COURSE HANDOUT

ENGINEERING PHYSICS (BSC-102)

ECE-1st SEMESTER

ACADEMIC YEAR (2024-25)

Prof. Rajinder Sharma

Department of Applied Sciences and Humanities

Department of Electronics and Communication Engineering

Model Institute of Engineering & Technology (Autonomous)

Kot Bhalwal, Jammu - 181122

www.mietjmu.in

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
BSC-102	Engineering Physics	BSC	**5**	**4**	**1**	0	50	100	150

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Apply the concept of gradient, divergence, and curl to understand advance physics.
CO2	Use Maxwell's equations to describe propagation of electromagnetic waves in a medium.
CO3	Apply the concept of wave function to solve problems related to particle confined in a box.
CO4	Understand the concept of interference, diffraction, and polarization of light.
CO5	Understand and Articulate the working principle of lasers and optical fibres

Unit 1

Mathematical Physics: Concepts of Del Operator; Gradient of scalar, divergence and Curl of vector, Gauss divergence theorem and Stokes theorem.

(10 Hrs)

Unit 2

Electromagnetic Theory: Displacement Current, Maxwell's equations in vacuum and non-conducting medium, Electromagnetic wave propagation in free space (EM wave equations for electric and magnetic fields for free space) and their solutions (plane wave solution), Velocity of electromagnetic waves.

(10 Hrs)

Unit 3

Quantum Mechanics: Inadequacies of Classical Mechanics, de-Broglie's concept of matter waves, Wave-packet (Wave-group), Phase and Group velocity, Heisenberg's uncertainty Principle, Experimental illustration of Uncertainty principle using single slit. Wave function: Definition, Interpretation and its significance, Schrodinger's Wave equation (Steady state and time dependent) for one dimension case, Concept of Operators and expectation Values, Applications of Schrodinger's equation (Time Independent) to: a) Particle in a One-Dimensional Box of infinite height, b) Single Step Potential Barrier.

(16 Hrs)

Unit 4

Applied Optics: Interference in thin films (by reflection and transmission of light), Theory of Newton's rings by reflected light, Determination of wavelength and refractive index of monochromatic light by Newton's rings theory, Fraunhofer and Fresnel's diffractions, Fraunhofer diffraction due to a single slit, Plane diffraction grating and its theory for secondary maxima and minima, Unpolarized and polarized light, Double refraction phenomenon, Nicol Prism, Mathematical representation of elliptically and circularly polarized light, Quarter and Half wave plates, Numerical problems.

(15 Hrs)

Unit 5:

Laser & Fibre Optics: Principal of Laser action, Einstein's coefficients, Ruby Lasers, Propagation of Light in Optical fibres, Acceptance angle and acceptance cone, Numerical Aperture, Single mode and Multimode fibres, Characteristics and General applications of Lasers and Optical fibres, Numerical problems.

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(5 Hrs)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Vector Analysis	Murray R. Spiegel	McGraw Hill Education	2nd (2017)
2.	Fundamentals of Physics	Robert Resnick Jearl Walker, David Halliday	Wiley	10th (2015)
3	Concepts of Modern Physics	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury	McGraw Hill Education	7th (2017)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Engineering Physics	H. K. Malik and A. K. Singh	McGraw Hill Education	2nd (2017)
2	Engineering Physics	S. Sharma and J. Sharma	Pearson India	1st (2018)

COURSE PLAN		
Unit-I Mathematical Physics		
S.No	**Topics**	**Recommended Books**
1	Concepts of Del operator, partial derivative, and fields (scalar and vector).	Book 1, Ch.1
2	Gradient of scalar field and physical significance.	Book 1, Ch.1
3	Divergence of vector and its expression in term of cartesian coordinates.	Book 1, Ch.1
4	Curl of vector and physical interpretation	Book 1, Ch.2
5	Stoke's theorem (proof)	Book 1, Ch.2
6	Gauss's divergence theorem (proof)	Book 1, Ch.2
7	Numerical problems	Book 1, Ch.2
Unit-II Electromagnetic Theory		
8	Concept of waves and basic of electromagnetic wave	Book 2, Ch.3
9	Concept and derivation of Displacement current	Book 2, Ch.3
10	Maxwell's equations in vacuum and non-conducting medium (differential and integral forms)	Book 2, Ch.3

11	Derivations of Maxwell's 1st and 2nd equation.	Book 2, Ch.3
12	Derivations of Maxwell's 3rd and 4th equation.	Book 2, Ch.3
13	Wave equations for electric and magnetic field vectors	Book 2, Ch.3
14	Velocity of electromagnetic wave and Relation between Eo & Bo.	Book 2, Ch.3
15	Numerical problems	Book 2, Ch.3
Unit-III Quantum Mechanics		
16	Inadequacies of classical mechanics	Book 3, Ch.4
17	de-Broglie's concept of matter waves and de-Broglie wavelength	Book 3, Ch.4
18	de-Broglie wavelength of electron and Davisson and Germer Experiment	Book 3, Ch.4
19	Wave-packet, Phase, and group velocities	Book 3, Ch.4
20	Heisenberg uncertainty principle, Experimental Illustration using single slit.	Book 3, Ch.4
21	Wavefunction- definition, interpretation, and physical significance	Book 3, Ch.4
22	Schrodinger wave equation (Steady state and time dependent) for one-dimensional case	Book 3, Ch.4
23	Concept of operators and expectation values	Book 3, Ch.4
24	Applications of Schrodinger's equation (Time independent) to (i) Particle in One-Dimensional Box	Book 3, Ch.4
25	(ii) Single Step Potential Barrier	Book 3, Ch.4
26	Numerical problems	Book 3, Ch.4
Unit-IV Applied Optics		
27	Basic of interference	Book 3, Ch.5
28	Interference in thin films (by reflection & transmission of light)	Book 3, Ch.5
29	Theory of Newton's rings by reflected light;Determination of ref. Index and wavelength	Book 3, Ch.5
30	Diffraction, Fraunhoffer & Fresnel's diffraction	Book 3, Ch.5
31	Fresnel's half period zones and rectilinear propagation of light	Book 3, Ch.5
32	Fraunhoffer diffraction due to single slit	Book 3, Ch.5
33	Plane diffraction grating & its theory for secondary maxima and minima	Book 3, Ch.5
34	Unpolarised and polarised light and Phenomenon of double refraction	Book 3, Ch.5
35	Geometry of Calcite crystal and Nicol Prism.	Book 3, Ch.5
36	Mathematical representation of elliptically and circularly polarized light	Book 3, Ch.5
37	Quarter and half wave plate.	Book 3, Ch.5
38	Numerical problems	Book 3, Ch.5

Unit-V Laser & Fibre Optics		
39	Basic of Laser, induced absorption, spontaneous emission, stimulated emission, and Einstein's coefficients	Book 3, Ch.7
40	Ruby laser construction and working	Book 3, Ch.7
41	Propagation of Light in Optical fibres, Acceptance angle, acceptance cone, numerical aperture and single mode and multimode fiber	Book 3, Ch.7
42	Characteristics and General applications of Lasers and Optical fibres	Book 3, Ch.7
43	Numerical problems	Book 3, Ch.7

ADDITIONAL WEB RESOURCES

1.	**MOOC:** Quantum Mechanics https://www.coursera.org/courses?query=quantum%20mechanics
2.	**NPTEL:** On Applied optics by Prof. Akhilesh Kumar Mishra IIT Rorkee https://onlinecourses.nptel.ac.in/noc23_ph41/preview

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

Monday to Friday

- **Contact Information**

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