

TEERTHANKER MAHAVEER UNIVERSITY

(Established under Govt. of U. P. Act No. 30, 2008)

Delhi Road, Moradabad (U.P)

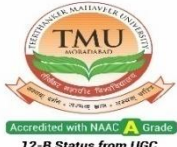
Website: www.tmu.ac.in

COURSE FILE

Faculty of Engineering

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Course Name	:	Engineering Physics
Course Code	:	EAS112
Faculty Member	:	Dr. Amit Kumar Sharma
Program	:	B.Tech CSE
Semester	:	I
Academic Year	:	2024-25

	Index	SESSION-2024-2025
		SEM- 1st Subject: Engineering Physics Code: EAS112 Dept. /Sec: CSE

Course & Faculty Details	Page No.
Vision & Mission of the Institute	3
Vision & Mission of Department	3
Program Educational Objectives	4
Program Specific Outcomes	4
Program Outcomes	5-6
Institute Academic Calendar	7-10
Department Academic Calendar	11
Course Evaluation Scheme	12-13
Course Syllabus as per university	14-15
Course Outcomes	16
CO-PO Mapping	16-18
CO-PO Mapping with Justification	19-23
Lecture Plan & Course Coverage (E-Contents and Web link)	24-26
Time Table-Faculty	27
Time Table-Section wise	28-29
Student List (Section wise)	30-35
List of Assignments/Quizzes	36-40
Class Test Paper (CT1, CT2, and CT3)	41-45
Class Test Marks (CT1, CT2, and CT3)	46-51
Class Test Solution	52-86
Assignments/Quizzes Solution	87-107
Class Attendance Sheet (Month Wise)	108-123
List of Slow Learner Students of Class test and action taken	124-141
List of Fast Learner Students of Class test and action taken	142-143
Previous Year Question Papers	144-152
Question Bank	153-157
Final Internal Marks	158-163
End Semester Exam Analysis	
End Sem Question Paper	NIL
Result & Analysis	164
CO Attainment of End Sem	165-167
Direct CO Attainment-CTs & End Sem	168-171
Indirect CO Attainment-Course Exit Survey	172-173-175
Overall CO Attainment (Direct and Indirect Assessment)	173-175
Course File Closure Report	176

FACULTY OF ENGINEERING

B.Tech. CSE NBA Accreditation 2025

INSTITUTE

VISION

To be recognised as institute of excellence, promoting value based education in computer science and engineering with multidisciplinary research, innovation and consultancy services to the society.

MISSION

1. To provide holistic education through outcome based learning.
2. To promote interdisciplinary learning and research for serving the needs of entire global community.
3. To inculcate innovation in graduates using technological advancements for the development of computational solutions.
4. To prepare graduates to be continuous learners by inculcating people skills.

DEPARTMENT

VISION

To be recognised as department of excellence, promoting value-based education in computer science and engineering with multidisciplinary research, innovation and consultancy services to the society.

MISSION

1. To provide value based education by implementing outcome-based teaching and learning process.
2. To promote inter-disciplinary research that for serving the needs of entire global community.

3. To inculcate desire for innovation in graduates using technological advancements for the development of effective solutions.
4. To prepare graduates as continuous learners by inculcating professional skills and ethical responsibilities.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

1. **Fundamental:** To prepare the graduates for career and proficiency in Computer Science and Engineering.
2. **Industry Ready:** To imbibe technical and aptitude skills related to Computer Science and Engineering to provide the best solution to industrial and societal problems.
3. **Continuous Learning:** To prepare graduates for pursuing higher education and life-long learning.
4. **Entrepreneurship Skills:** To imbibe entrepreneurship, leadership, effective communication and business skills through innovation, incubation and start-up activities.
5. **Social and Moral Ethics:** To develop awareness among the graduates about the various social responsibilities related to engineering ethics, human values and ecological understanding.

PROGRAM-SPECIFIC OUTCOMES (PSO)

PSO–1: Developing skills for creating computational solutions with emerging technologies, programming languages, mathematical foundations, algorithmic principles and open source platforms to solve complex engineering problems.

PSO–2: Understanding the evolutionary changes in computing by applying standard practices and skills acquired through computer engineering to provide solutions with innovative ideas and interdisciplinary research.

PSO–3: Applying modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur and pursue higher studies in their respective domains.

Program Outcomes for Engineering:

PO – 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO – 2	Problem analysis& Solving: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO – 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO – 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO – 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO – 6	Social Interaction & effective citizenship: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO – 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO – 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO – 9	Attitude (Individual and team work): Function effectively as an individual, and as member or leader in diverse teams, and in multidisciplinary settings.
PO – 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clean instructions.
PO – 11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO – 12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Institute Academic Calendar



TEERTHANKER MAHAVEER UNIVERSITY

(Established under Govt. of U. P. Act No. 30, 2008)

Delhi Road, Moradabad (U.P)

Phone No.: +91 8218290992

Email : jointregistrar@tmu.ac.in

Ref. No : TMU/R.O./2024-25/Academic Calendar/001(R)

Date : 23.12.2024

Circular

Subject: Revised Academic Calendar Session 2024-25 (Except Medical & Dental).

The Academic Calendar of the University for various programmes (except for Medical & Dental programmes) is proposed, herewith. The calendar is suggestive and the dates mentioned may change depending upon the unforeseen situations that may arise owing to causes beyond control.

For Semester System

S. No.	Events/Particulars		Dates	
Odd Semester				
			For 1 st Year	For 2 nd Year Onwards
1	Course allocation and tagging on ERP for odd semester		July 15, 2024	July 15-20, 2024
2	Submission of time table and upload on ERP for odd Semester		July 25, 2024	
3	Upload of e-contents for odd semester on website		Up to July 31, 2024	
4	Commencement of classes	Nursing Programmes	August 01, 2024	August 01, 2024
		All other Programmes (Including Student Induction Program for 1-3 weeks, as applicable)	August 21, 2024	
5	Registration of semester course and open elective courses (if applicable) by the students	Nursing Programmes	August 01-05, 2024	August 01-05, 2024
		All other Programmes	August 21-30, 2024	
6	Sharing of Course Handouts with Students		August 30, 2024	
7	CT-I*	All Programmes and Programmes under NEP-2020 for batches admitted in session 2024-25	October 14-18, 2024	October 14-18, 2024
8	CT-II*	All Programmes except programmes under NEP-2020 for batches admitted in session 2024-25	November 18-22, 2024	November 18-22, 2024
9	End of odd semester Classes (For all programmes)		December 04, 2024	

10	CT-II*	All Programmes under NEP-2020 admitted in session 2024-25	December 05-10, 2024
11	CT-III*	All Programmes except programmes under NEP-2020 for batches admitted in session 2024-25	
12	Preparatory Leave		December 11-15, 2024
13	Doubt Clearing Sessions		December 16-24, 2024
14	Conduct of Odd semester Practical Examinations		December 26, 2024- December,31 2024 (As per the Schedule)
15	Conduct of Odd semester Theory Examinations		2 nd January 2025 onwards (As per the Schedule)
16	Declaration of results of odd semester End Examinations		Within 15 days of conduct of Examinations

Even Semester		
1	Course allocation and tagging on ERP for even semester	January 10, 2025
2	Submission of time table and upload on ERP for even Semester	January 20, 2025
3	Commencement of Even Semester classes (for all programmes)	January 27, 2025
4	Registration for semester course and open elective courses (if applicable) by the students	January 27-30, 2025
5	Upload of e-contents for Even semester on website	February 03, 2025
6	Sharing of Course Handouts with Students	February 03, 2025
7	CT-I* for all Programmes except programmes under NEP-2020 for batches admitted in session 2024-25	March 04-08, 2025
8	CT-I* for Programme under NEP-2020 for batches admitted in session 2024-25	April 08-12, 2025
	CT-II* for all Programmes except programmes under NEP-2020 admitted in session 2024-25.	
9	End of Even Semester Classes	May 10, 2025
10	CT-II* Programme under NEP-2020 admitted in session 2024-25	May 12-15, 2025
	CT-III* for all Programmes except programmes under NEP-2020 for batches admitted in session 2024-25	
11	Preparatory Leave	May 16-19, 2025
12	Conduct of Even Semester Examinations	May 20 -June 10, 2025
13	Declaration of results of Even semester End Examinations	Within 15 days of conduct of examinations
14	Summer vacations/Internship (Wherever applicable)	June 11- July 31, 2025
15	Commencement of next academic session	August 01, 2025

For Annual System

S. No	Events/Particulars	Dates
1	Course allocation and tagging on ERP	July 01- July 15, 2024
2	Submission of time table and upload on ERP	July 15, 2024
3	Commencement of Classes 1 st year Nursing Students including induction programme (01 week) for newly admitted students.	August 01, 2024
	Commencement of Classes (2 nd Year onwards)	August 08, 2024
4	Registration of semester courses and open elective courses and backlogs (if any) by the students- 1 st Year Nursing Programmes	August 01-05, 2024
	Registration of semester courses and open elective courses and backlogs (if any) by the 1 st Year students (rest of the programmes)	August 08-30, 2024
	Registration of semester courses and open elective courses and backlogs (if any) by the students- (2 nd Year onwards)	August 08-12,2024
5	Sharing of Course Handouts with Students	August 30, 2024
6	Upload of e-contents on the website	Up to July 31, 2024
7	CT-I*	October 14-18, 2024
8	CT-II*	February 18-22, 2025
9	End of classes	May 05, 2025
10	CT-III*	May 06-10, 2025
11	Preparatory Leave	May 12-17, 2025
12	Conduct of Examinations	May 19-June 06, 2025
13	Declaration of Results	Within 15 days of conduct of examination
14	Summer Vacations	June 09-July 31, 2025
15	Commencement of next academic session	August 01, 2025

Notes-

1. * The CT of the concerned course should be conducted within the given window as per the scheduled time table. The Principals may draft the CT schedule according to the dates given by the concerned course faculty with maximum 2 CTs on a given date. Rest of the classes should remain unaffected with regard to teaching work.
2. Student Induction program to be planned as per the guidelines of UGC, AICTE, INC or other statutory bodies as applicable.
3. Academic Assignments including Internship/Education Tours/Training, wherever applicable, to be planned within the duration from end of last exam till the start of the next semester.
4. 15 days orientation to Internship for Physiotherapy Students to be planned during summer break.
5. Provision for supplementary examination, wherever applicable, to be made by the examination office and submitted to the competent authority for approval to schedule the same in line with the academic calendar.

This is issued with the approval of Hon'ble Vice Chancellor


(Dr. Vaibhav Rastogi)
Joint Registrar
Teerthankar Mahaveer University
Moradabad

Copy to

1. OSD to Hon'ble Chancellor for info. Please
2. P.S. to Hon'ble Chancellor for info. Please
3. P.S. to Hon'ble Group Vice Chairman for info. Please
4. Hon'ble Executive Director
5. Director (Administration)
6. Registrar
7. Director (Hospital Administration)
8. Director- Governance (Dental & Allied Health Sciences)
9. Director HR
10. Director (Accounts)
11. Director (Admissions)
12. Chief Warden
13. Chief Proctor
14. Finance Officer
15. Jt. Registrar (Alumni Relations)
16. Jt. Registrar (Administration)
17. Jt. Director (Security, Students Welfare & Admin.)
18. Jt. Director (TMU Entrance Test)
19. General Manager (IT)
20. Assistant Registrar (Registration & Migration)
21. Head (Social Media, Media, Digital Marketing & ERP)
22. Manager (Payroll)
23. Manager (Transport)
24. Hostel Warden(s)
25. Guard File

1. Hon'ble Vice Chancellor
2. Dean (Academics)
3. Controller of Examinations
4. Deans/ Principals/ HoDs
5. Dean Students' Welfare
6. Director (IQAC)
7. Director (CTLD)
8. Associate Dean (R&D)
9. Associate Dean (Academics)
10. Associate Dean (Ph.D. Cell)
11. University Librarian
12. Joint Director (CRC)

Department Academic Calendar

Teerthanker Mahaveer University					
Faculty of Engineering					
Academic Calendar for Session 2024-25					
Events/Particulars	Odd Semester		Events/Particulars	Even Semester	
	For 1st Year	For 2nd Year Onwards		For 1st Year	For 2nd Year Onwards
	Dates/Periods	Dates/Periods		Dates/Periods	Dates/Periods
Course Allocation and tagging on ERP for Odd Semester	July 15, 2024	July 15-20, 2024	Course Allocation and tagging on ERP for Even Semester	December 20, 2024	
Submission of Time Table and Upload on ERP	July 25, 2024		Submission of Time Table and Upload on ERP	January 10, 2025	
Upload e-contents for odd semester on website	Up to July 31, 2024		Upload e-contents for Even semester on website	January 18, 2025	
Commencement of classes: (For first year)	August 21, 2024	August 01, 2024			January 13, 2025
Two/Three Weeks Induction Program for newly joined students	August 21, 2024 to 10 Sep 2024				
Registration for the semester courses and open elective courses and backlogs (if any) for the students	August 21-30, 2024	August 01-05, 2024	Registration for the semester courses and open elective courses and backlogs (if any) for the students	January 13-15, 2025	
Sharing of Course Handouts with students	August 30, 2024		Sharing of Course Handouts with students	January 20, 2025	
CT-I	October 14-18 2024		CT-I	February 18-22, 2025	
CT-II	November 18-22, 2024		CT-II	March 24-28, 2025	
End of Odd Semester classes	December 04, 2024		End of Even Semester classes	May 05, 2025	
CT-III	December 05-10, 2024		CT-III	May 06-10, 2025	
Preparatory Leave	December 11-15, 2024		Preparatory Leave	May 12-17, 2025	
Conduct of Odd End Semester Examinations	December 16, 2024 January 04, 2025		Conduct of Even End Semester Examinations	May 19-June 06, 2025	
Declaration of results of odd End Semester Examinations	With in 15 days of conduct of examinations		Declaration of results of Even End Semester Examinations	With in 15 days after examinations	
			Summer vacations/Internship	June 9 July 31, 2025	
			Commencement of Next Academic Session 2025-26	August 01, 2025	

Prof. (Dr) Rakesh. Kr. Dwivedi
Dean
FoE, TMU, Moradabad

Course Evaluation Scheme

<u>Study & Evaluation Scheme</u>	
<u>SUMMARY</u>	
<i>Institute Name</i>	COLLEGE OF COMPUTING SCIENCES & INFORMATION TECHNOLOGY
<i>Programme</i>	<i>Bachelor of Technology(Computer Science & Engineering)</i>
<i>Duration</i>	<i>Four Years full time(Eight Semesters)</i>
<i>Medium</i>	<i>English</i>
<i>Minimum Required Attendance</i>	<i>75%</i>
<u>Credits</u>	
<i>Minimum Credits Required for Degree</i>	<i>186</i>

Assessment:					
Evaluation			Internal	External	Total
Theory			40	60	100
Practical/ Dissertations/ Project Reports/ Viva-Voce			50	50	100
Class Test-1	Class Test-2	Class Test-3	Assignment(s)	Attendance& Participation	Total
Best two out of three					
10	10	10	10	10	40
Duration of Examination			External	Internal	
			3 Hours	1.5 Hours	

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester end examination and teachers continuous evaluation.(i.e. both internal and external).A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have at least 45% marks in aggregate to clear the semester.

Evaluation of practical course [From Second Year Onwards]

Practical Courses Internal Evaluation (50 marks)

TWO EXPERIMENTS	ATTENDANCE	VIVA	TOTALINTERNAL
------------------------	-------------------	-------------	----------------------

30	10	10	50
Practical Courses External Evaluation (50 marks)			
TWO EXPERIMENTS	FILE WORK	VIVA	TOTALINTERNAL
30	10	10	50

Class participation & Attendance 10 %

Individual Assignment 10 %

CT-1 Exam 10 %

CT-2 Exam 10 %

CT-3 Exam 10 %

End Term Exam 60 %

Note: there is a consideration of best two CT's.

Course Syllabus as per university

EAS112 / EAS212: ENGINEERING PHYSICS

CO1. Understanding the wave nature of light with the study of interference, diffraction and polarization phenomena.

CO2. Understanding the particle (quantum) nature of light from the study of lasers.

CO3. Understanding the concept of space, time, mass and consistency of light speed with the help of special theory of relativity.

CO4. Applying the concepts of interference in experiments like Fresnel's biprism, Newton's ring, Michelson's interferometer, diffraction in single slit, resolving power of grating, and polarization in Malus's, Brewster's law and polarimeter.

CO5. Applying special theory of relativity to explain the phenomenon of length contraction, time dilation, mass-energy equivalence. Variation of mass with velocity.

Content	Contact Hours
Unit-1: Interference:	8
Interference of Light: Introduction, Principle of Superposition, Interference due to division of wavefront: Young's double slit experiment, Theory of Fresnel's Bi-Prism, Interference due to division of amplitude: parallel thin films, Wedge shaped film, Michelson's interferometer, Newton's ring.	
Unit-2: Diffraction & Resolving Power:	8
Diffraction: Introduction, Types of Diffraction and difference between them, Condition for diffraction, difference between interference and diffraction. Single slit diffraction: Quantitative description of maxima and minima with intensity variation, linear and angular width of central maxima. Resolving Power: Rayleigh's criterion of resolution, resolving power of diffraction grating and telescope.	
Unit-3: Polarization:	8
Introduction, production of plane polarized light by different methods, Brewster's and Malus Law, Quantitative description of double refraction, Nicol prism, Theory of production of plane, circular and elliptically polarized light, Quarter & half wave plate, Specific rotation, Laurent's half shade polarimeter.	
Unit-4: Laser Optics	8

Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Population inversion, Einstein's Coefficients, Principles of laser action, Solid state Laser(Ruby laser) and Gas Laser (He-Ne laser), Laser applications.	
Unit -5: Special Theory of Relativity	8
Special Theory of Relativity: Introduction, Inertial and non-inertial frames of Reference, Postulates of special theory of relativity, Galilean and Lorentz Transformations, Length contraction and Time Dilation, Relativistic addition of velocities, Variation of mass with velocity, Mass-Energy equivalence.	

Course Outcomes

Department of Computer Science and Engineering, Faculty of Engineering

Proposed CO-PO Matrix

Course Name: Engineering Physics

Year of Study: 2024-25

Course Code: EAS112

The Course outcomes (COs). On completion of the course the participants will be able to:

CO – 1. Understanding the wave nature of light with the study of interference, diffraction and polarization phenomena.

CO–2. Understanding the particle (Quantum) nature of light from the study of lasers.

CO -3. Understanding the concept of space, time, mass and consistency of light speed with the help of Special theory of relativity.

CO – 4. Applying the concepts of interference in experiments like Fresnel's biprism, Newton's ring, Michelson's interferometer, diffraction in single slit, resolving power of grating, and polarization in Malus's, Brewster's law and polarimeter.

