4	Week-8,9,10	Fardays law of induction, displacement current, wave equation in vacuum, light, polarisation, poynting energy.	Chalk and board
5	Week-11,12,13	Electric fields in matter, magnetic field in matter, reflection, refraction, dispersion, charge screening, skin depth.	Chalk and board
6	Week-14, 15	Four vectors, proper time, conserved currents, gauge potentials and EM tensor.	Chalk and board

COURSE ASSESSMENT METHODS (shall range from 4 to 6**)**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Evaluation 1-5 5 problem sets	Once in every two weeks	10 days	20%
2	cycle test-1	Last week of Feb	Max-2 hours	20%
3	Cycle test-2	2_{nd} Week of April	Max-2 hours	20%
CPA	Compensation Assessment*	Last week of April		

4	Final Assessment *	3rd week of May	3 hours	40%

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from students at the end of the semester regarding knowledge gained, content of the course, teaching effectiveness through questionnaire.

COURSE POLICY (including compensation assessment to be specified**)**

Compensation assessment shall be conducted only for those students who were absent in any regular assessment. The reasons for absenteeism shall be based on genuine grounds only.

Students can meet me outside the class room on Friday afternoon, Room 121.

Late arrival to the class is strictly discouraged. Every three late arrivals is considered as one absent.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty .
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

signed---

Course Faculty _____ CC- Chairperson _____ HOD_____

Guidelines

a The number of assessments for any theory course shall range from 4 to 6.

b Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40 %

e Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g Necessary care shall be taken to ensure that the course plan is reasonable and is objective.