PHY103A (Physics – II): Electromagnetics

2021 - 22, 1st semester (online mode)

November 29th, 2021

1 About the course

This course is one of the three foundation PHYSICS courses for the first year of Engineering and Sciences undergraduates and seeks to provide the students with the basics of the electromagnetic paradigm. In addition, a thorough grounding in this course helps tackle many more courses in the undergraduate program involving applications of vector calculus and fields, flux, flow and potential in general.

2 Course functioning

In the current semester, the course will run entirely in online mode. Course material, including video lectures, course handouts, and assignments, shall be made available to you in advance. You shall go through the course material as per the weekly schedule. This course will be of approximately 40 lectures and 10 tutorials. There will be one *live session* on every Monday during 11:00-11:50 hrs to discuss any course-related doubts (defined as **Discussion Hour**). There will also be one *live session* on every Tuesday during 11:00-11:50 hrs to learn solving problems based on the material covered in the previous week (defined as **Tutorial Hour**). There are six tutorial sections, and all students should attend tutorials only in the sections assigned to them. A problem-set covering the lectures of the previous week will be uploaded on the course website for the weekly tutorial session. Each problem set will have 6 – 8 problems. Usually, the first 4 – 5 problems (slightly difficult) will be discussed during tutorials, and the remaining ones (relatively easier) are practice problems that you need to solve yourselves. The practice problems are only for your practice and need not be submitted for grading. There will be a discussion forum on the mooKIT platform where you can post any doubt/question which can be answered by anyone of you and the instructors.

IIT Kanpur's mooKIT web platform `https://hello.iitk.ac.in/` will be used to run the course. All course materials will be uploaded on the mooKIT website weekly. You should watch the video lectures strictly as per the schedule. There will be a total of 10 quizzes with almost one quiz per week, and only best 8 out of the 10 will be counted for the grading. The quizzes will be conducted every Wednesday, and the material covered by the previous tutorial (held on Tuesday) will be the syllabus for

that quiz. All quizzes will be conducted online on the Codetantra platform. The mid-sem exam will also be conducted on the Codetantra platform, and exact details will be announced at a later stage. Details of the end-sem exam will also be announced at a later stage.

3 Schedule

i **Discussion hour:** Monday 11:00 – 11:50 hrs
ii **Tutorial hour:** Tuesday 11:00 – 11:50 hrs

- All users must have Zoom account through the IIT Kanpur email ids as "Only Authenticated users can join: Sign in to Zoom meetings".
- Zoom meeting id for weekly Discussion Hour: 915-0144-7538, passcode: 620877
- Zoom meeting link: https://iitk-ac-in.zoom.us/j/91501447538?pwd=STQwd003cTlibWFMSm9yY1FCVEtiQT09
- Zoom meeting IDs for the six Tutorial Sections will be provided soon on the course website.

4 Team and tutorial sections

Instructors & Tutors	**email**[1]	**Tutorial section**[2]
Prof. Krishnacharya (Instructor in-charge)	kcharya	Section C1 (1st half)
Prof. Soumik Mukhopadhyay (Instructor)	soumikm	Section C1 (2nd half)
Prof. Arijit Kundu	kundua	Section C2
Prof. Sudeep Bhattacharjee	sudeepb	Section C3
Prof. Taraknath Mandal	taraknath	Section D1
Prof. Arjun Bagchi	abagchi	Section D2
Dr. Nabarun Chakrabarty	nabarunc	Section D3

5 Course content

Vector calculus; Electrostatic with full use of vector calculus calculation of electric fields, electrostatic potential and Laplace's equation and uniqueness of its solution; Method of images; Energy in electrostatics; Introduction to multipole expansion, Dipole moment of a charge distribution, potential and field of a dipole, force and torque on a dipole in an electric field; Electrostatics in a medium, Displacement vector and boundary conditions, linear dielectrics, force on a dielectric;

Magnetostatics with full use of vector calculus; Introduction to vector potential; Current densities, Lorentz force law, force, and torque on a magnetic dipole in a magnetic field; Magnetostatics in a medium, magnetization, bound currents, magnetic field H, boundary condition on B and H, magnetic susceptibility, ferro, para, and diamagnetism.; Faraday's law, energy in a magnetic field; Displacement current; Fields produced by time-dependent electric and magnetic fields within quasistatic

[1] add @iitk.ac.in
[2] see details of Tutorial sections in the Resources section of the course website

approximation; Maxwell's equations in vacuum and conducting and nonconducting medium, Energy in an electromagnetic field, Poynting vector, plane electromagnetic waves; Reflection and refraction of electromagnetic wave from a boundary, Brewster's angle, Fresnel's equations, and total internal reflection.

6 Evaluation

i	Quiz (× 8):	80 marks
ii	Mid-sem exam:	40 marks
iii	End-sem exam:	60 marks
	Total:	**180 marks**

- There will be total 10 quizzes, and only the best 8 out of the 10 will be counted.
- Each Quiz will be of 10 marks and for 30 mins duration, which will be conducted every Wednesday during 11:00 - 11:30 hrs.
- All exams will be conducted in an online mode, and exact details will be announced well before each exam.
- Appearing in the End-sem exam is mandatory to pass the course.
- There will be no makeup exams for quizzes and mid-sem. Marks for missed quizzes or mid-sem exam will not be prorated.
- Marks less than 30% of the total will most likely result in a fail grade (E or F).
- On the basis of our experience of the last few semesters, the instructors have decided to enforce the strictest possible norms without exception. Please be warned that NO EXCUSE will be considered for leniency for any kind of cheating either as an individual or in a group. If a student is found adopting any unfair means, an F grade will be awarded straight away, and the matter will also be reported to DOAA and SSAC for further action.

7 Text and reference books

1. D. J. Griffiths, Introduction to Electrodynamics, *Fourth Edition* [TEXT BOOK]
2. E. M. Purcell, Electricity and Magnetism (Berkeley Physics Courses-Volume 2), *Second Edition*

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