CO-5: Applying special theory of relativity to explain the phenomenon of length contraction, time dilation, mass-energy equivalence. Variation of mass with velocity.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	0	0	0	0	0	0	0	0	0	0
CO2	2	0	0	0	0	0	0	0	0	0	0	0
CO3	2	0	0	0	0	0	0	0	0	0	0	0
CO4	0	2	0	0	0	0	0	0	0	0	0	0
CO5	0	2	0	0	0	0	0	0	0	0	0	0

Proposed CO-PSO Matrix

CO	PSO1	PSO2	PSO3
CO1	0	0	0
CO2	0	0	0
CO3	0	0	0
CO4	0	0	0
CO5	0	0	0

PO-1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO-2	Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO-3	Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems
PO-5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO-6	The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-9	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PSO-1	Developing skills for creating computational solutions with emerging technologies, programming languages, mathematical foundations, algorithmic principles and open source platforms to solve complex engineering problems.
PSO-2	Ability to understand the evolutionary changes in computing by applying standard practices and skills acquired through computer engineering to provide solutions with innovative ideas and interdisciplinary research.
PSO-3	Ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur and pursue higher studies in their respective domains

Faculty Signature

CO-PO Mapping Justification

Course Name: Engineering Physics

Course

Code: EAS112

PSO No	Program Objective	Course Outcome	Relevance	Justification
PO1	Engineering Knowledge	CO1	Medium	Imparting fundamental knowledge of interference, Diffraction and Polarization which is critical for understanding certain computational imaging systems, optical communication, and photonic devices.
		CO2	Medium	Understanding quantum nature and lasers involves applying physics and mathematical concepts.
		CO3	Medium	Special theory of relativity enhances the student's scientific understanding, particularly in advanced fields like GPS system.
		CO4		
		CO5		
PO2	Problem Analysis	CO1	Low	
		CO2	Low	
		CO3	Low	
		CO4	Medium	Applying concepts of experiments of interference, diffraction and polarization provide foundational knowledge for understanding light propagation and its applications in engineering.
		CO5	Medium	The conceptual analysis of phenomena like length contraction, time dilation and velocity addition enhance analytical thinking, helping students approach complex problems from first principles.

PO3	Design/Development of solutions	CO1		
		CO2		
		CO3		
		CO4		
		CO5		
PO4	Conduct Investigations of Complex problems	CO1	-	
		CO2		
		CO3		
		CO4		
		CO5		
PO5	Modern Tool Usage	CO1		
		CO2		
		CO3		
		CO4		
		CO5		
PO6	The Engineer and Society	CO1		
		CO2		
		CO3		
		CO4		

		C05		
PO7	Environm ent and Sustainabi lity	C01		
		C02		
		C03		
		C04		
		C05		
PO8	Ethics	C01		
		C02		
		C03		
		C04		
		C05		
PO9	Individual and Team Work	C01		
		C02		
		C03		
		C04		
		C05		
PO1 0	Communicati on	C01		
		C02		
		C03		
		C04		
		C05		
PO1 1	Project Manage ment and	C01		
		C02		
		C03		
		C04		

	Finance	CO5		
PO1 2	Life- Long Learn ing	CO1		
		CO2		
		CO3		
		CO4		
		CO5		

PSO	Course Outcome	Relevance	Justification
PSO1	CO1		
	CO2		
	CO3		
	CO4		
	CO5		
PSO2	CO1		
	CO2		
	CO3		
	CO4		

	CO5		
PSO3	CO1		
	CO2		
	CO3		
	CO4		
	CO5		

Designed By Subject Faculty:

Faculty Signature

Reviewed By:

Approved/ Not Approved					
------------------------------	--	--	--	--	--

Comments					
Role	Senior Subject Expert	Departmental SeniorFaculty	Departmental SeniorFaculty	Departmental SeniorFaculty	Other Department SeniorFaculty
Faculty Name					
Sig.with Date					

Learning Plan/Lesson Plan

Sessions Nos.	Topics	Pedagogy	References	Session outcome (Bloom's Taxonomy)	CoursOutcome (COs)
1.	Fundamental of optics	Lecture & discussion, Q & A	R2	L2	CO1
2.	Introduction to interference, Principle of Superposition,	Lecture & discussion, Q & A	R2	L2	CO1
3.	Interference due to division of wavefront: Young's double slit experiment	Lecture & discussion, Q & A	R2	L2	CO1
4.	Theory of Fresnel's Bi-Prism	Lecture & discussion, Q & A	R2	L2	CO1
5.	Interference due to division of amplitude: parallel thin films	Lecture & discussion, Q & A	R2	L2	CO1
6.	Wedge shaped film	Lecture & discussion, Q & A	R2	L2	CO1
7.	Michelson's interferometer	Lecture & discussion, Q & A	R2	L2	CO1
8.	Newton's ring	Lecture & discussion, Q & A	R2	L2	CO1
9.	Diffraction: Introduction	Lecture & discussion, Q & A	R2	L2	CO1
10.	Types of Diffraction and difference between them,	Lecture & discussion, Q & A	R2	L2	CO1
11.	Condition for diffraction, difference between interference and diffraction	Lecture & discussion, Q & A	R2	L2	CO1
12.	Single slit diffraction: Quantitative description of maxima and minima with intensity variation	Lecture & discussion, Q & A	R2	L2	CO1
13.	Single slit diffraction: Quantitative description of maxima and minima with intensity variation, linear and angular width of central maxima	Lecture & discussion, Q & A	R2	L2	CO1
14.	Resolving Power: Rayleigh's criterion of resolution	Lecture & discussion, Q & A	R2	L2	CO1
15.	Resolving power of diffraction grating and telescope	Lecture & discussion, Q & A	R2	L2	CO1
16.	Polarization: Introduction	Lecture & discussion, Q & A	R2	L2	CO1
17.	Production of plane polarized light by different methods	Lecture & discussion, Q & A	R2	L2 & L3	CO1 & CO5
18.	Brewster's and Malus Law.	Lecture & discussion, Q & A	R2	L2 & L3	CO1 & CO5
19.	Quantitative description of double refraction	Lecture & discussion, Q & A	R2	L2 & L3	CO1 & CO5
20.	Quantitative description of double refraction	Lecture & discussion, Q & A	R2	L2 & L3	CO1 & CO5

21.	Nicol prism	Lecture & discussion, Q & A	R2	L2 & L3	CO1 & CO5
22.	Quarter & half wave plate	Lecture & discussion, Q & A	R2	L2 & L3	CO1 & CO5
23.	Specific rotation	Lecture & discussion, Q & A	R2	L2 & L3	CO1 & CO5
24.	Laurent's half shade Polarimeter	Lecture & discussion, Q & A	R2	L2 & L3	CO1 & CO5
25.	Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Population inversion	C&T, S/P, BS	R4, R8	L1, L2	CO2
26.	Einstein's Coefficients	C&T, S/P	R4, R8	L2, L3, L3	CO2
27.	Principles of laser action	C&T, S/P	R4, R8	L2, L3	CO2
28.	Solid state Laser (Ruby laser)	C&T, S/P	R4, R8	L2, L3, L3	CO2
29.	Gas Laser (He-Ne laser)	C&T, S/P	R4, R8	L2, L3, L3	CO2
30.	Laser applications	C&T, S/P	R4, R8	L2, L3, L3	CO2
31.	Special Theory of Relativity: Introduction	Lecture & discussion, Q & A	R 1 & R 3	L2	CO2
32.	Inertial and non-inertial frames of Reference	Lecture & discussion, Q & A	R4	L2 & L3	CO3 & CO4
33.	Postulates of special theory of relativity	Lecture & discussion, Q & A	R4	L2 & L3	CO3 & CO4
34.	Galilean and Lorentz Transformations	Lecture & discussion, Q & A	R4	L2 & L3	CO3 & CO4
35.	Galilean and Lorentz Transformations	Lecture & discussion, Q & A	R4	L2 & L3	CO3 & CO4
36.	Length contraction and Time Dilation	Lecture & discussion, Q & A	R4	L2 & L3	CO3 & CO4
37.	Relativistic addition of velocities	Lecture & discussion, Q & A	R4	L2 & L3	CO3 & CO4
38.	Variation of mass with velocity,	Lecture & discussion, Q & A	R4	L2 & L3	CO3 & CO4
39.	Mass-Energy equivalence	Lecture & discussion, Q & A	Notes	L2 & L3	CO3 & CO4

Pedagogy/Teaching Method:*

C&T:-Chalk & Talk; S/P:-Slides/PPT; Videos; SEM: Seminar; Demo; CHART; ET/GL: Expert Talk/Guest Lecture; QUIZ; CPS: Class room problem solving; GD:-Group discussion; RTCS: Real time case studies; JAR:-Journal article review; PD:-Poster design; OL:-Online lecture/Google class room; Industrial Visit (IV), Assignment (ASG), Quiz/Puzzle (Q), Brain storming (BS), Think-Pair-Share (TPS), Certification(CERT), SIM: Simulation, P/G: Pledge/Greeting, Q/R: Quotes, references, LS: Literature Survey, RW: Report Writing, MM: Model making, PED: Professional/ethical dilemma, Coding, Activity/Event, FV: Field Visit etc.

*Strictly adhere to the Teaching Pedagogy/Teaching Method mentioned above and fill up in the column

** For Book/Web Reference- Please refer the point no H and ensure the compliance of the same

References

Text Books:

- R1. Optics, Brij Lal & Subrahmanyam, S. Chand & Co.
- R2. Optics, Ajay Ghatak, Tata Mc Graw-Hill.
- R3. Engineering Physics, H. K. Malik & A.K. Singh, McGraw-Hill
- R4. Lasers Theory, Principles and Applications, Dr. Manjeet Singh, Vaya Education of India
- R5. Mechanics, D.S.Mathur, S. Chand & Co

Reference Books:

- R6. F. A. Jenkins and H. E. White, Fundamentals of Optics, McGraw-Hill.
- R7. Concept of Modern Physics, Beiser, Tata McGraw-Hill.
- R8. Lasers And Non Linear Optics B. B. Laud, New Age Delhi
- R9. R. Resnick, Introduction to Special Relativity, John Wiley, Singapore

Web references

W1 <https://youtu.be/8vWkevnecJI?si=tbinhQytW5uSUMrj>

W2 <https://youtu.be/hvpYKPyT-vc?si=xg7dr9YsJzd-3L1v>

W3https://youtube.com/playlist?list=PLoy6y70SbvkhWdOi1YBKjpaJTlUvtJboo&si=4RmPBoF_bh8DZlNX

Time Table of Faculty

ODD Semester Time Table (w.e.f. Sept. 2024)

Faculty Name: Dr. Amit Kumar Sharma

Mobile No: 817199420

Session: 2024-25

Room No: 4129

	9:00 – 9:55	10:00– 10:55	11:00- 11:55	12:00- 12:55	12:55- 1:55	1:55- 2:55	2:55- 3:55
MON				EAS112 (A)	L U N C H	EAS112 (B)	
TUE			EAS112 (A)	EAS112 (B)			
WED			EAS112 (A)				
THU	EAS112 (A)			EAS112 (B)			
FRI				EAS112 (B)			
SAT							

Sr. No.	COURSE CODE	SEM	COURSE NAME	SECTION	ROOM NO. / LAB NO.	THEORY	TUTORIAL	LAB	CONTACT HRS.
1	EAS112	1	Engineering Physics	A,B	3101	4+4			8

Time Table of Students

B.Tech. (CSE) I Semester (A)

	9:00 –9:55	10:00–10:55	11:00-11:55	12:00-12:55	12:55-1:55	1:55-2:55	2:55-3:55
MON	TGE102	TMU-101	EAS116	EAS112	L U N C H	Library	
TUE	EME161 (A2))/ EEE161 (A1)		EAS112	EAS116		EEE117	Library
WED	TGE102	EEE117	EAS112	EAS116		EME161 (A1) EAS162 A2	
THU	EAS112	TMU-101	EAS162 (A1)/ EEE161 (A2)			EEE117	Internet
FRI	EAS116	TMU-101	TGE102			EEE117	Library
SAT							

S. No	Course Code	Subject Name	Room No	Short Name	Faculty Name
1	EAS116	Engineering Mathematics-I	3101	DAK	Dr. Ajit Kumar
2	EAS112	Engineering Physics	3101	DAS	Dr. Amit Kr. Sharma
3	EEE117	Basics Electrical Engineering	3101	GG	Dr.GarimaGoswami
4	TMU-101	Environmental Studies	3101	MHS	Mohd. Saleem.
5	TGE102	English Communication–I	3225	DSJ	Dr. Sonia Jayant
6	EAS162	Engineering Physics (Lab)	1123	DAS	Dr. Amit Sharma
7	EEE161	Basics Electrical Engineering (Lab)	2229	GG	Dr.GarimaGoswami
8	EME161	Engineering Drawing Lab	3138	AG	Mr. Arun Gupta

B.Tech. (CSE) I Semester (B)

	9:30 – 10:25	10:30– 11:25	11:30– 12:25	12:30– 01:25	01:25- 2:25	2:25-3:10	3:10-3:55
MON	TMU-101	EAS116	EEE117	Mentor Interaction	L U N C H	EAS112	TMU-101
TUE	EME161 (B1) / EAS162 (B2)		TGE103	EAS112		EEE117	EAS116
WED	EAS162 (B1) / Library B2		TGE103 (P)			EME161 (B2) / B1 Library	
THU	EEE117	EAS116	TMU-101	EAS112		EEE161 (B2) / Library B1	
FRI	EEE117	EAS116	TMU-101	EAS112		EEE161 (B1) / B2 Library	
SAT							

S. No	Course Code	Subject Name	Room No	Short Name	Faculty Name
1	EAS116	Engineering Mathematics-I	3106	AK	Dr. Ajeet Kumar
2	EAS112	Engineering Physics	3106	DAS	Dr. Amit Sharma
3	EEE117	Basics Electrical Engineering	3106	DSP	Dr. Shubhendra Pratap Singh
4	TMU-101	Environmental Studies	3106	DMS	Dr. Mudit Saxena
5	TGE103	English Communication–I	3225	DSJ	Dr. Sonia Jayant
6	EAS162	Engineering Physics (Lab)	1123	DAS	Dr. Amit Sharma
7	EEE161	Basics Electrical Engineering (Lab)	2229	DSP	Dr. Shubhendra Pratap Singh
8	EME161	Engineering Drawing Lab	3138	DAG	Dr. Arun Gupta
9					

Student List (Section Wise)

Student List B.Tech. (CSE) Sec - A

S.No.	Enrollment No.	Student Name
1	TCA2409001	ABDUL MUNEEB KHAN
2	TCA2409002	ABDUS SUBOOR KHAN
3	TCA2409004	ABHAY RAJ SINGH
4	TCA2409005	ABHIMANYU RAI
5	TCA2409006	ABHINAV SUNIL PATIL
6	TCA2409007	ABHISHEK JAIN
7	TCA2409008	ABHISHEK KUMAR
8	TCA2409010	ABHISHEK SHUKLA
9	TCA2409013	ADI JAIN
10	TCA2409016	AJAY KUMAR
11	TCA2409020	AKSHITA JAIN
12	TCA2409021	AMAAN SHAHID
13	TCA2409022	AMAN THAPAN
14	TCA2409025	AMRUTA VILAS HUDDAR
15	TCA2409026	ANAMTA NAQVI
16	TCA2409027	ANAND MISHRA
17	TCA2409028	ANAND RAJ
18	TCA2409029	ANIMESH JAIN
19	TCA2409030	ANIMESH JAIN
20	TCA2409032	ANKIT KUMAR
21	TCA2409033	ANKIT KUMAR
22	TCA2409034	ANKIT KUMAR
23	TCA2409037	ANSH CHAUDHARY
24	TCA2409038	ANSH JAIN

25	TCA2409039	ANSHIK KUMAR GUPTA
26	TCA2409041	ANUJ PAL
27	TCA2409042	ANURAG YADAV
28	TCA2409044	ANVI JAIN
29	TCA2409045	ARCHANA KUMARI
30	TCA2409047	ARPAN KUMAR
31	TCA2409048	ARPIT JAIN
32	TCA2409049	ARUN
33	TCA2409050	ARUN KUMAR
34	TCA2409052	ASHUTOSH KUMAR
35	TCA2409053	ASHUTOSH KUMAR RAI
36	TCA2409055	ATUL KUMAR GUPTA
37	TCA2409056	AVADHESH KUMAR SHARMA
38	TCA2409058	AYUSH SINGH
39	TCA2409059	AZHAAN MOHAMMAD KHAN
40	TCA2409060	DAKSH JAIN
41	TCA2409061	DAKSH RUHELA
42	TCA2409064	DIVYANSH BHARDWAJ
43	TCA2409066	DIVYANSHU KUMAR
44	TCA2409067	GAGANDEEP SHARMA
45	TCA2409072	GYAYAK PATODI
46	TCA2409073	HARSH JAIN
47	TCA2409075	HARSHIT JAIN
48	TCA2409076	HARSHIT JAIN
49	TCA2409077	HEMANT CHAHAL
50	TCA2409078	HIMANSHU JAIN
51	TCA2409081	HRITHIK PAWAR

52	TCA2409083	JAMSHED ALAM
53	TCA2409084	JAY RAM KUMAR MANDAL
54	TCA2409086	KAMAL
55	TCA2409087	KARTIK KUMAR SINGH
56	TCA2409089	KRATI JAIN
57	TCA2409091	KRISH PAL
58	TCA2409092	LAKSHYA GAHLOUT
59	TCA2409095	MAHAK JAIN
60	TCA2409096	MANAS MADHAV

Student List B.Tech. (CSE) Sec - B

S.No.	Enrollment No.	Student Name
1	TCA2409097	MANISEN GUPTA
2	TCA2409099	MANYA JAIN
3	TCA2409100	MANYUPMA KUMARI
4	TCA2409105	MISHIKA JAIN
5	TCA2409106	MOHAMMAD AMAAN
6	TCA2409107	MOHAMMAD FAIZ
7	TCA2409109	MOHAMMAD HANZALA GAZI
8	TCA2409111	MOHD AYAN
9	TCA2409112	MUSKAN
10	TCA2409113	NAMAN JAIN
11	TCA2409114	NAVED ALAM
12	TCA2409115	NIKET JAIN
13	TCA2409116	NIKSHAY JAIN
14	TCA2409119	OMPRAKASH
15	TCA2409120	PALAK JAIN
16	TCA2409121	PALAK SHARMA
17	TCA2409122	PANKAJ KUMAR
18	TCA2409124	PARTH JAIN
19	TCA2409125	PARTH SHARMA
20	TCA2409127	PRAJJAWAL SINGH
21	TCA2409128	PRAPHOOL KUMAR
22	TCA2409129	PRATEEK JAIN
23	TCA2409130	PRINCE JAIN
24	TCA2409131	PRINCE KUMAR PATEL
25	TCA2409132	PRITAN KUMAR

26	TCA2409135	PUNEET CHAUHAN
27	TCA2409137	RADHIKA
28	TCA2409138	RADHIKA VERMA
29	TCA2409139	RANJEET KUMAR
30	TCA2409143	RIDDHI JAIN
31	TCA2409146	ROCKEY RAJ
32	TCA2409148	SAMEER
33	TCA2409149	SAMYAK JAIN
34	TCA2409150	SANSKAR PATIL
35	TCA2409152	SATYAM JAIN
36	TCA2409155	SEHWAG GOUR
37	TCA2409156	SHAFIA KHATOON
38	TCA2409158	SHALABH CHAUDHARY
39	TCA2409159	SHASHANK KUMAR MISHRA
40	TCA2409160	SHEETAL
41	TCA2409161	SHIMPU
42	TCA2409162	SHIVANG YADAV
43	TCA2409164	SHREYA PANDEY
44	TCA2409166	SNEHA JAIN
45	TCA2409167	SONU KUMAR
46	TCA2409169	SRISTI RANI
47	TCA2409171	TANISH CHAUHAN
48	TCA2409172	TANZILA BASIR
49	TCA2409175	URJA JAIN
50	TCA2409176	UTKARSH CHAUHAN
51	TCA2409177	UTKARSH GUPTA
52	TCA2409179	VANDANA KUMARI

53	TCA2409181	VANSH JAIN
54	TCA2409182	VANSH KUMAR
55	TCA2409183	VARSHA
56	TCA2409185	VINAYAK AGRAHARI
57	TCA2409187	VISHVAMOHAN SHARMA
58	TCA2409189	VISHWAS RASTOGI
59	TCA2409190	VIVEK YADAV
60	TCA2409193	ZAINAB AYYOOB

Faculty of Engineering

Assignment -1

Program Name: B. Tech. (CSE)

Year:I	Semester: I	Academic Session: 2024-25
Course Code: EAS 112	Course Name: Engineering Physics	
		Max. Marks: 20

*Bloom Level {1-Remembering, 2-Understanding, 3-Applying, 4-Analyzing, 5-Evaluating, 6-Creating}

Attempt all questions.

