Semester - 2

ENGINEERING PHYSICS - C

Course Code	Teaching hours per week				Credits	Exam hours	Course type	CIE Marks	ESE Marks
	L	T	P	R					
26NNCBS102	2	0	2	0	3	2 Hrs. 30 Min.	Theory +Lab	40	60

1. **Preamble:**
   This course introduces students to the fundamental principles governing matter, energy and their interactions. It also builds a strong conceptual and analytical foundation needed to understand natural phenomena and the behaviour of physical systems. Emphasis is placed on developing problem-solving skills, experimental reasoning and the ability to apply physical laws across various domains of Science. Through theory and practical, students gain the knowledge essential for further studies.

2. Prerequisites:
Fundamental understanding of core concepts in Physics and Electronics

Module Number	Syllabus Description	Contact Hours
1	**Laser and Fibre Optics -** **Laser**: Characteristics of Laser - Optical processes – Absorption, Spontaneous emission and Stimulated emission, Principle of laser – Population inversion- Pumping- Metastable states, Basic components of laser - Active medium, Optical resonator, Construction and working of Ruby laser, Construction and working of CO_2 Laser, Applications (Qualitative). **Fibre Optics**: Principle of propagation of light, Types of fibres-Step index and Graded index fibres - Acceptance angle, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Applications.	7

2	**Interference and Diffraction** **Interference**: Definition, Principle of superposition, Constructive and destructive interference, Optical path length, phase difference and path difference, Thin Films in reflected system - Condition for constructive and destructive interference, Cosine-Law, Colours in thin films, Air wedge- Measurement of thickness of thin sheets. **Diffraction:** Types of diffraction, Diffraction grating – Construction - Grating equation, Dispersive and Resolving Power (qualitative), Comparison - Interference and Diffraction, Prism spectrum and Grating spectrum.	7
3	**Quantum Mechanics** Introduction, de-Broglie wavelength, matter waves, concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Wave function – properties - physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling (Qualitative)	7
4	**Waves and Acoustics** **Waves:** Transverse and longitudinal waves, Concept of frequency, wavelength and time period, Transverse vibrations in a stretched string-derivation of velocity and frequency - laws of transverse vibration. **Acoustics**: Reverberation and echo, Reverberation time and its significance - Sabine's Formula, Factors affecting acoustics of a building. Ultra sonics - properties, Production -Piezoelectric method-Piezoelectric oscillator-construction and working, SONAR, NDT and other applications.	7
	Total hours (Theory)	28
	Total hours (Practical)	10
	Total hours (Theory + Practical)	38

Course Assessment Method

(CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Continuous Assessment	Internal Examination -1 (Written)	Internal Examination -2 (Written)	Internal Examination -3 (Lab Examination)	Total
5	10	10	10	5	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module • Total of 8 Questions, each carrying 3 marks. **(8 x 3 = 24 marks)**	• Each question carries 9 marks • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x9 =36 marks)**	**60**

3.Course Outcomes

At the end of the course students should be able to:

Course Outcomes	Description	Blooms Taxonomy Level
CO1	Apply the principles of lasers and optical fibres in various engineering systems	K3
CO2	Apply the phenomena of interference and diffraction of light in practical situations	K3
CO3	Apply the principles of quantum mechanics to study the behaviour of matter at the atomic and sub-atomic level.	K3
CO4	Apply the principles of waves and acoustics in real- world applications	K3
CO5	Apply basic knowledge of principles and theories in physics to conduct experiments	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

4. Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	2	2	-	-	-	3
CO2	3	3	-	-	-	2	2	-	-	-	3
CO3	3	3	-	-	-	2	2	-	-	-	3
CO4	3	3	3	-	-	2	2	-	-	-	3
CO5	3	3	3	2	3	3	2	3	2	-	3

5. Text Books

Sl No	Title of Book	Name of Author/s	Publisher	Edition and Year
1	A Textbook of Engineering Physics	M N Avadhanlu, P G Kshirsagar &TVS Arun Murthy	S Chand & Co	6th Edition, 2003
2	Engineering Physics	H K Malik, A.K. Singh	McGraw Hill Education	2nd Edition, 2017
3	Optics	Ajoy Ghatak	McGraw Hill Education	11th Edition, 2018
4	Advanced Engineering Physics	Premlet B	Phasor Books	10th Edition, 2017