		MM	Unit	BTL	CO
1	Define coherent sources. Why sustained interference is not possible without coherent sources?	2	1	2	CO1
2	What is the shape of interference fringes in Young's double slit experiment, Newton's ring experiment and Michelson interferometer?	2	1	2	CO1
3	Why two independent sources can not be coherent.	2	1	2	CO1
4	Why the Newton's rings are circular?	2	1	2	CO1
5	Why the centre is dark in Newton's ring experiment.	2	1	2	CO1
6	Write the conditions of sustained interference.	2	1	2	CO1
7	Interference fringes are obtained using a glass biprism of base angle 2° each and refractive index 1.50. If the distance between the slit and the biprism is 10 cm, calculate fringe width in the interference pattern obtained at distance of 90 cm away from the biprism, when the slit is illuminated by light of wavelength $5890 \text{ \AA}$.	2	1	3	CO4
8	What is Stoke's law for the phase change of reflection?	2	1	2	CO1
9	Monochromatic light from a narrow slit illuminates two narrow slits 0.5 mm apart, producing an interference pattern with bright fringes 2.0 mm apart on a screen 80 cm away. Find the wavelength of light.	2	1	3	CO4
10	What do you mean by wavefront? What is the shape of wavefront for a point source?	2	1	2	CO1

Faculty of Engineering

Assignment -2

Program Name: B. Tech. (CSE)

Year: I	Semester: I	Academic Session: 2024-25
Course Code: EAS 112	Course Name: Engineering Physics	
		Max. Marks: 20

*Bloom Level {1-Remembering, 2-Understanding, 3-Appling, 4-Analyzing, 5-Evaluating, 6-Creating}

Attempt all questions.

		MM	Unit	BTL	CO
1	Define resolving power and limit of resolution of an optical instrument	2	2	2	CO1
2	Discuss the difference between interference and diffraction fringe pattern.	2	2	2	CO1
3	What is Rayleigh criterion of resolution?	2	2	2	CO1
4	State the essential condition for diffraction of light to occur.	2	2	2	CO1
5	Distinguish between Fresnel and Fraunhofer diffractions.	2	2	2	CO1
6	Write expression for resolving power of plane diffraction grating and telescope.	2	2	2	CO1
7	In a plane transmission grating, the angle of diffraction for second order maxima for wavelength 5×10^{-5} cm is 30° . Calculate the number of lines in one centimetre of the grating surface.	2	2	3	CO4
8	A parallel beam of light of wavelength 5890 Å, is incident perpendicularly on a slit of width 0.1 mm. Calculate angular width and linear width of central maximum formed on the screen 100 cm away.	2	2	3	CO4
9	A light of wavelength 600 nm falls normally on a slit of width 20 μm. Determine the angular position of first and second minima.	2	2	3	CO4
10	Explain diffraction on the basis of wave theory.	2	2	2	CO1



Faculty of Engineering

Assignment -3

Program Name: B. Tech. (CSE)

Year: I	Semester: I	Academic Session: 2024-25
Course Code: EAS 112	Course Name: Engineering Physics	
		Max. Marks: 20

*Bloom Level {1-Remembering, 2-Understanding, 3-Applying, 4-Analyzing, 5-Evaluating, 6-Creating}

Attempt all questions.

		MM	Unit	BTL	CO
1	What are the differences between ordinary and extraordinary rays?	2	3	2	CO3
2	Calculate the thickness of a half wave plate of quartz for sodium light of wavelength 5000 Å. The ordinary and extra-ordinary refractive indices for sodium are 1.544 and 1.553, respectively.	2	3	3	
3	Determine the Brewster's angle for a glass of refractive index 1.5 when it is immersed in water of refractive index 1.33	2	3	3	
4	How will you detect a plane polarized light?	2	3	2	
5	Discuss the phenomenon of double refraction.	2	3	2	
6	Define optical activity and specific rotation.	2	3	3	
7	Two polaroids are adjusted so as to obtain maximum intensity. Through what angle should one Polaroid be rotated to reduce the intensity to (i) half (ii) one forth.	2	3	2	
8	Distinguish between positive and negative crystals in which double refraction occur.	2	3	2	
9	Define Biot's law of optical activity.	2	3	2	
10	Define optic axis and principal section of a double refracting crystal.	2	3	2	

Faculty of Engineering

Assignment -4

Program Name: B. Tech. (CSE)

Year:I	Semester: I	Academic Session: 2024-25
Course Code: EAS 112	Course Name: Engineering Physics	
		Max. Marks: 20

*Bloom Level {1-Remembering, 2-Understanding, 3-Applying, 4-Analyzing, 5-Evaluating, 6-Creating}

Attempt all questions.

		MM	Unit	BTL	CO
1	What is a 'LASER'. Write its full form.	2	4	2	CO3
2	Define spatial and temporal coherence.	2	4	2	
3	Discuss spontaneous and stimulated emission of radiation.	2	4	2	
4	What is 'optical pumping' in laser?	2	4	2	
5	Define a resonance cavity in laser.	2	4	2	
6	What is the use of meta stable states in laser?	2	4	2	
7	Define the term 'Population inversion' in laser.	2	4	2	
8	Draw energy level diagram of Ruby laser.	2	4	2	
9	Draw energy level diagram of He-Ne laser.	2	4	2	
10	Write five applications of lasers	2	4	2	



Faculty of Engineering

Assignment -5

Program Name: B. Tech. (CSE)

Year: I	Semester: I	Academic Session: 2024-25
Course Code: EAS 112	Course Name: Engineering Physics	
		Max. Marks: 20

*Bloom Level {1-Remembering, 2-Understanding, 3-Applying, 4-Analyzing, 5-Evaluating, 6-Creating}

Attempt all questions.

		MM	Unit	BTL	CO
1	Derive Lorentz transformation	5	5	2	CO3
2	Show that even particle do not have rest mass have energy and momentum and thus derive $E^2 = P^2c^2 + m_0c^2$.	2	5	3	CO5
3	Show that $x'^2 + y'^2 + z'^2 - c^2t'^2 = x^2 + y^2 + z^2 - c^2t^2$ is invariant under Lorentz transformation.	5	5	3	CO5
4	Explain the difference between invariant and conserve quantity.	2	5	2	CO3
5	Define proper time and proper length.	2	5	2	CO3
6	Show that the circle $x^2 + y^2 + a^2$ in a frame F appears to be an ellipse in frame F' moving with velocity v relative to F.	2	5	3	CO5
7	At What speed should a clock be moved so that it may appear to lose 1 minute in each hour.	2	5	3	CO5

Class Test Paper (CT1, CT2, and CT3)



तीर्थकर महावीर विश्वविद्यालय
Teerthanker Mahaveer University
 An Ultimate Destination for World Class Education

Faculty of Engineering

FIRST INTERNAL EXAMINATION (CT-1)

Program Name: B. Tech. (CSE)

Year: I	Semester: I	Academic Session: 2024-25
Course Code: EAS112	Course Name: Engineering Physics	
Duration: 90 minutes	Max. Marks: 30	

*Bloom Level {1-Remembering, 2-Understanding, 3-Appling, 4-Analyzing, 5-Evaluating, 6-Creating}

Attempt all questions.

1.	SHORT QUESTION	MM	Unit	BTL	CO
	<u>Answer any five questions</u>				
	A. Define coherent sources. Why sustained interference is not possible without coherent sources?	2	1	2	1
	B. What is Stoke's law for the phase change of reflection?	2	1	2	1
	C. Monochromatic light from a narrow slit illuminates two narrow slits 0.5 mm apart, producing an interference pattern with bright fringes 2.0 mm apart on a screen 80 cm away. Find the wavelength of light.	2	1	2	1
	D. What is the shape of interference fringes in Michelson interferometer?	2	1	2	1
	E. Distinguish between interference & diffraction fringe pattern.	2	2	2	1
	F. Define resolving power and limit of resolution of an optical instrument.	2	2	2	1
	G. Write the formula for resolving power of a plane diffraction grating and explain all terms used in that formula.	2	2	2	1
	H. A light of wavelength 550 nm falls normally on a slit of width 2.2 μm . Determine the angular position of second and third minima	2	2	2	1
	LONG QUESTIONS				
2.	A Derive expression for fringe width in young's double slit experiment. Show that the dark and bright fringes have same width.	10	1	3	4
	OR				
	B Discuss the interference due to reflected light in a wedge shaped thin film. Find the condition of maxima and minima.	10	1	3	4
3.	A Discuss the Fraunhofer diffraction due to single slit. Show that the relative intensities of successive maxima are nearly 1: $4/9\pi^2$: $4/25\pi^2$: $4/49\pi^2$	10	2	3	4
	OR				
	B Discuss Rayleigh criteria of resolution with suitable diagram. Find the expression for resolving power of telescope.	10	2	3	4

Course Outcome Wise Marks Distribution	CO1	CO2	CO3	CO4	CO5
	16			40	
Bloom's Taxonomy Wise Marks Distribution	L1	L2	L3	L4	L5
		16	40		



Faculty of Engineering

FIRST INTERNAL EXAMINATION (CT-2)

Program Name: B. Tech. (CSE)

Year: I	Semester: I	Academic Session: 2024-25
Course Code: EAS112	Course Name: Engineering Physics	
Duration: 90 minutes	Max. Marks: 30	

*Bloom Level {1-Remembering, 2-Understanding, 3-Applying, 4-Analyzing, 5-Evaluating, 6-Creating}

Attempt all questions.

1.	SHORT QUESTION	Max Marks	Unit	Bloom Level*	CO
	<u>Answer any five questions</u>				
	A Define Positive and Negative Crystals based on double refraction.	(2)	3	2	1
	B State Brewster's law.	(2)	3	2	1
	C State Biot's law of optical activity.	(2)	3	2	1
	D Define optic axis and principal section.	(2)	3	2	1
	E Explain spontaneous emission of radiation with proper diagram.	(2)	4	2	2
	F What are meta stable states?	(2)	4	2	2
	G Explain the term 'LASER'.	(2)	4	2	2
	H What is optical resonator in Laser.	(2)	4	2	2
	LONG QUESTIONS				
2.	A Why do the phase retardation plates do used? Explain half and quarter wave plate. Which retardation plates are used to generate circular and elliptical polarized lights.	(10)	3	3	4
	OR				
	B Explain the construction and working of Laurent half shade polarimeter with suitable diagram and explain working of half shade device.	(10)	3	3	4
3.	A Explain the principle of principal of optical pumping and population inversion in LASER. Write the characteristics of LASER beam and also mention its few applications.	(10)	4	3	2
	OR				
	B Explain the construction and working of Ruby Laser.	(10)	4	3	2

Course Outcome Wise Marks Distribution	CO1	CO2	CO3	CO4	CO5
	8	28		20	

Bloom's Taxonomy Wise Marks Distribution	L1	L2	L3	L4	L5
		16	40		



Faculty of Engineering

THIRD INTERNAL EXAMINATION (CT-3)

Program Name: B. Tech. (CSE)

Year: I	Semester: I	Academic Session: 2024-25
Course Code: EAS112	Course Name: Engineering Physics	
Duration: 90 minutes	Max. Marks: 30	

*Bloom Level {1-Remembering, 2-Understanding, 3-Applying, 4-Analyzing, 5-Evaluating, 6-Creating}

Attempt all questions.

1.	SHORT QUESTION	MM	Unit	BTL	CO
	<u>Answer any five questions</u>				
	A. Why two independent light sources are not coherent?	(2)	1	2	1
	B. Write conditions for sustained interference.	(2)	1	2	1
	C. What is the necessary condition for diffraction to occur?	(2)	2	2	1
	D. What is mean by resolving power of an optical instrument?	(2)	2	2	1
	E. Define optical activity and specific rotation.	(2)	3	2	1
	F. Why the population inversion is essential criteria for Lasing?	(2)	4	2	2
	G. Deduce the velocity at which the mass of particle becomes 1.5 times its rest mass ($c=3 \times 10^8$ m/s)	(2)	5	2	3
	H. Write the postulates of special theory of relativity.	(2)	5	2	3
	LONG QUESTIONS				
2.	A Derive the expression for the length contraction. The length of a rod is found to be one-fourth of its length, when at rest. What is the speed of rod relative to the observer?	(10)	5	2	3
	OR				
	B Define the term 'Frame of Reference'. Write Galilean transformation equations. Show that length of a rod is invariant under Galilean transformation.	(10)	5	2	3
3.	A Derive expression for variation of mass with velocity.	(10)	5	3	5
	OR				
	B Show that $x^2 + y^2 + z^2 - c^2 t^2 = x'^2 + y'^2 + z'^2 - c^2 t'^2$ remains invariant under Lorentz transformation.	(10)	5	3	5

Course Outcome Wise Marks Distribution	CO1	CO2	CO3	CO4	CO5
	10	2	24		20
Bloom's Taxonomy Wise Marks Distribution	L1	L2	L3	L4	L5
		36	20		

Class Test Marks (CT1, CT2, and CT3)



TEERTHANKER MAHAVEER UNIVERSITY

DELHI ROAD, MORADABAD U.P-244001

AWARD LIST

(INTERNAL ASSESSMENT THEORY)

ROGRAM: BACHELOR OF TECHNOLOGY **MAX. MARKS** : 40

(COMPUTER SCIENCE & ENGINEERING) **SESSION** : 2024-25

SEMESTER: FIRST SEMESTER **COURSE CODE:** EAS112

COURSE: ENGINEERING PHYSICS **DATE :** 27-12-2024

COLLEGE: COLLEGE OF COMPUTING **Section:** A

SCIENCES & INFORMATION TECHNO

SL. NO.	ENROLLMENT NO.	STUDENT'S NAME	CT1	CT2	CT3
MARKS			10	10	10
1	TCA2409001	ABDUL MUNEEB KHAN	4.67	6.67	7.67
2	TCA2409002	ABDUS SUBOOR KHAN	1	7.67	7
3	TCA2409004	ABHAY RAJ SINGH	3.33	4.67	1
4	TCA2409005	ABHIMANYU RAI	3.33	3.67	5.67
5	TCA2409006	ABHINAV SUNIL PATIL	3.67	4	AB
6	TCA2409007	ABHISHEK JAIN	7	10	9
7	TCA2409008	ABHISHEK KUMAR	1	6.67	1.33
8	TCA2409010	ABHISHEK SHUKLA	4	5.67	2.67
9	TCA2409013	ADI JAIN	0.67	1.33	3.67
10	TCA2409016	AJAY KUMAR	0.67	1	AB

11	TCA2409020	AKSHITA JAIN	2.33	4	3.33
12	TCA2409021	AMAAN SHAHID	7.33	8	5
13	TCA2409022	AMAN THAPAN	2.33	8	3.33
14	TCA2409025	AMRUTA VILAS HUDDAR	3.33	6.33	2
15	TCA2409026	ANAMTA NAQVI	3	3.67	0.33
16	TCA2409027	ANAND MISHRA	1.67	2.67	2.67
17	TCA2409028	ANAND RAJ	2	1	2.67
18	TCA2409029	ANIMESH JAIN	4.67	7.33	6.67
19	TCA2409030	ANIMESH JAIN	3.33	7	1
20	TCA2409032	ANKIT KUMAR	4	8.67	4
21	TCA2409033	ANKIT KUMAR	4	6	4.67
22	TCA2409034	ANKIT KUMAR	2.67	3.33	0.33
23	TCA2409037	ANSH CHAUDHARY	4	0.33	AB
24	TCA2409038	ANSH JAIN	8.33	9.33	AB
25	TCA2409039	ANSHIK KUMAR GUPTA	9.33	8.67	AB
26	TCA2409041	ANUJ PAL	5	4.33	AB
27	TCA2409042	ANURAG YADAV	3.67	1.33	1.67
28	TCA2409044	ANVI JAIN	5.67	6	4.33
29	TCA2409045	ARCHANA KUMARI	6.67	8.67	AB
30	TCA2409047	ARPAN KUMAR	7.33	8	4.33
31	TCA2409048	ARPIT JAIN	8.33	4.33	6.67
32	TCA2409049	ARUN	2.33	AB	0.33
33	TCA2409050	ARUN KUMAR	2	5	1.33
34	TCA2409052	ASHUTOSH KUMAR	2.67	8.67	4.67
35	TCA2409053	ASHUTOSH KUMAR RAI	2.33	5.33	5
36	TCA2409055	ATUL KUMAR GUPTA	2.67	6.67	AB

37	TCA2409056	AVADHESH KUMAR SHARMA	7	1	AB
38	TCA2409058	AYUSH SINGH	6	7.67	AB
39	TCA2409059	AZHAAN MOHAMMAD KHAN	2.67	3.33	0.67
40	TCA2409060	DAKSH JAIN	6.67	6.67	7
41	TCA2409061	DAKSH RUHELA	5.67	9	7.67
42	TCA2409064	DIVYANSH BHARDWAJ	4.33	3.33	4
43	TCA2409066	DIVYANSHU KUMAR	2.33	3.33	1.67
44	TCA2409067	GAGANDEEP SHARMA	2.67	4	0.67
45	TCA2409072	GYAYAK PATODI	2.67	6.67	8
46	TCA2409073	HARSH JAIN	8.33	6.67	2
47	TCA2409075	HARSHIT JAIN	1	2	2
48	TCA2409076	HARSHIT JAIN	4.67	4.67	0.33
49	TCA2409077	HEMANT CHAHAL	9.67	8.67	AB
50	TCA2409078	HIMANSHU JAIN	6	5.67	AB
51	TCA2409081	HRITHIK PAWAR	3	8	6.33
52	TCA2409083	JAMSHED ALAM	2	3.33	3
53	TCA2409084	JAY RAM KUMAR MANDAL	2.33	6	AB
54	TCA2409086	KAMAL	1	2.33	3.33
55	TCA2409087	KARTIK KUMAR SINGH	7	8	AB
56	TCA2409089	KRATI JAIN	6.33	7	4.67
57	TCA2409091	KRISH PAL	3	3	AB
58	TCA2409092	LAKSHYA GAHLOUT	3.33	3.33	4.67
59	TCA2409095	MAHAK JAIN	7.33	8.33	3.33
60	TCA2409096	MANAS MADHAV	1.33	6	2.67



Class Test Marks (CT1, CT2, and CT3)

TEERTHANKER MAHAVEER UNIVERSITY

DELHI ROAD, MORADABAD U.P-244001

AWARD LIST

(INTERNAL ASSESSMENT THEORY)

ROGRAM: BACHELOR OF TECHNOLOGY **MAX. MARKS** : 40

(COMPUTER SCIENCE & ENGINEERING) **SESSION** : 2024-25

SEMESTER: FIRST SEMESTER **COURSE CODE:** EAS112

COURSE: ENGINEERING PHYSICS **DATE :** 27-12-2024

COLLEGE: COLLEGE OF COMPUTING **Section:** B

SCIENCES & INFORMATION TECHNO

SL. NO.	ENROLLMENT NO.	STUDENT'S NAME	CT1	CT2	CT3
MARKS			10	10	10
1	TCA2409097	MANISEN GUPTA	3.67	6.33	2.67
2	TCA2409099	MANYA JAIN	4.33	7.67	10
3	TCA2409100	MANYUPMA KUMARI	3	6.67	4.67
4	TCA2409105	MISHIKA JAIN	AB	7.67	AB
5	TCA2409106	MOHAMMAD AMAAN	7.67	7.67	6
6	TCA2409107	MOHAMMAD FAIZ	7.67	9.33	AB
7	TCA2409109	MOHAMMAD HANZALA GAZI	7	4	AB
8	TCA2409111	MOHD AYAN	7.33	7.33	AB

9	TCA2409112	MUSKAN	4.67	7	4.33
10	TCA2409113	NAMAN JAIN	9	9.33	AB
11	TCA2409114	NAVED ALAM	2.33	3	AB
12	TCA2409115	NIKET JAIN	8	9	AB
13	TCA2409116	NIKSHAY JAIN	3.33	7	3.33
14	TCA2409119	OMPRAKASH	1.33	3.33	5.33
15	TCA2409120	PALAK JAIN	1	3	0.33
16	TCA2409121	PALAK SHARMA	4.33	AB	3.33
17	TCA2409122	PANKAJ KUMAR	2	3	3.33
18	TCA2409124	PARTH JAIN	3.33	3	AB
19	TCA2409125	PARTH SHARMA	1	1.33	0.67
20	TCA2409127	PRAJJAWAL SINGH	2.33	6.67	1.67
21	TCA2409128	PRAPHOOL KUMAR	7	1.33	3
22	TCA2409129	PRATEEK JAIN	5.67	6.33	AB
23	TCA2409130	PRINCE JAIN	4.67	4	AB
24	TCA2409131	PRINCE KUMAR PATEL	5.67	5.33	3.33
25	TCA2409132	PRITAN KUMAR	1.67	0	1.33
26	TCA2409135	PUNEET CHAUHAN	3	3	0.33
27	TCA2409137	RADHIKA	8	10	AB
28	TCA2409138	RADHIKA VERMA	4	4.67	3
29	TCA2409139	RANJEET KUMAR	2	5	3.33
30	TCA2409143	RIDDHI JAIN	3	4.67	1.67
31	TCA2409146	ROCKEY RAJ	9	8.33	AB
32	TCA2409148	SAMEER	5.67	5.67	1.33
33	TCA2409149	SAMYAK JAIN	8	8	5.33
34	TCA2409150	SANSKAR PATIL	6	0.67	AB

35	TCA2409152	SATYAM JAIN	7.67	9.33	8.33
36	TCA2409155	SEHWAG GOUR	1.33	2.33	1.67
37	TCA2409156	SHAFIA KHATOON	6.33	9	9.67
38	TCA2409158	SHALABH CHAUDHARY	6	8.67	3
39	TCA2409159	SHASHANK KUMAR MISHRA	5	8.67	4.67
40	TCA2409160	SHEETAL	2	4.67	3.67
41	TCA2409161	SHIMPU	3	5.33	3.67
42	TCA2409162	SHIVANG YADAV	9	9.67	AB
43	TCA2409164	SHREYA PANDEY	3	4.33	4.33
44	TCA2409166	SNEHA JAIN	2	3.33	AB
45	TCA2409167	SONU KUMAR	2.67	1.67	3.33
46	TCA2409169	SRISTI RANI	1.33	2.33	2.67
47	TCA2409171	TANISH CHAUHAN	1	3	1.33
48	TCA2409172	TANZILA BASIR	9	AB	8.67
49	TCA2409175	URJA JAIN	3.67	6.33	6.33
50	TCA2409176	UTKARSH CHAUHAN	3	5	5.67
51	TCA2409177	UTKARSH GUPTA	4.67	7	7.33
52	TCA2409179	VANDANA KUMARI	1	3.33	3.33
53	TCA2409181	VANSH JAIN	9.33	8.33	AB
54	TCA2409182	VANSH KUMAR	5	7	7.33
55	TCA2409183	VARSHA	4.33	9	9.67
56	TCA2409185	VINAYAK AGRAHARI	1.33	3.33	3.67
57	TCA2409187	VISHVAMOHAN SHARMA	4.33	0.67	3.33
58	TCA2409189	VISHWAS RASTOGI	6.67	6.67	AB
59	TCA2409190	VIVEK YADAV	AB	4.33	4.67
60	TCA2409193	ZAINAB AYYOOB	3	5.67	2

Class Test Solution CT-1

Question 1a: Define coherent sources. Why sustained interference is not possible without coherent sources?

Answer:

Coherent sources are two or more light (or wave) sources that emit waves having:

1. Constant phase difference, and
2. Same frequency (or wavelength).

In simpler terms, the waves from coherent sources are synchronized in such a way that their relative positions (crests and troughs) remain fixed over time.

Interference is the phenomenon where two or more waves superimpose to form a resultant wave of greater, lower, or the same amplitude. For sustained (or stable) interference patterns (like bright and dark fringes), the superposing waves must:

- Stay in phase (or have a constant phase difference),
- Have the same frequency.

If the sources are not coherent, their phase difference keeps changing randomly over time. This leads to:

- Fluctuating interference patterns, which shift and blur rapidly,
- No stable constructive or destructive interference over time.

As a result, the interference effects cancel out or average out, and no observable or sustained interference pattern is formed.

Coherent sources are essential for producing a stable and observable interference pattern because they ensure a constant phase relationship, which is necessary for constructive and destructive interference to occur consistently at fixed positions in space.

Question 1b: What is Stoke's law for the phase change of reflection?

When light reflects off a surface, there can be a phase change, depending on the relative refractive indices:

- Reflection from a medium of higher refractive index: Phase shift of π radians (180°)
- Reflection from a medium of lower refractive index: No phase shift

This is critical in thin-film interference, antireflection coatings, and related phenomena.

Question 1c: Monochromatic light from a narrow slit illuminates two narrow slits 0.5 mm apart, producing an interference pattern with bright fringes 2.0 mm apart on a screen 80 cm away. Find the wavelength of light.

To find the **wavelength of light** in a double-slit interference experiment, we use the formula for fringe spacing:

$$\Delta y = \frac{\lambda L}{d}$$

Where:

- $\Delta y = 2.0 \text{ mm} = 2.0 \times 10^{-3} \text{ m}$ (fringe spacing),
- $L = 80 \text{ cm} = 0.80 \text{ m}$ (distance to the screen),
- $d = 0.5 \text{ mm} = 0.5 \times 10^{-3} \text{ m}$ (slit separation),
- λ is the wavelength of the light (what we are solving for).

Rearranging the formula:

$$\lambda = \frac{\Delta y \cdot d}{L}$$

Plug in the values:

$$\begin{aligned}\lambda &= \frac{(2.0 \times 10^{-3}) \cdot (0.5 \times 10^{-3})}{0.80} \\ \lambda &= \frac{1.0 \times 10^{-6}}{0.80} = 1.25 \times 10^{-6} \text{ m} \\ \lambda &= 1250 \text{ nm}\end{aligned}$$

Question 1d: What is the shape of interference fringes in Michelson interferometer?

In a **Michelson interferometer**, the **shape of the interference fringes** depends on the alignment and geometry of the setup. The most common shapes are:

Circular Fringes (Concentric Rings)

- These are also called **Haidinger fringes** or **fringes of equal inclination**.
- Formed when the mirrors are nearly **perfectly perpendicular** to each other and the light is **collimated**.
- The fringes represent regions where light from the two paths interferes constructively or destructively at the **same angle of inclination**.

- Typically observed when viewing the fringes at a distance (e.g., with a telescope or screen placed far away).

Straight or Parallel Fringes

- These occur when one mirror is **slightly tilted** with respect to the other.
- The tilt introduces a linear phase difference across the beam, resulting in straight, equally spaced fringes.
- These are called **fringes of equal thickness** and are often used to measure small displacements or refractive index changes.

Question 1f : Distinguish between interference & diffraction fringe pattern.

Difference Between Interference and Diffraction Fringe Patterns

Aspect	Interference	Diffraction
Cause	Superposition of light from two or more coherent sources (e.g., Young's double-slit).	Bending and spreading of light around an obstacle or slit (usually a single slit).
Number of Sources	Requires two or more coherent sources.	Involves one source and one aperture or obstacle.
Fringe Spacing	Equally spaced fringes.	Unequally spaced fringes (central fringe is widest).
Fringe Intensity	All bright fringes can have similar intensity.	Brightness gradually decreases away from the central maximum.
Fringe Width	Fringe width is constant.	Fringe width varies (central fringe is much broader).
Central Fringe	May be bright or dark, depending on phase difference.	Always bright and central maximum is the brightest.
Typical Setup	Young's double-slit, Michelson interferometer, etc. Interference is due to the interaction of waves from separate sources.	Single-slit diffraction, diffraction grating, etc. Diffraction is due to the bending of waves around edges or through openings.

Question 1g: Define resolving power and limit of resolution of an optical instrument.

Resolving Power

Resolving power of an optical instrument is its ability to distinguish between two closely spaced objects.

Mathematically, for a telescope or microscope, resolving power is given by:

Resolving Power = $1/\text{Limit of Resolution}$

- A higher resolving power means the instrument can distinguish between objects that are closer together.
- It's a measure of the instrument's detail-separating ability.

Limit of Resolution

The limit of resolution is the minimum distance between two points or objects at which they can be distinguished as separate. It is the smallest separation that can be resolved by the instrument.

Question 1g: Write the formula for resolving power of a plane diffraction grating and explain all terms used in that formula.

The resolving power of a plane diffraction grating is given by the formula:

$$R = \lambda / \Delta\lambda = nN$$

Explanation of Terms:

- **R:** Resolving power of the grating. It measures the ability of the grating to distinguish between two closely spaced wavelengths.
- **λ :** The average or central wavelength of the two spectral lines being resolved.
- **$\Delta\lambda$:** The minimum difference in wavelength between two spectral lines that the grating can just resolve.
- **n :** The order of the diffraction (an integer: 1, 2, 3, ...). Higher orders generally give better resolution.
- **N :** The total number of slits (or lines) illuminated on the grating. It depends on the width of the grating and the slit density (number of lines per unit length).

Question 1h; A light of wavelength 550 nm falls normally on a slit of width 2.2 μm . Determine the angular position of second and third minima

To find the **angular positions of the minima** in a **single-slit diffraction pattern**, we use the formula:

$$a \sin \theta = m\lambda$$

Where:

- a = slit width = $2.2 \mu\text{m} = 2.2 \times 10^{-6} \text{ m}$
- λ = wavelength of light = $550 \text{ nm} = 550 \times 10^{-9} \text{ m}$
- m = order of minimum (for second and third minima, $m = 2$ and 3)
- θ = angular position of the minima

$$\sin \theta_2 = \frac{m\lambda}{a} = \frac{2 \times 550 \times 10^{-9}}{2.2 \times 10^{-6}} = \frac{1100 \times 10^{-9}}{2.2 \times 10^{-6}} = 0.5$$

$$\theta_2 = \sin^{-1}(0.5) = 30^\circ$$

◆ **For the third minimum ($m = 3$):**

$$\sin \theta_3 = \frac{3 \times 550 \times 10^{-9}}{2.2 \times 10^{-6}} = \frac{1650 \times 10^{-9}}{2.2 \times 10^{-6}} = 0.75$$

$$\theta_3 = \sin^{-1}(0.75) \approx 48.59^\circ$$

Derivation of Fringe Width in Young's Double Slit Experiment

In Young's double-slit experiment, monochromatic light of wavelength λ is incident on two narrow slits separated by a distance d . The light passing through the slits produces an interference pattern on a screen placed at a distance L from the slits. The pattern consists of bright and dark fringes.

1. Interference Condition:

For constructive interference (bright fringes), the path difference between the light from the two slits must be an integer multiple of the wavelength:

$$\text{Path difference} = n\lambda \quad \text{where } n = 0, 1, 2, 3, \dots$$

For destructive interference (dark fringes), the path difference must be an odd multiple of half the

For destructive interference (dark fringes), the path difference must be an odd multiple of half the wavelength:

$$\text{Path difference} = \left(n + \frac{1}{2}\right)\lambda$$

2. Geometry of the Setup:

- Let y be the distance between the central maximum (zeroth order) and the m -th order fringe on the screen.
- d is the distance between the two slits.
- L is the distance between the slits and the screen.
- The angle θ_m is the angle of the m -th order maximum (bright fringe) from the central maximum.

3. Deriving the Fringe Width:

In the case of small angles, the angle θ is approximately equal to $\sin \theta$, so the path difference for the m -th

- L is the distance between the slits and the screen.
- The angle θ_m is the angle of the m -th order maximum (bright fringe) from the central maximum.

3. Deriving the Fringe Width:

In the case of small angles, the angle θ is approximately equal to $\sin \theta$, so the path difference for the m -th order maximum is:

$$d \sin \theta_m = m\lambda$$

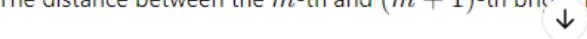
For small angles, the position of the m -th bright fringe on the screen is related to the angle by:

$$y_m = L \tan \theta_m \approx L \sin \theta_m$$

Therefore, the position of the m -th bright fringe becomes:

$$y_m = L \cdot \frac{m\lambda}{d}$$

The distance between the m -th and $(m+1)$ -th bright fringe (the **fringe width**, denoted by β) is:



The distance between the m -th and $(m+1)$ -th bright fringe (the **fringe width**, denoted by β) is:

$$\beta = y_{m+1} - y_m = \frac{L(m+1)\lambda}{d} - \frac{Lm\lambda}{d}$$

Simplifying:

$$\beta = \frac{L\lambda}{d}$$

Thus, the **fringe width** β is independent of the order of the fringe and is given by:

$$\boxed{\beta = \frac{L\lambda}{d}}$$

4. Dark Fringes:

For the dark fringes, the condition for destructive interference is:

$$d \sin \theta_m = \left(n + \frac{1}{2} \right) \lambda$$

4. Dark Fringes:

For the dark fringes, the condition for destructive interference is:

$$d \sin \theta_m = \left(m + \frac{1}{2}\right) \lambda$$

Following similar steps for the position of the dark fringes, we get the position for the m -th dark fringe as:

$$y_m^{\text{dark}} = L \cdot \frac{\left(m + \frac{1}{2}\right) \lambda}{d}$$

The distance between two successive dark fringes is:

$$\beta_{\text{dark}} = y_{m+1}^{\text{dark}} - y_m^{\text{dark}} = \frac{L\lambda}{d}$$

- **Fringe width** (distance between adjacent bright or dark fringes) is the same for both **bright** and **dark fringes** and is given by:

$$\boxed{\beta = \frac{L\lambda}{d}}$$

- The fringe width is **independent of the order of the fringe** and depends on the wavelength of the light λ , the distance between the slits d , and the distance from the slits to the screen L .

Thus, both **bright fringes** and **dark fringes** have the same width.

Question 2(b): Discuss the interference due to reflected light in a wedge shaped thin film. Find the condition of maxima and minima.

Answer 2(b):

Interference Due to Reflected Light in a Wedge-Shaped Thin Film

When light is incident on a wedge-shaped thin film formed by placing two glass plates at a small angle, a phenomenon of **interference** is observed due to multiple reflections. This setup produces an **interference pattern** of alternate bright and dark fringes, known as **fringes of equal thickness**. This occurs due to the **constructive and destructive interference** of the light waves reflected from the top and bottom surfaces of the air wedge.

Formation of Wedge-Shaped Film

Consider two optically flat glass plates placed together such that one edge is in contact and the other is separated by a small object like a thin wire or a paper strip. This arrangement creates an air film of **varying thickness** — zero at the contact edge and increasing linearly towards the other end. The film thus forms a wedge with a small wedge angle θ .

Mechanism of Interference

When monochromatic light is incident (typically near normal incidence) on the wedge:

- A portion of the light reflects from the **top surface** of the air wedge (glass-air interface).
- Another portion transmits through the air film and reflects from the **bottom surface** (air-glass interface) and travels back.

These two reflected rays, after traveling slightly different optical paths, interfere with each other. The interference depends on the **path difference** and any **phase changes** due to reflection.

Optical Path Difference

Let the thickness of the air film at a point be t . The ray reflecting from the bottom surface travels a distance $2t$ inside the air film (going down and then back up). The refractive index of air is approximately 1, so the **geometrical path difference** is $2t$.

However, we also need to consider **phase changes**:

- Reflection at a **denser medium** (air to glass) causes a π phase shift (equivalent to an extra path of $\lambda/2$).
- The top reflection (glass-air) has **no phase change**.
- The bottom reflection (air-glass) has a π phase change.