6. Reference Books

Sl No	Title of Book	Name of Author/s	Publisher	Edition and Year
1	Engineering Physics	G Vijayakumari	Vikas Publications	8th Edition, 2014
2	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	6th Edition 2003
3	Engineering Physics	Aruldhas G	PHI Pvt. Ltd	2nd Edition, 2015
4	A Text Book of Engineering physics	Dominic, A. Nahari	OWL Publications	2nd Edition, 2016
5	Engineering Physics	Rakesh Dogra	Katson Books	1st Edition, 2019
6	Experiments in Engineering Physics	M.N. Avadhanulu, A.A Dani and P.M Pokely	S. Chand & Co	Third edition, 2008

7	Practical Physics with Viva Voice,	S.L. Gupta and Dr. V. Kumar	Pragati Prakashan Publishers	27th edition, 2009
8	Engineering Physics Practicals	K. Gupta	Krishna Prakashan Pvt. Ltd	Second edition, 2013
9	*Engineering Physics Practicals*	Rao, B. S., Kesava Vamsi Krishna V, and K. S. Rudramamba	Laxmi Publications, 2013	Second edition 2013

7. Video Links or any other Reference Materials

Sl No	Details Like Weblink, Publication Details	Module
1	https://nptel.ac.in/courses/115102124 https://nptel.ac.in/courses/104104085	1
2	https://nptel.ac.in/courses/115105537	2
3	https://nptel.ac.in/courses/115102023 https://nptel.ac.in/courses/115101107	3
4	https://nptel.ac.in/courses/112104212 https://nptel.ac.in/courses/124105004	4

Experiment List

(Minimum 10 Experiments)

Experiment Number	Syllabus Description: List of Experiments
1	Optical fibre characteristics- Measurement of Numerical aperture.
2	Determination of wavelength of Laser using diffraction grating.
3	Measure the wavelength of Laser using a millimetre scale as a grating.
4	Determination of wavelength of a monochromatic light using Newton's Rings method.
5	Determination of diameter of wire or thickness of thin sheet using Air wedge method.
6	Determination of slit width (diffraction due to a single slit).
7	Measure wavelength of light source using diffraction grating.
8	Determination of resolving power and dispersive power of grating.
9	Characteristics of LED.
10	CRO basics-Measurement of frequency and amplitude of wave forms.
11	Solar Cell- I V and Intensity Characteristics.
12	Melde's experiment- Frequency calculation in Transverse and Longitudinal Mode.

13	LCR circuit –forced and damped harmonic oscillations.
14	Determination of wavelength and velocity of ultrasonic waves using ultrasonic diffractometer.
15	Determination of particle size of lycopodium powder.

1. Continuous Assessment – Laboratory Evaluation (Total: 10 Marks)

The continuous assessment for laboratory sessions will be based on the following four components, with marks awarded for each experiment. Final marks will be the average of all experiments conducted as per the syllabus.

i. Preparation and Pre-Lab Work (2 Marks)

- Pre-Lab Assignments: Students will be evaluated based on pre-lab assignments or quizzes that assess their understanding of the upcoming experiment.
- Understanding of Theory: Marks will reflect the student's preparedness and conceptual clarity related to the theory behind the experiment.

ii. Execution of Experiments (2 Marks)

- Procedure and Implementation: Assessment of how accurately and safely the experiment is performed, with adherence to standard procedures.
- Skill Proficiency: Evaluation of the student's efficiency in handling apparatus, precision in observations, and ability to address any issues during the experiment.
- Teamwork: Consideration of the student's cooperation, communication, and participation in collaborative lab work.

iii. Laboratory Records and Reports (3 Marks)

- Quality of Report: Lab reports will be assessed for clarity, completeness, correctness, and appropriate interpretation of experimental data and conclusions.
- Timely Submission: Importance will be given to punctual submission of neatly maintained rough records for Laboratory works.

iv. Viva Voce (3 Marks)

- Oral Examination: Students will be examined on their ability to explain the experimental setup, procedures, results, and relevant theoretical background during viva sessions.