Thus, the **effective path difference** Δ becomes:

$$\Delta = 2t + \frac{\lambda}{2}$$

Conditions for Interference

- **Constructive Interference (Maxima / Bright Fringes):**

For constructive interference, the total path difference should be an **integral multiple** of the wavelength:

$$2t + \frac{\lambda}{2} = m\lambda \quad \text{where } m = 0, 1, 2, \dots$$
$$\Rightarrow 2t = (m - \frac{1}{2})\lambda$$

- **Destructive Interference (Minima / Dark Fringes):**

For destructive interference, the total path difference should be an **odd multiple of half wavelengths**:

$$2t + \frac{\lambda}{2} = (m + \frac{1}{2})\lambda$$
$$\Rightarrow 2t = m\lambda$$

Fringe Width and Fringe Pattern

Since the wedge has a **linearly increasing thickness**, the interference fringes are **straight, parallel, and equally spaced**. The distance between successive bright or dark fringes is called the **fringe width**.

Let the wedge angle be θ , and x be the distance from the point of contact. Then,

$$t = x \tan \theta \approx x\theta \quad (\text{for small } \theta)$$

Using the condition for destructive interference (dark fringes):

$$2x\theta = m\lambda \Rightarrow x = \frac{m\lambda}{2\theta}$$

Thus, the fringe width β is:

$$\beta = x_{m+1} - x_m = \frac{(m+1)\lambda}{2\theta} - \frac{m\lambda}{2\theta} = \frac{\lambda}{2\theta}$$

Conclusion

Interference in a wedge-shaped film occurs due to the superposition of light waves reflected from the top and bottom surfaces of a thin air film. The condition for constructive and destructive interference depends on the optical path difference and the phase change upon reflection. The resulting fringes are straight, equidistant, and parallel to the wedge edge, providing useful applications in measuring small thicknesses and testing the flatness of surfaces.

Question 3(a): Discuss the Fraunhofer diffraction due to single slit. Show that the relative intensities of successive maxima are nearly 1: $4/9\pi^2$: $4/25\pi^2$: $4/49\pi^2$

Answer 3(a):

Fraunhofer diffraction occurs when both the source of light and the screen (or observing plane) are at **infinite distances** (or effectively collimated using lenses), so that the incident wavefronts are planar and parallel. A common and important case of Fraunhofer diffraction is the diffraction pattern produced by a **single slit**.

1. Setup and Assumptions

Consider a single narrow slit of width a , illuminated by monochromatic light of wavelength λ . The light passes through the slit and then spreads out, forming a diffraction pattern on a distant screen (or in the focal plane of a lens placed after the slit).

Let:

- θ be the angle of diffraction, measured from the central axis (normal to the slit).
- The slit extends along the y-axis; diffraction is observed in the x-direction.

2. Principle of Superposition

According to **Huygens' Principle**, each point on the slit acts as a secondary source of wavelets. The resultant intensity at a point on the screen is due to the **superposition of these wavelets**, considering their relative phase differences.

3. Path Difference and Phase Difference

For two points on the slit separated by a distance y , the **path difference** between their secondary waves reaching an angle θ is:

$$\Delta = y \sin \theta$$

This corresponds to a **phase difference** ϕ of:

$$\phi = \frac{2\pi}{\lambda} y \sin \theta$$

4. Resultant Amplitude and Intensity

The total amplitude at an angle θ is obtained by integrating the contributions from all elements across the slit width. The resulting amplitude $A(\theta)$ is:

$$A(\theta) = A_0 \cdot \frac{\sin \beta}{\beta} \quad \text{where } \beta = \frac{\pi a \sin \theta}{\lambda}$$

The corresponding **intensity** $I(\theta)$ is proportional to the square of the amplitude:

$$I(\theta) = I_0 \left(\frac{\sin \beta}{\beta} \right)^2$$

Here:

- I_0 is the central (maximum) intensity.
 - β is a dimensionless variable dependent on the angle θ .
-

5. Positions of Minima and Maxima

- **Minima (dark fringes)** occur when:

$$\beta = n\pi \quad \text{for } n = \pm 1, \pm 2, \pm 3, \dots \Rightarrow a \sin \theta = n\lambda$$

These are **zeroes of intensity**.

- **Maxima (bright fringes)** occur between these minima. The central maximum (at $\theta = 0$) is the brightest and widest. The **secondary maxima** lie in between the minima but are **much weaker**.

6. Relative Intensities of Maxima

We now derive the **relative intensities** of the secondary maxima. The intensity is:

$$I(\theta) = I_0 \left(\frac{\sin \beta}{\beta} \right)^2$$

The secondary maxima occur approximately at positions where:

$$\beta = (2n + 1) \frac{\pi}{2} \quad (\text{approximately})$$

To find the intensity at these values, plug into the intensity formula:

$$\text{Let } \beta_n = \frac{(2n+1)\pi}{2} \text{ for } n = 1, 2, 3, \dots$$

Then:

$$I_n = I_0 \left(\frac{\sin \left(\frac{(2n+1)\pi}{2} \right)}{\frac{(2n+1)\pi}{2}} \right)^2$$

But $\sin \left(\frac{(2n+1)\pi}{2} \right) = \pm 1$, so:

$$I_n = I_0 \left(\frac{1}{\frac{(2n+1)\pi}{2}} \right)^2 = \frac{4I_0}{(2n+1)^2\pi^2}$$

Hence, the relative intensities of the maxima are:

$$\frac{I_1}{I_0} = \frac{4}{9\pi^2}, \quad \frac{I_2}{I_0} = \frac{4}{25\pi^2}, \quad \frac{I_3}{I_0} = \frac{4}{49\pi^2}, \dots$$

So, the **relative intensities** of the central and successive secondary maxima are approximately:

$$1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} : \dots$$

These values decrease rapidly, showing that secondary maxima are **much fainter** compared to the central maximum.

Question 3(b): Discuss Rayleigh criteria of resolution with suitable diagram. Find the expression for resolving power of telescope.

Answer 3(b):

1. Introduction to Resolution

In optics, **resolution** refers to the ability of an optical instrument (like a telescope, microscope, or camera) to distinguish between two closely spaced objects. When two point sources of light are very close to each other, their images may overlap due to **diffraction**, making them appear as one. The criterion used to determine the limit at which two sources are just resolved is known as the **Rayleigh Criterion**.

2. Rayleigh Criterion of Resolution

The **Rayleigh Criterion** was proposed by Lord Rayleigh and provides a quantitative measure of the minimum angular separation required to distinguish two point sources.

Statement:

Two point sources are said to be **just resolved** when the **central maximum** of the diffraction pattern of one source coincides with the **first minimum** of the diffraction pattern of the other.

3. Diffraction from Circular Aperture

Most optical instruments like telescopes have circular apertures (lenses or mirrors), and thus produce **diffraction patterns** known as **Airy discs**.

- The central bright region is called the **Airy disc**.
- Surrounding the central disc are alternating dark and bright rings due to diffraction.

The **angular radius** θ of the first dark ring (first minimum) in the Airy pattern is given by:

$$\theta = 1.22 \frac{\lambda}{D}$$

Where:

- λ = Wavelength of light
- D = Diameter of the circular aperture (objective lens or mirror)
- θ = Minimum angular separation for just resolution (in radians)

This angle θ is known as the **limit of resolution**.



4. Diagram for Rayleigh Criterion

Below is a qualitative description of the diagram you should draw:

- Draw two overlapping Airy disc intensity profiles.
- In the first case, both central maxima overlap completely (unresolved).
- In the second case, the maximum of one coincides with the minimum of the other (just resolved – Rayleigh Criterion).
- In the third case, the maxima are clearly separated (well resolved).

Label:

- Central maxima
- First minima
- Angular separation θ

5. Resolving Power of a Telescope

The resolving power of a telescope is defined as the reciprocal of the angular limit of resolution:

$$\text{Resolving Power} = \frac{1}{\theta}$$

Substituting Rayleigh's criterion:

$$\text{Resolving Power} = \frac{D}{1.22\lambda}$$

Where:

- D = Diameter of the objective lens or mirror
- λ = Wavelength of light

Thus, the **larger the aperture D** , the **greater** the resolving power.

6. Key Points

- Resolution is **limited by diffraction**, not by the quality of lenses alone.
 - The **Rayleigh criterion** provides a practical and widely accepted definition of just resolution.
 - The **resolving power increases** with aperture size and decreases with increasing wavelength.
-

7. Applications

- Astronomical telescopes use large mirrors to achieve high resolving power to observe distant stars and galaxies.
- In microscopy, resolution is crucial to distinguish between closely spaced biological structures.
- In camera lenses and binoculars, resolving power determines image clarity at high magnification.

Class Test Solution CT-2

Question 1A : Define Positive and Negative Crystals based on double refraction.

A crystal in which the **velocity of the extraordinary ray is less than** the velocity of the ordinary ray.

A crystal in which the **velocity of the extraordinary ray is greater than** the velocity of the ordinary ray.

Property	Positive Crystal	Negative Crystal
Velocity of E-ray	Less than O-ray	Greater than O-ray
Refractive Index	$\mu_e > \mu_o$	$\mu_e < \mu_o$
Examples	Quartz, Tourmaline	Calcite, Iceland Spar

Question 1B: State Brewster's law.

Brewster's Law

Statement:

Brewster's law states that **when unpolarized light is incident on a transparent surface at a specific angle**, known as the **Brewster angle**, the **reflected light is completely polarized** perpendicular to the plane of incidence.

$$\tan \theta_B = \mu_1 / \mu_2$$

Where:

- θ_B = Brewster angle (angle of incidence at which reflected light is fully polarized)
- μ_1 = refractive index of the first medium (usually air)
- μ_2 = refractive index of the second medium (like glass or water)

Question 1C: State Biot's law of optical activity.

Biot's law states that the **angle of rotation** of the plane of polarization of plane-polarized light passing through an optically active substance is **directly proportional** to the **length of the path** and the **concentration** of the substance.

$$\theta = [\alpha] \cdot l \cdot c$$

Where:

- θ = angle of rotation of the plane of polarization
- $[\alpha]$ = specific rotation (a constant for a given substance at a given wavelength and temperature)
- l = length of the path through the substance (in decimeters)
- c = concentration of the solution (in grams per cm^3 for liquids, or as appropriate)

Question 1D: Define optic axis and principal section.

Optic Axis

The optic axis of a uniaxial crystal is an imaginary line along which no double refraction occurs. Light traveling along this axis passes through the crystal without being split into ordinary and extraordinary rays.

- It is a unique direction in anisotropic (birefringent) crystals like calcite or quartz.
- Along the optic axis, the refractive indices of the ordinary and extraordinary rays are equal.
- There is only one optic axis in uniaxial crystals and two in biaxial crystals.

Principal Section

The principal section of a uniaxial crystal is the plane that contains both the optic axis and the direction of propagation of light.

- It is the plane of symmetry for analyzing birefringence and polarization behavior in crystals.
- Within the principal section, light can be resolved into an ordinary ray (perpendicular to the optic axis) and an extraordinary ray (parallel to the optic axis).

Question 1E: Explain spontaneous emission of radiation with proper diagram.

Spontaneous emission is the process by which an excited atom or molecule returns to a lower energy state by emitting a photon *without any external influence*.

- When an atom absorbs energy (from heat, light, or electricity), an electron moves to a higher energy level (excited state).
- This excited state is unstable, and the electron eventually returns to the ground state.
- During this transition, the atom spontaneously emits a photon of light with energy:

$$E = h\nu = E_2 - E_1$$

Question 1F: What are meta stable states?

A **metastable state** is an **excited energy state** of an atom or molecule in which it can remain for a **relatively long time** (much longer than typical excited states) **before returning to the ground state**.

- It is not the most stable state, but it's more stable than other excited states.
- The atom stays in the metastable state much longer than in a normal excited state (lifetime ranges from microseconds to seconds).
- Transition from a metastable state to a lower energy state is less probable or "forbidden" by
-

Metastable states are crucial in laser operation.

They allow population inversion—a condition where more atoms are in an excited state than in the ground state.

This enables stimulated emission to dominate over absorption.

quantum mechanical selection rules.

Question 1G: Explain the term 'LASER'.

The term **LASER** stands for **Light Amplification by Stimulated Emission of Radiation**.

Here's a breakdown of what it means:

- **Light:** Refers to electromagnetic radiation, often in the visible spectrum, but lasers can also produce infrared or ultraviolet light.
- **Amplification:** The process of increasing the intensity of light.
- **Stimulated Emission:** A physical process where an excited atom or molecule, when struck by a photon of a specific energy, emits a second photon of the same energy, direction, phase, and polarization.
- **Radiation:** Refers to the emitted energy in the form of electromagnetic waves or particles.

A **laser** is a device that emits a beam of light that is very **intense, coherent** (all waves are in phase), and usually **monochromatic** (single wavelength). Lasers are used in many fields such as medicine, communications, industry, and entertainment.

Question 1H: What is optical resonator in Laser.

An optical resonator (also known as an optical cavity) is a crucial component of a laser that helps to amplify light by providing feedback. An **optical resonator** is a set of **two or more mirrors** arranged to reflect light back and forth through the **gain medium** (the material that amplifies light) in a laser.

Main Components:

1. **Gain Medium:** The material that emits light through **stimulated emission** (e.g., a gas, crystal, or semiconductor).
2. **Mirrors:**
 - One **fully reflective mirror**.
 - One **partially reflective mirror** (also called the **output coupler**), which allows some light to escape as the laser beam.

Function:

- Light generated in the gain medium bounces between the mirrors.
- Each pass through the gain medium amplifies the light through stimulated emission.
- This buildup of coherent light eventually escapes through the output coupler as the **laser beam**.

Why It's Important:

- It ensures that only light of specific wavelengths (that meet resonance conditions) is amplified.
- It enhances the **coherence**, **directionality**, and **monochromaticity** of the laser light.

Simple Analogy:

Think of the optical resonator as an echo chamber for light. Just as sound can be amplified in a hall by bouncing off the walls, light is amplified in a laser by bouncing between mirrors.

The **optical resonator** is the part of the laser that traps light and makes it stronger and more organized, allowing the laser to produce its characteristic focused, powerful beam.

Question 2(A): Why do the phase retardation plates do used? Explain half and quarter wave plate. Which retardation plates are used to generate circular and elliptical polarized lights.

Ans: Phase retardation plates, also known as **wave plates**, are optical devices used to **alter the polarization state** of light by introducing a **phase shift** between the orthogonal components of the light wave. They are used to:

- Convert linearly polarized light to circular or elliptical polarization, and vice versa.
- Rotate the plane of polarization.
- Modify the polarization state for use in optical instruments, laser systems, and telecommunications.

Types of Retardation Plates:

1. Half-Wave Plate ($\lambda/2$ Plate):

- It introduces a phase shift of 180° (π radians) or half a wavelength between the fast and slow axes.
- It rotates the plane of polarization of linearly polarized light.
- The angle of rotation is twice the angle between the incident polarization direction and the wave plate's optical axis.

Use: Changes the orientation of linear polarization but doesn't change its type.

2. Quarter-Wave Plate ($\lambda/4$ Plate):

- It introduces a **phase shift of 90° ($\pi/2$ radians) or a quarter of a wavelength.**
- Converts **linearly polarized light into circular or elliptical** polarization (and vice versa), depending on the orientation.

Generation of Circular and Elliptical Polarized Light:

Polarization Type	Required Plate	Input Light	Orientation of Input
Circular Polarization	Quarter-Wave Plate ($\lambda/4$)	Linearly polarized light	At 45° to the fast/slow axis
Elliptical Polarization	Quarter-Wave Plate ($\lambda/4$)	Linearly polarized light	At any angle $\neq 0^\circ$ or 45° to optical axes

Wave Plate	Phase Shift	Effect on Light
Half-Wave Plate ($\lambda/2$)	180° (π rad)	Rotates linear polarization direction
Quarter-Wave Plate ($\lambda/4$)	90° ($\pi/2$ rad)	Converts linear to circular/elliptical polarization

So, to generate circular or elliptical polarized light, a quarter-wave plate is used with linearly polarized light, by adjusting the input polarization angle relative to the optical axes.

Question 2(B): Explain the construction and working of Laurent half shade polarimeter with suitable diagram and explain working of half shade device.

Ans: A **Laurent half-shade polarimeter** is an optical instrument used to **measure the optical rotation** caused by **optically active substances** (like sugar solutions). It works based on the principle of **polarization of light** and employs a **half-shade device** to increase sensitivity and accuracy.

Main Components:

1. **Light Source:**
 - Usually a **sodium lamp** (producing monochromatic light, typically 589 nm).
2. **Collimator:**
 - A lens system that converts the light from the source into a **parallel beam**.
3. **Polarizer:**
 - Usually a **Nicol prism**, used to produce **plane-polarized light**.
4. **Half-Shade Device:**
 - Placed just after the polarizer. It consists of **two semicircular halves**:
 - One is a **quartz half-wave plate**.
 - The other is a **plain glass plate** of the same thickness.
 - Both are cemented together along a diameter.
5. **Sample Tube:**
 - A glass tube that holds the optically active liquid (like sugar solution). The light passes through this sample.
6. **Analyzer:**
 - Another Nicol prism, used to analyze the light emerging from the sample.
7. **Telescope:**
 - Helps in observing the image clearly and comparing the two halves of the field of view.

Working Principle of Half-Shade Device:

- The half-shade device creates a **contrast** between the two halves of the field of view.
- The **quartz half** (retarding plate) introduces a **phase difference** of 180° (half-wave) between the orthogonal components of light.
- When polarized light enters the device:
 - In the **glass half**, it passes unchanged.
 - In the **quartz half**, the vibration direction of light is rotated slightly depending on the orientation of the half-wave plate.
- This causes a **difference in intensity** when viewed through the analyzer unless the analyzer is adjusted such that both halves appear equally bright.

Working of Laurent's Polarimeter:

1. Light from the sodium lamp becomes **plane-polarized** by the polarizer.
2. This light enters the **half-shade device**, which modifies the phase in one half of the field.
3. The light then passes through the **optically active solution** in the sample tube, rotating the plane of polarization by an angle α .
4. The **analyzer** is rotated until **both halves** of the field of view appear **equally bright**.
5. The **angle of rotation** is read from a **graduated scale** attached to the analyzer.

Advantages of Half-Shade Device:

- Enhances **sensitivity** and **accuracy**.

- Provides a **clear brightness contrast**, allowing precise detection of the correct orientation.

Formula for Optical Rotation:

$$\alpha = \theta l / c$$

Where:

- α = Specific rotation ($^{\circ} \cdot \text{dm}^{-1} \cdot \text{g}^{-1} \cdot \text{mL}$)
- θ = Observed angle of rotation
- l = Length of sample tube (dm)
- c = Concentration of solution (g/mL)

Question 3(A): Explain the principle of principal of optical pumping and population inversion in LASER. Write the characteristics of LASER beam and also mention its few applications.

Ans: Optical pumping is the process of using external light energy (usually from a flash lamp or another laser) to excite electrons in atoms or molecules from a lower energy state to a higher energy state.

Key Idea:

- Atoms absorb photons of specific energies and move to **excited states**.
- This builds up the population in higher energy levels.

Purpose in LASER:

To create a condition where more atoms are in excited states than in lower states — a requirement for **stimulated emission**.

Population Inversion:

Normally, most atoms reside in the **ground state**. To produce laser light, we need **population inversion**, i.e., **more atoms in an excited state** than in the lower state.

How it's achieved:

- Using **optical pumping**, electrical discharge, or other methods.
- Usually requires a **three-level** or **four-level energy system**.

Why it's important:

- In normal conditions, absorption dominates over stimulated emission.
- In **population inversion**, **stimulated emission** > **absorption**, enabling **laser action**.

Characteristics of a LASER Beam:

1. Monochromatic:
 - Emits light of a single wavelength (pure color).
2. Coherent:
 - All photons are in phase — peaks and troughs align.
3. Highly Directional:
 - Travels in a very narrow beam with minimal divergence.
4. High Intensity:
 - Light is amplified, making the beam extremely bright and powerful.
5. Polarized (in most cases):
 - The electric field oscillates in a single direction.

Applications of LASER:

Field	Application
Medicine	Eye surgery (LASIK), cancer treatment, dental procedures
Industry	Cutting, welding, engraving, and material processing
Communication	Optical fiber communication using laser diodes
Military	Range finding, target designation, directed-energy weapons
Research	Spectroscopy, holography, and quantum optics
Entertainment	Laser light shows, barcode scanners

Question 3(B): Explain the construction and working of Ruby Laser.

Ans: The **Ruby Laser** was the **first laser** ever built (by Theodore Maiman in 1960). It is a **solid-state laser** that uses **ruby crystal** as the **gain medium**.

Main Components:

Component	Description
Active Medium	Ruby crystal (Al_2O_3 doped with 0.05% Cr^{3+} ions). The Cr^{3+} ions are responsible for lasing action.

Component	Description
Optical Pumping Source	Helical Xenon flash lamp is used to optically pump the Cr^{3+} ions to higher energy levels.
Optical Resonator (Cavity)	Consists of two mirrors: one fully reflective and one partially reflective . These are placed on either end of the ruby rod.
Cooling System	Maintains optimal operating temperature of the laser.

Working of Ruby Laser:

Step-by-step Process:

➤ (i) Optical Pumping:

- The **flash lamp** emits intense light, which **excites Cr^{3+} ions** in the ruby crystal to a higher energy level (E_3).

➤ (ii) Spontaneous Emission:

- Excited Cr^{3+} ions quickly fall to a **metastable state** (E_2) via non-radiative transition.
- The ions **remain longer** in E_2 (metastable), allowing **population inversion** to build up between E_2 and the ground state E_1 .

➤ (iii) Stimulated Emission:

- Once population inversion is achieved, some Cr^{3+} ions fall to E_1 from E_2 and emit **coherent photons** (wavelength = **694.3 nm**, red light).
- These photons **stimulate other excited ions** to emit more photons — triggering a **chain reaction**.

➤ (iv) Optical Resonator Action:

- The emitted photons reflect back and forth between the **two mirrors**.
- The **partially reflective mirror** allows some light to escape as a **narrow, coherent laser beam**.

Key Characteristics of Ruby Laser:

- Type:** Solid-state laser
- Wavelength:** 694.3 nm (deep red)
- Pulse Output:** Not continuous, it operates in **pulsed mode**
- Gain Medium:** Synthetic ruby (Cr^{3+} in Al_2O_3)
- Pump Source:** Flash lamp

Applications of Ruby Laser:

- Holography
- Tattoo and hair removal
- Range finding
- Scientific research
- Laser spectroscopy

Class Test Solution CT-3

Question 1A: Why are two independent light sources not coherent?

Two independent light sources are not coherent because they emit light waves with random phases and different frequencies. Coherence requires a constant phase relationship over time between the waves from two sources. Independent sources like two separate bulbs cannot maintain such synchronization, resulting in no observable sustained interference pattern.

Question 1B: Write conditions for sustained interference.

Conditions for sustained (observable and stable) interference:

- The sources must be **coherent** (have a constant phase difference).
- The sources must emit light of the **same frequency or wavelength**.
- The **intensity** of the two waves should be comparable.
- The waves should **overlap spatially** (interfere in the same region).
- The path difference between the two waves should be **small and stable**.

Question 1C: What is the necessary condition for diffraction to occur?

Diffraction occurs when a wave encounters an obstacle or a slit that is **comparable in size to its wavelength**. So, the necessary condition is:

- The size of the obstacle/aperture must be **on the order of the wavelength** of the wave.

Question 1D: What is meant by resolving power of an optical instrument?

Resolving power refers to the **ability of an optical instrument** (like a telescope or microscope) to **distinguish between two closely spaced objects**. Higher resolving power means the instrument can distinguish finer details and smaller separations.

Question 1E: Define optical activity and specific rotation.

- **Optical activity** is the property of certain substances to **rotate the plane of polarization** of polarized light passing through them.
- **Specific rotation** is the angle of rotation per unit length and per unit concentration of an optically active substance, defined as:

$$[\alpha] = \alpha / l \cdot c$$

where α is the observed rotation in degrees, l is the path length in decimeters, and c is the concentration in grams per milliliter.

Question 1F: Why is population inversion an essential criterion for lasing?

Population inversion is essential for lasing because it ensures that **more atoms are in an excited state** than in the lower energy state. This condition is necessary for **stimulated emission** to dominate over absorption, allowing the **amplification of light** and the creation of a coherent laser beam.

Question 1G: Deduce the velocity at which the mass of a particle becomes 1.5 times its rest mass

Let m_0 be the rest mass and m the relativistic mass.

Given:

Question 1H: Write the postulates of the special theory of relativity.

The **Special Theory of Relativity**, proposed by Einstein, is based on two postulates:

1. **Principle of Relativity:** The laws of physics are the same in all inertial frames of reference (i.e., frames moving at constant velocity relative to each other).
 2. **Constancy of the Speed of Light:** The speed of light in vacuum is the same for all observers, regardless of the motion of the light source or the observer (approximately $3 \times 10^8 \text{ m/s}$).
-

Question 2(A): Derive the expression for the length contraction. The length of a rod is found to be one-fourth of its length, when at rest. What is the speed of rod relative to the observer?

Ans:

1. Introduction to Length Contraction

Length contraction is a fundamental prediction of Einstein's Special Theory of Relativity, which states that an object moving at a velocity comparable to the speed of light will appear **shorter in length** to a stationary observer than it does in its own rest frame.

This contraction occurs **only in the direction of motion** and is not due to any physical compression but arises from the nature of space and time in special relativity.

2. Derivation of the Length Contraction Formula

Let us derive the expression for length contraction using the **Lorentz transformations**.

Assumptions:

- An object (e.g., a rod) is moving at a constant velocity v relative to a stationary observer.
- The **rest length** of the object (its proper length) is L_0 , which is the length measured in the **object's rest frame**.

-
- The **contracted length** L is the length observed by the **stationary observer**.

Key Concept:

In special relativity, **simultaneity** is relative. To measure the length of a moving object, the observer must record the positions of both ends **simultaneously** in their own frame.

Using Lorentz transformations, the relation between the coordinates in the stationary and moving frame is:

$$x' = \gamma(x - vt), \quad t' = \gamma\left(t - \frac{vx}{c^2}\right)$$

Where:

- x, t are coordinates in the observer's frame
- x', t' are coordinates in the moving frame
- $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$ is the Lorentz factor
- c is the speed of light

Let the ends of the rod be at positions x_1 and x_2 in the observer's frame (measured **simultaneously** at time t):

$$L = x_2 - x_1$$

In the rest frame of the rod (its own frame), the positions are x'_1 and x'_2 , measured at **different times** t'_1 and t'_2 . But the rod is stationary in its own frame, so:

$$L_0 = x'_2 - x'_1$$

From Lorentz transformation:

$$\begin{aligned} x' = \gamma(x - vt) &\Rightarrow x'_1 = \gamma(x_1 - vt), \quad x'_2 = \gamma(x_2 - vt) \\ \Rightarrow L_0 = x'_2 - x'_1 &= \gamma(x_2 - x_1) = \gamma L \end{aligned}$$

Therefore, the **length observed in the moving frame** is:

$$L = \frac{L_0}{\gamma} = L_0 \sqrt{1 - \frac{v^2}{c^2}}$$

This is the **length contraction formula**.

3. Interpretation of Length Contraction

- L_0 : Proper length (length of object at rest)
- L : Contracted length (length observed when the object moves with speed v)
- v : Relative velocity between observer and object
- c : Speed of light

As $v \rightarrow c$, $\gamma \rightarrow \infty$, so $L \rightarrow 0$: the length appears to contract drastically.

As $v \rightarrow 0$, $\gamma \rightarrow 1$, so $L \rightarrow L_0$: the object appears to retain its proper length.

4. Numerical Problem

Given:

The **observed length** $L = \frac{1}{4}L_0$ (i.e., one-fourth of the proper length)

We have:

$$L = L_0 \sqrt{1 - \frac{v^2}{c^2}} = \frac{1}{4}L_0$$

Divide both sides by L_0 :

$$\sqrt{1 - \frac{v^2}{c^2}} = \frac{1}{4}$$

Now square both sides:

$$1 - \frac{v^2}{c^2} = \frac{1}{16} \Rightarrow \frac{v^2}{c^2} = 1 - \frac{1}{16} = \frac{15}{16} \Rightarrow v = c\sqrt{\frac{15}{16}}$$

$$v = c \cdot \frac{\sqrt{15}}{4} \approx c \cdot \frac{3.873}{4} \approx 0.968c$$

5. Final Answer

The speed of the rod relative to the observer is approximately:

$$\boxed{v \approx 0.968c}$$

That is, about **96.8% of the speed of light**.

Question 2(B): Define the term ‘Frame of Reference’. Write Galilean transformation equations. Show that length of a rod is invariant under Galilean transformation.

1. Frame of Reference

A **Frame of Reference** is a coordinate system used to describe the position, velocity, and acceleration of objects. It serves as a **point of view** from which measurements and observations are made.

There are two types of frames:

- **Inertial Frame:** A frame of reference that is either at rest or moving with constant velocity (i.e., no acceleration). Newton's laws of motion hold true in such frames.
- **Non-Inertial Frame:** A frame that is accelerating. In this frame, fictitious forces (like centrifugal force) may appear.

For example:

- A person standing on a platform observes a train moving past — the platform is an **inertial frame**.
- A person sitting inside a speeding train feels a jerk when the train accelerates — the train becomes a **non-inertial frame** during acceleration.

2. Galilean Transformation Equations

Galilean transformations are used to relate the coordinates of an event or an object in **two inertial frames of reference** that are moving at a constant velocity relative to each other.

Let: • S be a stationary inertial frame.

_____ • S' be another inertial frame moving with constant velocity v along the x-axis relative to S . _____

- An event occurs at point (x, y, z, t) in frame S .
- The same event has coordinates (x', y', z', t') in frame S' .

Galilean Transformation Equations:

$$x' = x - vt$$

$$y' = y$$

$$z' = z$$

$$t' = t$$

These equations assume that:

- Time is **absolute**, i.e., $t' = t$
- Space is measured independently of time
- Both frames agree on the simultaneity of events

3. Invariance of Length under Galilean Transformation

Let us now **prove** that the **length of a rod is invariant** under Galilean transformation.

Let:

- A rod is lying along the **x-axis** in frame S .
- The coordinates of its two ends at a given time t are x_1 and x_2 .
- So, the **length** of the rod in S is:

$$L = x_2 - x_1$$

Now, transform these coordinates to frame S' using the Galilean transformations:

$$x'_1 = x_1 - vt, \quad x'_2 = x_2 - vt$$

So, the **length** in S' becomes:

$$L' = x'_2 - x'_1 = (x_2 - vt) - (x_1 - vt) = x_2 - x_1 = L$$

Thus,

$$\boxed{L' = L}$$

The **length remains unchanged** (invariant) under Galilean transformation.

Question 3(A): Derive expression for variation of mass with velocity.

Ans:

1. Introduction

According to **Einstein's Special Theory of Relativity**, the **mass of a body is not constant** when it moves at a speed comparable to the speed of light. Instead, it **increases with velocity**. This concept is in contrast to classical mechanics, where mass is considered invariant.

The relativistic mass increases as the speed of the object increases and becomes **infinite** as the object's speed approaches the **speed of light (c)**. This implies that no object with mass can be accelerated to the speed of light.

2. Conceptual Background

In Newtonian mechanics, the momentum of a particle is given by:

$$p = mv$$

In special relativity, this is modified. The **relativistic momentum** is defined as:

$$p = \gamma m_0 v$$

Where:

- p = Relativistic momentum
- m_0 = Rest mass (mass of the body at rest)
- v = Velocity of the body
- $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \text{Lorentz factor}$
- c = Speed of light in vacuum

The factor γ accounts for the relativistic effects.

From this, we can define **relativistic mass** as:

$$m = \gamma m_0 = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

This equation gives the expression for **mass variation with velocity**.

3. Derivation of Mass Variation with Velocity

Let's derive this expression using the **principle of conservation of momentum** and **Lorentz transformations**.

Step 1: Assumptions

- Let a particle of rest mass m_0 move with velocity v .
- The relativistic momentum is defined to ensure conservation of momentum in all inertial frames.
- As the speed increases, the resistance to acceleration (i.e., inertia) increases, which effectively means mass increases.

We assume the force acting on the particle causes a change in momentum:

$$F = \frac{dp}{dt} = \frac{d(\gamma m_0 v)}{dt}$$

Now compute the derivative:

$$\frac{d(\gamma m_0 v)}{dt} = m_0 \frac{d}{dt} \left(\frac{v}{\sqrt{1 - \frac{v^2}{c^2}}} \right)$$

This shows that acceleration becomes harder as $v \rightarrow c$, implying an increase in **relativistic mass**.

Thus, we define:

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

This is the required expression.

4. Key Points

- **Rest Mass m_0 :** Mass measured when the object is at rest.
- **Relativistic Mass m :** Mass observed when the object moves with velocity v .
- **As $v \rightarrow c$: $m \rightarrow \infty$**
- Therefore, **no material particle** can reach or exceed the speed of light, because it would require infinite energy to do so.

5. Table of Mass Increase with Velocity

Velocity v	$\frac{v}{c}$	Lorentz Factor γ	Relativistic Mass m
0	0	1	$m = m_0$
0.5c	0.5	1.15	$m \approx 1.15m_0$
0.8c	0.8	1.67	$m \approx 1.67m_0$
0.9c	0.9	2.29	$m \approx 2.29m_0$
0.99c	0.99	7.09	$m \approx 7.09m_0$

6. Conclusion

The mass of a body is **not a constant** in relativistic mechanics. As the velocity of an object increases and approaches the speed of light, its mass increases significantly. This effect is quantified by the expression:

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

This result has been verified experimentally, especially in particle accelerators where particles gain high velocities and exhibit increased inertia consistent with relativistic predictions. This concept is essential in modern physics, especially in the fields of high-energy physics and astrophysics.

Question 3(B): Show that $x^2 + y^2 + z^2 - c^2 t^2 = x'^2 + y'^2 + z'^2 - c^2 t'^2$ remains invariant under Lorentz transformation.

1. Introduction

One of the foundational results of **Einstein's Special Theory of Relativity** is the **invariance of the spacetime interval** between two events. This means that although the individual coordinates of time and space may vary between two inertial frames (due to relative motion), a certain combination of these coordinates — called the **spacetime interval** — remains **unchanged** (invariant) under **Lorentz transformations**.

We will now **prove** that:

$$x^2 + y^2 + z^2 - c^2 t^2 = x'^2 + y'^2 + z'^2 - c^2 t'^2$$

This quantity is called the **spacetime interval** (in the context of the Minkowski space metric), and it remains the same for all inertial observers.

2. Lorentz Transformation Equations

Let's consider two inertial frames:

- Frame **S**: stationary frame
- Frame **S'**: moving with velocity v along the **x-axis** relative to **S**

The Lorentz transformation equations (for standard configuration) are:

$$x' = \gamma(x - vt) \tag{1}$$

$$y' = y \tag{2}$$

$$z' = z \tag{3}$$

$$t' = \gamma \left(t - \frac{vx}{c^2} \right) \tag{4}$$

where

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

3. Spacetime Interval in S and S'

Let us compute the quantity $x'^2 + y'^2 + z'^2 - c^2 t'^2$ using the Lorentz transformation.

Step 1: Substitute from equations (1) to (4)

First compute x'^2 and $c^2 t'^2$:

From equation (1):

$$x' = \gamma(x - vt) \Rightarrow x'^2 = \gamma^2(x - vt)^2 \quad (5)$$

From equation (4):

$$t' = \gamma\left(t - \frac{vx}{c^2}\right) \Rightarrow c^2 t'^2 = \gamma^2 c^2 \left(t - \frac{vx}{c^2}\right)^2 = \gamma^2 \left(c^2 t^2 - 2vxt + \frac{v^2 x^2}{c^2}\right) \quad (6)$$

Now subtract $c^2 t'^2$ from x'^2 :

$$x'^2 - c^2 t'^2 = \gamma^2(x - vt)^2 - \gamma^2 \left(c^2 t^2 - 2vxt + \frac{v^2 x^2}{c^2}\right)$$

Expand both expressions:

$$\begin{aligned} x'^2 &= \gamma^2(x^2 - 2xvt + v^2 t^2) \\ c^2 t'^2 &= \gamma^2(c^2 t^2 - 2vxt + \frac{v^2 x^2}{c^2}) \end{aligned}$$

So:

$$x'^2 - c^2 t'^2 = \gamma^2 \left[x^2 - 2xvt + v^2 t^2 - c^2 t^2 + 2vxt - \frac{v^2 x^2}{c^2} \right]$$

Simplify:

$$x'^2 - c^2 t'^2 = \gamma^2 \left[x^2 \left(1 - \frac{v^2}{c^2}\right) - c^2 t^2 \left(1 - \frac{v^2}{c^2}\right) \right]$$

Factor out $\left(1 - \frac{v^2}{c^2}\right)$:

$$x'^2 - c^2 t'^2 = \gamma^2 \left(1 - \frac{v^2}{c^2}\right) (x^2 - c^2 t^2)$$

But recall:

$$\gamma^2 = \frac{1}{1 - \frac{v^2}{c^2}} \Rightarrow \gamma^2 \left(1 - \frac{v^2}{c^2}\right) = 1$$

Therefore:

$$x'^2 - c^2 t'^2 = x^2 - c^2 t^2 \quad (7)$$

4. Add the Transverse Coordinates

From equations (2) and (3), we have:

$$y' = y, \quad z' = z \Rightarrow y'^2 + z'^2 = y^2 + z^2$$

So:

$$x'^2 + y'^2 + z'^2 - c^2 t'^2 = x^2 + y^2 + z^2 - c^2 t^2$$

This proves the invariance of the spacetime interval.