(Marks obtained under each of the above components will be recorded for every experiment and averaged to calculate the final internal mark for the laboratory course.)

2. Laboratory Examination Evaluation Pattern (5 Marks)

1. Procedure / Preliminary Work / Conduct of Experiments (2 Marks)

- Understanding and Explanation of Procedure: Clarity in describing the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

2. Result (2 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.

3. Viva Voce (1 Mark)

- Proficiency in answering questions related to theoretical and practical aspects of the subject.

MODEL QUESTION PAPER			
FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY(FISAT) (Autonomous) <FIRST/SECOND> SEMESTER B. TECH DEGREE EXAMINATION (2026 Scheme), <Month & Year>			
Course Code: 26NNCBS102			
Course Name: Engineering Physics -C			
Max. Marks: 60		Duration: 2 Hours 30 Minutes	
PART A			
Q. No	***Answer all questions. Each question carries 3 marks***	**Marks**	**CO**
1	Explain Population Inversion and Metastable state	3	CO1
2	Draw a properly labelled block diagram of a fibre optic communication system	3	CO1
3	What will happen to the diameter of the rings when Newton's rings arrangement is immersed in a liquid immersed in a liquid? Explain	3	CO2
4	What is diffraction? Compare diffraction pattern with interference pattern	3	CO2
5	What is quantum mechanical tunnelling? Name two electronic devices based on this phenomenon	3	CO 3
6	Write the physical significance of wave function	3	CO3

7		Write the three-dimensional wave equation and its solution	3	CO 4
8		Explain Sabine's formula	3	CO 4
PART B				
Answer any one full question from each module. Each full question carries 9 marks				
Module 1				
9	a	With properly labelled diagrams, explain the construction and working of Ruby Laser	6	CO1
	b	Explain the basic principle of LASER	3	CO1
10	a	Derive a relation for the numerical aperture of a step index fibre in terms of the refractive indices of core and cladding	6	CO1
	b	Evaluate the numerical aperture of a step index fiber if the core refractive index is 1.5 and cladding refractive index is 1.48 when light is launched from air.	3	CO1
Module 2				
11	a	Explain with the help of figure, how air wedge can be used to determine the diameter of a thin wire. What will be the nature of the fringe pattern if monochromatic source is replaced by white light?	6	CO2
	b	Newton's rings are observed in reflected light of wavelength 5.9×10^{-7} m. The diameter of the 10th dark ring is 0.005m. Find the radius of curvature of the lens and thickness of air film	3	CO2
12	a	Explain the construction of a grating and derive grating equation	6	CO2
	b	A plane transmission grating having 5×10^5 lines/m is used at normal incidence. Calculate the angular separation, in the second order, between the two sodium lines of wavelengths 589nm and 589.6nm	3	CO2
Module 3				
13	a	Find the energy Eigen values and Eigen function of a particle moving in a one-dimensional box	7	CO3
	b	If an electron's position can be measured to an accuracy of 2.0×10^{-8} m. How accurately can its velocity be known?	2	CO3
14	a	Derive the Schrodinger's time dependent equation for a moving particle and hence derive the Schrodinger's time independent equation	6	CO3
	b	An electron is accelerated through a potential difference of 200V. Find the de-Broglie wavelength.	3	CO3
Module 4				
15	a	Derive an expression for the velocity of transverse waves in a stretched string and state the laws of transverse vibrations	7	CO4
	b	A string of mass 0.65 kg is stretched between two supports 30 m apart. If the tension in the string is 160 N, find the velocity of the wave in the string. How long will a pulse take to travel from one support	2	CO4

		to the other?		
16	a	Explain any six factors affecting the acoustics of a building and give their remedies.	5	CO4
	b	A cinema hall has a volume of 20000m^3. It is required to have a reverberation time of 4s. What should be the total absorption of the hall	4	CO4

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