Assignment/ Quizzes Solution

Assignment-1

Assignment: 01

①

Ques 1: Define coherent sources. Why sustained interference is not possible without coherent sources?

Ans: Coherent sources are two or more wave sources that emit waves with a constant phase difference, the same frequency, and similar waveform. These sources are essential for producing a stable interference pattern.

→ Why sustained interference is not possible without coherent sources -

Interference occurs when two or more waves superpose to form a resultant wave. For this interference pattern to be stable and sustained, the following conditions must be met -

1. Constant phase difference: If the phase difference b/w the source keeps changing randomly, the interference pattern will keep shifting and average out over time, making it invisible or unstable.
2. Same Frequency: Different frequencies cause wave crests and troughs to drift apart, leading to non-uniform and time-varying interference, again destroying any clear pattern.

Ques 2: What is the shape of interference fringes in young & double slit experiment, Newton's ring experiment and michelson interferometer?

Ans: The shape of interference fringes observed in each of three ~~at~~ classic experiments:

1. Young & double slit Experiment (YDSE):-
Fringe shape → Straight and parallel lines -



2. Newton's rings Experiment:-

Fringe shape: Concentric circular rings.



[It occurs due to varying thickness of a film b/w a plano-convex lens and a flat glass plate].

Michelson Interferometer: -

• Fringe Shape: - Depends on the alignment.

(i) Circular Fringes: If mirrors are perfectly perpendicular and the path difference radially.

(ii) Straight Fringes: If mirrors are slightly tilted.



[It occurs due to difference in optical path lengths from two perpendicular mirrors.]

Ques 3: Why two independent sources can not be coherent?

Ans: In actual practice, it is not possible to have two independent sources, which are coherent. This can be explained as follows -

→ A source of light consists of large number of atoms. Acc. to the atomic theory, each atom consists of a central nucleus and the e^- revolve around.

So, two independent sources can't be coherent because they emit waves with random phase relationship & potentially slightly different frequencies, making sustained interference impossible.

Ques 4: Why the Newton's rings are circular?

Ans: Newton's rings are circular because the air film b/w the plane-convex lens and the flat glass plate has a radially symmetric thickness.

Why Circular?

→ At any given radial distance (r) from the center, the air film thickness is constant in all directions.

→ So, the path difference for interference is the same for all points from the center.

→ As a result, bright and dark fringes form in the shape of concentric circles.

Ques 5: Why the center is dark in Newton's rings experiment?

Ans: The center is dark in Newton's rings experiment due to destructive interference at the point of contact b/w the plane-convex lens and the point of the flat glass plate.

At the center: The lens and glass plate are in direct contact, so the air film thickness is zero.

The center is dark in Newton's rings because: -

→ The air film thickness is zero → Path difference = 0.

→ A π phase shift occurs on one reflection → destructive interference → Dark fringes at the center.

Q6: Write the conditions of sustained interference.
 Ans: Conditions for sustained interference: For two waves to produce sustained interference, the following conditions must be met →

Condition	Purpose.
1). Coherent Source	Maintain constant phase difference
2). Equal or similar amplitude	Clear and visible fringes.
3). Same frequency and wavelength.	Stable interference pattern.
4). Same polarization	Effective interference.
5). Constant path differences	Non-fluctuating pattern
6). Overlapping wavefronts	Enable interference.

Q7: Interference fringes are obtained using a glass biprism of base angle 20° each and refractive index (1.50). If the distance b/w the slit and the biprism is (10cm), Calculate fringe width in the interference pattern obtained at distance of (90cm) away from the biprism, when the slit is illuminated by light of wavelength (5890 Å).

Ans: To calculate the fringe width (β) in a biprism interference experiment, we use it as -

$$\left[\beta = \frac{\lambda D}{d} \right]$$

For biprism $d = 2n(u-1)\theta$,

- Where, λ = Wavelength of light
 D = Distance from virtual sources of the screen.
 d = Separation b/w two virtual sources.
 x = Distance from slit to biprism.
 n = refractive index of biprism
 θ = base angle of biprism (in radians).

Given: $\theta = 20^\circ = 20 \text{ arcminutes} = \frac{20}{60} = \frac{1}{3} \text{ degrees} = \frac{\pi}{540} \text{ radians}$.

$n = 1.5$, $x = 10 \text{ cm}$, $D = 90 \text{ cm}$, $\lambda = 5890 \text{ Å} = 5.89 \times 10^{-7} \text{ m}$.

Calculated $d = 2n(u-1)\theta$

$$d = 20 \times 0.5 \times \frac{\pi}{540}$$

$$= 10 \times \frac{\pi}{540}$$

$$= \frac{31.42}{540} = 0.0582 \text{ cm}$$

$$[d = 0.000582 \text{ m}]$$

$$\beta = \frac{\lambda D}{d} = \frac{5.89 \times 10^{-7} \times 0.90}{0.000582}$$

$$= \frac{5.301 \times 10^{-7}}{0.000582} = 9.11 \times 10^{-4} \text{ m}$$

$$= 0.911 \text{ mm}$$

$$[\text{Fringe width} = 0.911 \text{ mm}]$$

Ans

Q8: What is Stoke's Law for the phase change of reflection?

Ans: → Stoke's Law explains phase change on reflection.

→ When light reflects from a denser medium, it gets a 180° phase shift.

→ When it reflects from a rarer medium, there is no phase shift.

→ This affects how interference patterns form. Ans.

Ques 9: Monochromatic light from a narrow slit illuminates two narrow slits (0.5 mm) apart, producing an interference pattern with bright fringes (2.0 mm) apart on a screen (80 cm) away. Find the wavelength of light -

Ans: We can use the fringe width formula for young's double slit experiment: $B = \frac{\lambda D}{d}$

Given: B = Fringe width
= 2.0 mm
= $2.0 \times 10^{-3} \text{ m}$

D = distance from slit to screen
= 80 cm = 0.80 m

d = Distance b/w slits
= 0.5 mm = $0.5 \times 10^{-3} \text{ m}$

λ = wavelength of light
(to be found)

$$\lambda = \frac{Bd}{D}$$

$$\lambda = \frac{2.0 \times 10^{-3} \times 0.5 \times 10^{-3}}{0.80}$$

$$\lambda = \frac{1.0 \times 10^{-6}}{0.80} = 1.25 \times 10^{-6} \text{ m}$$

$$[\lambda = 12500 \text{ \AA}]$$

Ques 10: What do you mean by wavefront? What is the shape of wavefront for a point source?

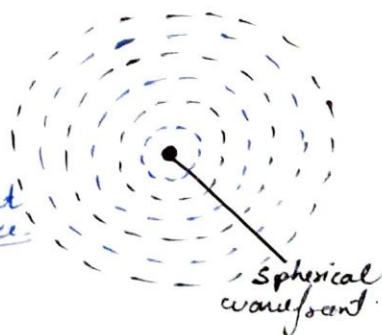
Ans: Wavefront: A wavefront is an imaginary surface connecting all points a wave that vibrate in phase. It shows the directions & spread of the wave.

Shape of wavefront for a point source:-

→ For a point source, the wavefronts are spherical in shape, as the waves spread uniformly in all directions from the source.

& In short: wavefront = surface of Equal phase.

Shape for point source: Spherical wavefront. Point Source



Assignment-2

Assignment - 02.

①

Ques 1: Define resolving power and limit of resolution of an optical instrument.

Ans: Resolving power of an optical instrument is its ability to distinguish two closely spaced objects as separate. Mathematically, it is defined as the reciprocal of the smallest angular separation (θ) that can be resolved:

$$\text{Resolving Power} = \frac{1}{\theta_{\min}}$$

where $\theta_{\min}$ is the minimum resolvable angle.

Limit of resolution is the smallest distance or angular separation b/w two object that an optical instrument can resolve. It represents the practical boundary of detail the instrument can distinguish.

• For a microscope, its typically given by:-

$$\text{Limit of Resolution} = \frac{1.22 \lambda}{2NA}$$

Ques 2: Discuss the difference b/w interference and diffraction fringe pattern.

<u>Aspect</u>	<u>Interference</u>	<u>Diffraction</u>
<u>Cause</u>	Superposition of waves from 2 or more coherent sources.	Bending of waves through a single slit or around edges.
<u>Fringe Spacing</u>	Fringes are equally spaced.	Fringes are not equally spaced.
<u>Brightness of fringes</u>	All bright Fringes usually have equal intensity.	Central fringe is brightest, others are dimmer.
<u>Source requirement</u>	Needs two slits or two sources.	Can occur with one slit or obstacle.
<u>Pattern type</u>	Alternating bright and dark straight lines.	Central bright band with decreasing side bands.

Q3: What is Rayleigh criterion of resolution?

Ans: The Rayleigh criterion gives the minimum distance at which two point light sources can be just resolved by an optical instrument like a telescope or microscope.

Formula: For a circular aperture the angle resolution θ is given by - $\left[\theta = 1.22 \frac{\lambda}{D} \right]$

where, θ = minimum resolvable angle (in radian).

λ = wavelength of light.

D = diameter of the aperture (lens opening).

Q4: State the essential condition for diffraction of light to occur.

Ans: The size of the obstacle or the slit should be comparable to the wavelength of light.

→ Diffraction happens when light passes through a narrow slit or around an object, and the slit size is similar to the light's wavelength.

Example: Visible light has a wavelength of around 400-700 nm. So diffraction is noticeable when the slit or obstacle is very small.

Q5: Distinguish b/w Fresnel and Fraunhofer diffractions.

Ans	Feature	Fresnel diffraction	Fraunhofer diff.
→ Types of wavefront, source & screen, lenses used, Mathematical Analysis		Diverging or converging at finite distances from the slit. Not required. More complex.	Plane wavefront. At infinite distances. Lenses are used to focus light. Simple compared to Fresnel.
	Practical Example	Shadow of a coin in sunlight.	Diffraction through a single slit using a laser.

Q6: Write Expression for resolving power of plane diffraction grating and telescope.

Ans: 1. Resolving power of a plane diffraction grating.

$$\text{Resolving power (R)} = \frac{\lambda}{\Delta \lambda} = nN$$

where, λ = wavelength of light.
 $\Delta\lambda$ = minimum diffraction in wavelength.
 n = order of diffraction.
 N = Total number of slits illuminated.

(3)

2. Resolving power of a telescope -

$$\text{Resolving power} = \frac{1}{\theta} = \frac{D}{1.22\lambda}$$

where - θ = smallest angle b/w objects that can be resolved
 λ = wavelength of light.
 D = Diameter of telescope & objective lens.

Q7: In a plane transmission grating, the angle of diffraction for second order maxima for wavelength 5×10^{-5} cm is 30° . Calculate the number of lines in one centimetre of the grating surface.

Ans: To solve this problem, we will use the grating eqn -
 $[n\lambda = d \sin \theta]$

from the eqn - $[d = \frac{n\lambda}{\sin \theta}]$

Substitute the values -

$$d = \frac{2 \times 5 \times 10^{-5}}{\sin 30^\circ} \Rightarrow \frac{10 \times 10^{-5}}{0.5} \Rightarrow \frac{10^{-4}}{0.5}$$

Now, number of lines per cm is - $\Rightarrow 2 \times 10^4 \text{ cm}$

$$\frac{1}{d} = \frac{1}{2 \times 10^{-4}} = 5 \times 10^3$$

$\Rightarrow 5000 \text{ lines per cm}$

Q8: A parallel beam of light of wave length $5890 \text{ \AA}$, is incident perpendicularly on a slit of width 0.1 mm . Calculate angular width and linear width of central maximum formed on the screen 100 cm away.

Ans: Given,

$$\text{Wavelength } (\lambda) = 5890 \text{ \AA} = 5890 \times 10^{-10} \text{ m} = 5.89 \times 10^{-7} \text{ m}$$

$$\text{Slit width, } a = 0.1 \text{ mm} = 1 \times 10^{-4} \text{ m}$$

$$\text{Distance to screen, } D = 100 \text{ cm} = 1 \text{ m}$$

The angular width of the central maximum is -

$$\theta = 2 \sin^{-1} \left(\frac{\lambda}{a} \right)$$

$$\theta = 2 \sin^{-1} \left(\frac{5.89 \times 10^{-7}}{1 \times 10^{-4}} \right) = 2 \sin^{-1}(0.00589)$$

(9)

$$[\theta \approx 2 \times 0.00589 = 0.01178] \text{ Radian}$$

linear width is -

$$w = 2D \tan \left(\frac{\theta}{2} \right) \approx 2D \left(\frac{\theta}{2} \right) = D\theta$$

$$w = 1 \times 0.01178 = 0.01178 \text{ m}; [= 1.178 \text{ cm}]$$

Now, Angular width = 0.01178 Radians

Linear width = 1.178 Answer

Ques 9: A light of wavelength 600nm falls normally on a slit of width 20μm. Determine the angular position of first and second minima.

Ans. Minima Condition - $a \sin \theta = m\lambda$

$$\therefore a = \text{slit width} = 20 \mu\text{m} = 20 \times 10^{-6} \text{ m}$$

$$\lambda = \text{wavelength} = 600 \text{ nm} = 600 \times 10^{-9} \text{ m}$$

m = order of minimum (1. For first, 2 For Second).

θ = angle of diffraction for m th minimum.

1 : First minima ($m=1$);

$$\sin \theta_1 = \frac{m\lambda}{a} = \frac{1 \times 600 \times 10^{-9}}{20 \times 10^{-6}} = 0.03$$

$$\theta_1 = \sin^{-1}(0.03)$$

$$[\theta_1 = 1.72]$$

2// Minima ($m=2$) Second -

$$\sin \theta_2 = \frac{2 \times 600 \times 10^{-9}}{20 \times 10^{-6}}$$

$$= 0.06$$

$$\theta_2 = \sin^{-1}(0.06)$$

$$[\theta_2 = 3.44] \text{ Ans.}$$

Ques 10: Explain Diffraction on the basis of wave theory.

Ans: Diffraction is the bending or spreading of waves when they pass through a narrow slit or around the edges of an obstacle.

Huygen's principle (Wave theory basis):

→ Acc. to Huygens, every point on a wavefront acts as a source of secondary wavelets that spread out in all directions. The new wavefront is formed by the envelope of these wavelets.

How diffraction happens: 1) When a plane wavefront hits a narrow slit.

- ⑤
- These wavelets interfere with each other. • At some points, they add up (bright fringes).
 - At other points, they cancel out (dark fringes).
- 3). As a Result you see a diffraction pattern.
→ A central bright maximum with alternating dark and bright bands on either side.

Conclusion: Diff.ⁿ is a direct result of wave behaviour of light and the wave theory successfully explains how light bends and separates when it passes through slits or around obstacles.

Assignment-3

Assignment : 03.

Q1: What are the differences b/w ordinary & extraordinary rays?

Ans: Ordinary rays

Ordinary ray is a distinct light beam that results from the double refraction of light.

Ordinary ray follows Snell's Law.

O-ray is Polarized perpendicular to crystal optic axis

O-ray travels at a constant speed throughout the crystal

Extra ordinary rays.

→ It is also distinct light beam.

→ It does not follow Snell's Law

→ E-ray is polarized parallel to crystal optic axis.

→ E-ray & velocity can vary depending on its direction within the crystal.

Q2: Calculate the thickness of a half wave plate of quartz for Sodium light of wavelength $5000 \text{ \AA}$. The O-ray & E-ray refractive indices for Sodium are 1.544 & 1.553, respectively.

Ans: To calculate the thickness of a half wave plate, we use the formula -

$$t = \frac{\lambda}{2(n_e - n_o)}$$

where -

t = thickness of the half-wave plate.

λ = wavelength of light

n_e = refractive index for extraordinary ray

n_o = refractive index for ordinary ray.

Given: $\lambda = 5000 \text{ \AA} = 5000 \times 10^{-10} \text{ m} = 5 \times 10^{-7} \text{ m}$

$n_o = 1.544$

$n_e = 1.553$

Now substitute the values -

$$t = \frac{\lambda}{2(n_e - n_o)} \Rightarrow t = \frac{5 \times 10^{-7}}{2(1.553 - 1.544)} \Rightarrow \frac{5 \times 10^{-7}}{2(0.009)} \Rightarrow \frac{5 \times 10^{-7}}{0.018}$$

$$t = 2.78 \times 10^{-5} \text{ m}$$

$$[t = 27.8 \mu\text{m}]$$

Ans.

Q3: Determine the Brewster's angle for a glass of refractive index 1.5 when it is immersed in water of refractive index 1.33.

Ans: To find Brewster's angle, we use the formula -

$$\tan i_B = \frac{n_2}{n_1}$$

- i_B = Brewster's angle, we
- n_1 = refractive index of initial medium (water)
- n_2 = refractive index of second medium (glass)

Given: $n_1 = 1.33$ (water)
 $n_2 = 1.5$ (glass)

then, $\tan i_B = \frac{n_2}{n_1} = \frac{1.5}{1.33}$
 $= 1.1278$

$i_B = \tan^{-1}(1.1278)$
($i_B = 48.3^\circ$ degree)
Ans,

Ques 4. How will you detect a plane polarized light?
Ans: To detect plane polarized light, you can use a device called a polarized analyzer, which is essentially a polarizing filter. Here is how the direction works -

Method 1. Pass the light through the analyzer.

2. Rotate the analyzer slowly about the axis of light beam.
3. Observe the intensity of transmitted light.

If the light intensity varies from maximum to zero as you rotate it, the light is plane polarized.

4. If the intensity remains constant, the light is unpolarized or circularly polarized. Ans

Ques 5: Discuss the phenomenon of double refraction.

Ans: Double refraction (Birefringence): Double refraction is a phenomenon where a single light ray entering an anisotropic crystal splits into two refracted rays, each travelling in different directions.

1. Occurs in anisotropic materials: Different refractive indices
2. Two refracted rays: O-Ray: obeys Snell's law ② E-Ray: Does not follow Snell's law

crystals showing the effects: Calcite, quartz, mica, Iceland.

Uses of double refraction: 1) Polarization of light.

2) Optical devices like Nicol prism.

3) Stress analysis in Materials.

Q6. Define optical activity and specific rotation.

Ans: Optical activity: Optical activity is the phenomenon where a substance can rotate the plane of polarized light as it passes through it.

When light is polarized, its electric field oscillates in a single direction.

Specific rotation: Specific rotation is a measure of this rotation, expressed as the angle of rotation per unit length of the sample and concentration.

Specific rotation is typically expressed in degrees per decimeter per gram for millimeter is usually expressed without units.

Ques 7: Two polaroids are adjusted so as to obtain maximum intensity. Through what angle should the polaroid be rotated to reduce the intensity to
i) Half & (ii) One fourth.

Ans: When two polaroids are initially aligned for maximum transmitted intensity, the intensity of light after the first polaroid is half of the incident unpolarized light intensity due to polarization. The intensity after second polaroid, rotated by an angle θ relative to the first, follows Malus' Law -

$$I = \frac{1}{2} I_0 \cos^2 \theta$$

(i) To reduce the intensity of half -- intensity --

$$I = \frac{1}{2} \times \frac{1}{2} I_0 \cos^2 \theta$$

$$\frac{1}{4} I_0 \cos^2 \theta = \cos^2 \theta = \frac{1}{2}$$

$$\left[\cos \theta = \frac{1}{\sqrt{2}} \right], [\theta = 45^\circ]$$

(ii) To reduce the intensity of one-fourth --- intensity ---

$$I = \frac{1}{4} \times \frac{1}{2} I_0 = \frac{1}{8} I_0$$

$$\frac{1}{8} I_0 = \frac{1}{2} I_0 \cos^2 \theta$$

$$\cos^2 \theta = \frac{1}{4}, \left[\cos \theta = \frac{1}{2} \right]; [\theta = 60^\circ]$$

Ans

Q8. Distinguish b/w positive & negative crystals in which double refraction occur.

Features	Positive Crystal	Negative Crystal
Relation b/w refractive indices	$n_e > n_o$	$n_e < n_o$
velocity of E-Ray	Slower than ordinary ray	Slower than E-Ray
velocity of O-Ray	Faster than E-Ray	Slower than E-Ray
Example	Quartz	Calcite, Tourmaline.

Q9. Define Biot's Law of optical activity —

Ans: Biot's Law of optical activity states that —

- 1) The angle of rotation (θ) of the plane of polarization of plane-polarized light passing through an optically active substance is directly proportional to the length (L) of the substance through which the light passes.
- 2) For solutions & vapours, the angle of rotation is also directly $\propto$ to concentration of optically active substances.
- 3) The angle of rotation is inversely $\propto$ to the square of wavelength of light used.

In mathematical: $\theta \propto L$ & $\theta \propto C$; $\theta \propto \frac{1}{\lambda^2}$

$$\theta = \alpha LC$$

where, α is the constant —

Q10. Define optic axis & principal section of a double refracting crystal.

Ans: Optic axis: The optic axis of a double refracting crystal is the direction in the crystal along which light does not experience double refraction.
i.e. - it travels as a single ray.

① Principal Section: The principal section is a plane that contains the optic axis and is perpendicular to the crystal's refracting surface. It is important in analyzing the behaviour of polarized light in the crystal.

Assignment-4

Assignment: 04

①

Q1: What is a "LASER" write its full form?

Ans: A LASER is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. So, the full form of LASER: Light Amplification of Stimulated Emission of radiation.

Q2: Define Spatial and temporal coherence.

Ans: Spatial Coherence: Spatial Coherence refers to the degree of correlation b/w waves at different in space.

Temporal Coherence: Temporal Coherence refers to the degree of correlation b/w waves at different moment in time.

Q3: Discuss Spontaneous and Stimulated emission of radiation.

Ans: Spontaneous emission: Spontaneous emission occurs randomly without external influence.

Stimulated emission: Stimulated emission is triggered by an incoming photon resulting in two photons with identical properties being emitted.

Q4: What is 'Optical Pumping' in LASER?

Ans: Optical pumping is a process in which light is used to raise or (pump) electrons from a lower energy level in an atom or molecule to a higher one. It is common and used in laser construction to pump the active laser medium.

Q5: Define a resonance cavity in laser.

Ans: Resonance cavity also known as optical resonator is an arrangement of mirrors or other optical element designed to confine light waves and allow them to circulate within a closed path.

Q6: What is the use of meta stable states in laser?

Ans: Metastable states are crucial in laser operation because they allow for a sustained population inversion.

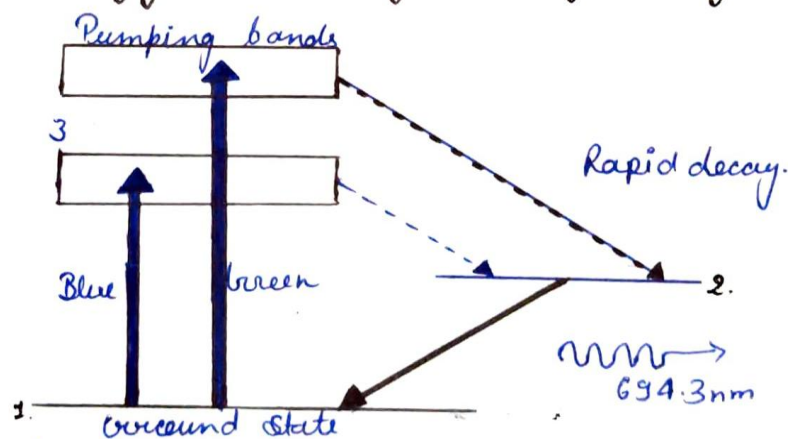
Q7: Define the term "Population inversion" in laser. ⑦
 Ans: Population inversion is a condition where more atoms are in an excited state than in the ground state enabling laser action.

Q8: Write the five applications of lasers.
 Ans: Laser has five applications —

- (i) Manufacturing: Lasers are used in various manufacturing process like cutting, welding & drilling materials with high precision & speed.
- (ii) Medical application: Lasers are use in surgeries, like eye surgeries.
- (iii). Communication: Lasers are crucial in optical fiber communication system.
- (iv). Scientific research: Lasers are use in spectroscopy to analyse material.
- (v). Everyday Device: Lasers are found in laser scanners checkout.

Ques 9: Draw energy level diagram of Ruby Laser.

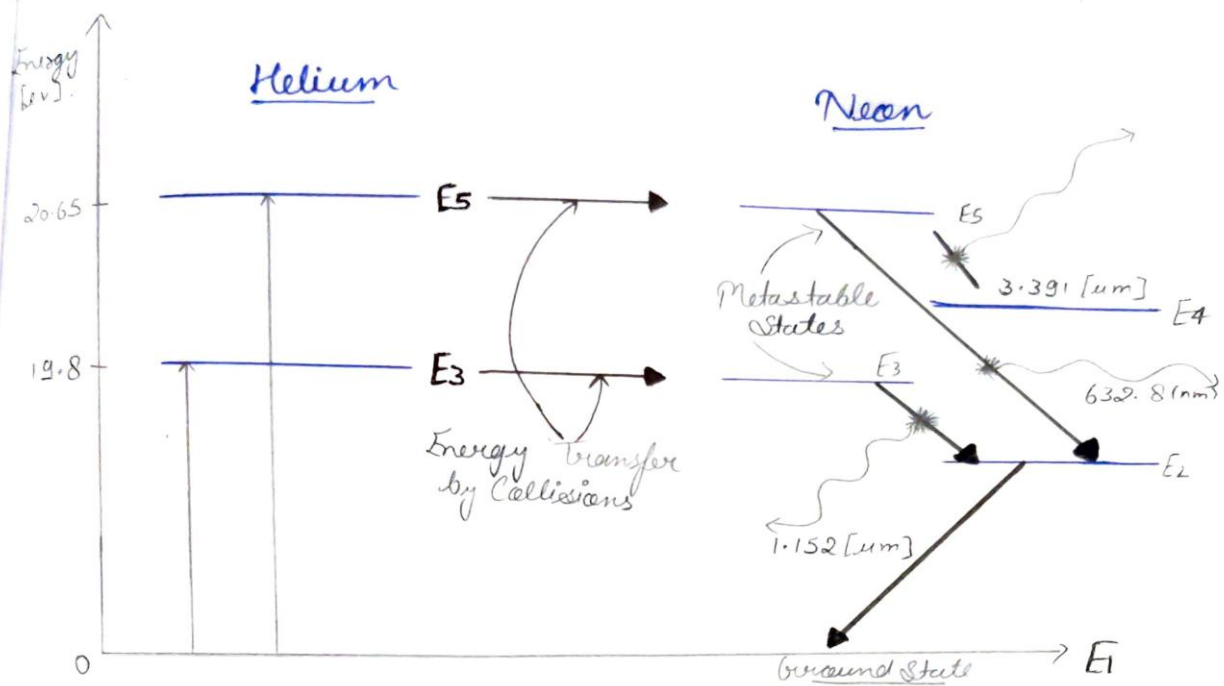
Ans.



This diagram above shows the energy levels involved in the ruby laser.

Ques 10: Draw energy level diagram of He-Ne laser.

Ans: The energy level diagram of He-Ne laser is —



He-Ne Laser Diagram.

Assignment-5

Assignment: 05.

Q1. Derive Lorentz transformation -

Ans: The Lorentz transformation is a set of eq^s that relates the space and time co-ordinates of two inertial observers moving at a constant velocity relative to each other.

It is foundational in Einstein's theory of special relativity -

Derivation: Assume linear transformation b/w frames -

$$x' = A(x - vt)$$
$$t' = \beta(d - \frac{vx}{c^2})$$

Now substitute -

$$x' = A(ct - vt)$$
$$= A(c - v)t$$

$$t' = \beta(d - \frac{vx}{c^2})$$
$$= \beta(1 - \frac{v}{c})t$$

$$\frac{x'}{t'} = \frac{A(c - v)}{\beta(1 - \frac{v}{c})} = c = 1$$

Now, Determine A or γ

$$x^2 - c^2 t^2 = x'^2 - c^2 t'^2$$

Substitute - $x' = A(x - vt)$

$$t' = A(t - \frac{vx}{c^2})$$

$$x^2 - c^2 t^2 = A^2[(x - vt)^2 - c^2(t - \frac{vx}{c^2})^2]$$

$$x^2(1 - \frac{v^2}{c^2}) + t^2[v^2 - c^2] = x^2 - c^2 t^2$$

Now, we want -

$$= A^2[x^2(1 - \frac{v^2}{c^2}) + t^2(v^2 - c^2)]$$

$$= x^2 - c^2 t^2$$

$$A^2 = \frac{1}{1 - \frac{v^2}{c^2}}$$

$$A = \gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\left[\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \right] \text{ Ans}$$

Q. Show that even particle do not have rest mass have energy and momentum and thus derive -

$$E^2 = p^2 c^2 + m_0^2 c^4$$

Let's prove that -
 Total Energy $\Rightarrow E = \gamma m_0 c^2$
 momentum $\Rightarrow p = \gamma m_0 v$

where, $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$

m_0 = rest mass

v = velocity.

c = speed of light.

Let's derive it,

$$E^2 = (\gamma m_0 c^2)^2 = \gamma^2 m_0^2 c^4$$

$$p^2 = (\gamma m_0 v)^2 = \gamma^2 m_0^2 v^2$$

multiply the momentum by c^2 -

$$E^2 - p^2 c^2 = \gamma^2 m_0^2 c^4 - \gamma^2 m_0^2 v^2 c^2$$

$$= \gamma^2 m_0^2 c^2 (c^2 - v^2)$$

$$\therefore \left[\gamma^2 = \frac{1}{1 - \frac{v^2}{c^2}} \right]$$

$$\gamma^2 (c^2 - v^2) = c^2$$

$$E^2 - p^2 c^2 = m_0^2 c^4$$

Now, $E^2 = p^2 c^2 + m_0^2 c^4$

$$\therefore (m_0 = 0)$$

$$E^2 = p^2 c^2$$

$$[E = pc]$$

Energy $(E) = h\nu$

momentum $\Rightarrow p = \frac{E}{c} = \frac{h\nu}{c}$

$$[E^2 = p^2 c^2 + m_0^2 c^4]$$

Q.E.D.

Ques 3. Show that $[x'^2 + y'^2 + z'^2 - c^2 t'^2 = x^2 + y^2 + z^2 - c^2 t^2]$ is invariant under Lorentz transformation.

Ans: Lorentz transformation.

[For motion X-axis]

$$x' = \gamma(x - vt)$$

$$y' = y$$

$$z' = z$$

$$t' = \gamma\left(t - \frac{vx}{c^2}\right)$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Now, Compute; LHS;

$$x'^2 + y'^2 + z'^2 - c^2 t'^2$$

Substitute x' & t' -

$$\gamma^2(x - vt)^2 + y^2 + z^2 - c^2 \gamma^2\left(t - \frac{vx}{c^2}\right)^2$$

Now expand both squares -

$$1). (x - vt)^2 = x^2 - 2xvt + v^2 t^2$$

$$2). \left(t - \frac{vx}{c^2}\right)^2 = t^2 - \frac{2vxt}{c^2} + \frac{v^2 x^2}{c^4}$$

Now substitute & expand -

$$= \gamma^2 x^2 - 2\gamma^2 xvt + \gamma^2 v^2 t^2 + y^2 + z^2 - c^2 \gamma^2 \left[t^2 - \frac{2vxt}{c^2} + \frac{v^2 x^2}{c^4}\right]$$

$$\Rightarrow \gamma^2 x^2 - \gamma^2 \frac{v^2 x^2}{c^2} - \gamma^2 x^2 \left(1 - \frac{v^2}{c^2}\right).$$

Combine xvt terms -

$$- 2\gamma^2 xvt + 2\gamma^2 xvt = 0$$

$$\gamma^2 = \frac{1}{1 - \frac{v^2}{c^2}} \Rightarrow \gamma^2 \left(1 - \frac{v^2}{c^2}\right) = 1$$

$$\gamma^2 (c^2 - v^2) = c^2$$

L.H.S $x^2 + y^2 + z^2 - c^2 t^2.$

$$[x'^2 + y'^2 + z'^2 - c^2 t'^2 = x^2 + y^2 + z^2 - c^2 t^2]$$

Hence proved

Q4: Explain the difference b/w invariant & conserve quantity.
 Ans: In simple terms, the difference b/w invariant & conserve quantity.

Property	Invariant quantity	Conserved quantity
Constant for all observers.	Yes (Frame-independent)	Not necessary
Constant over time	Not necessarily	Yes, is an isolated system.
Related to transformations	Lorentz invariance	Noether's theorem
Example	Spacetime, intervals, rest mass	Energy, momentum, charge

Q5: Define proper time & proper length -

Ans: Proper time: It is the time measured by a clock that is moving with you.

$$\text{Formula} \Rightarrow \tau = \frac{t}{\gamma} \Rightarrow t \sqrt{1 - \frac{v^2}{c^2}}$$

t = time

v = relative velocity.

c = speed of light

γ = Lorentz Factor.

Proper Length: It is actual length of an object measured when the object is not moving.

$$\text{Formula} \Rightarrow L = \frac{L_0}{\gamma}$$

$$\left[L_0 = \sqrt{1 - \frac{v^2}{c^2}} \right]$$

L_0 = Proper Length

L = Contracted Length

Ans

Q6: At what speed should a clock be moved so that it may appear to lose 1 minute in each hour.

Ans: Let,

$$t = 60 \text{ minutes.}$$

$$T = 59 \text{ minutes} \rightarrow \text{Proper time}$$

$$v = \text{speed of moving clock}$$

$$c = \text{speed of light.}$$

$$\left[\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \right]$$

use the time dilation formula.

$$T = \frac{t}{\gamma}$$

$$\left[\gamma = \frac{t}{T} \right]$$

$$\text{Substitute} \rightarrow \gamma = \frac{60}{59}$$

$$\gamma = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\frac{60}{59} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Now square both sides -

$$\left(\frac{60}{59} \right)^2 = \frac{1}{1 - \frac{v^2}{c^2}}$$

$$1 - \frac{v^2}{c^2} = \left(\frac{59}{60} \right)^2$$

$$\frac{v^2}{c^2} = 1 - \left(\frac{59}{60} \right)^2$$

$$= 1 - \frac{3481}{3600}$$

$$= \frac{119}{3600}$$

$$\therefore \frac{v}{c} = \sqrt{\frac{119}{3600}} = \underline{\underline{0.1819}}$$

$$v = 0.1819 \times c$$

$$v = 0.1819 \times 3 \times 10^8 \text{ m/s}$$

$$\left[v = 5.46 \times 10^7 \text{ m/s} \right]$$

Ans.

Attendance Sheet (Month-wise) Section-A

Attendance for the month of Sep 2024

		Day	11	12	14	17	18	19	25	26
		Month	Sep	Sep	Sep	Sep	Sep	Sep	Sep	Sep
Sl.	Enrollment No.	Student Name								
1	TCA2409001	ABDUL MUNEEB KHAN	P	P		P	P	P	P	P
2	TCA2409002	ABDUS SUBOOR KHAN	P	P	P	P	P	P	P	P
3	TCA2409004	ABHAY RAJ SINGH	P		P	P	P	P	P	P
4	TCA2409005	ABHIMANYU RAI	P	P	P	P	P	P	P	P
5	TCA2409006	ABHINAV SUNIL PATIL		P	P	P	P	P	P	P
6	TCA2409007	ABHISHEK JAIN	P	P		P	P	P	P	P
7	TCA2409008	ABHISHEK KUMAR	P	P	P	P	P	P		P
8	TCA2409010	ABHISHEK SHUKLA	P	P	P	P	P	P	P	P
9	TCA2409013	ADI JAIN	P	P	P	P	P	P	P	P
10	TCA2409014	ADITYA	P	P	P	P	P	P	P	P
11	TCA2409016	AJAY KUMAR	P	P	P	P	P	P	P	
12	TCA2409020	AKSHITA JAIN	P	P	P	P	P	P		P
13	TCA2409021	AMAAN SHAHID	P	P	P	P		P	P	P
14	TCA2409022	AMAN THAPAN	P	P		P	P	P	P	P
15	TCA2409025	AMRUTA VILAS HUDDAR	P		P	P	P	P	P	P
16	TCA2409026	ANAMTA NAQVI		P	P	P	P	P	P	P
17	TCA2409027	ANAND MISHRA	P		P	P	P	P	P	P
18	TCA2409028	ANAND RAJ	P	P		P	P	P	P	P
19	TCA2409029	ANIMESH JAIN	P	P	P	P		P	P	P
20	TCA2409030	ANIMESH JAIN	P	P	P	P	P	P		P
21	TCA2409032	ANKIT KUMAR	P	P	P	P	P	P	P	P

22	TCA2409033	ANKIT KUMAR	P	P	P	P	P	P	P	P
23	TCA2409034	ANKIT KUMAR	P	P	P	P	P	P	P	P
24	TCA2409037	ANSH CHAUDHARY	P	P	P	P	P	P	P	P
25	TCA2409038	ANSH JAIN	P	P	P	P	P	P		P
26	TCA2409039	ANSHIK KUMAR GUPTA	P	P	P	P		P	P	P
27	TCA2409041	ANUJ PAL	P	P		P	P	P	P	P
28	TCA2409042	ANURAG YADAV		P	P	P	P	P	P	P
29	TCA2409044	ANVI JAIN	P	P	P	P		P	P	P
30	TCA2409045	ARCHANA KUMARI	P	P	P	P	P	P		P
31	TCA2409047	ARPAN KUMAR	P	P	P	P	P	P	P	P
32	TCA2409048	ARPIT JAIN	P	P	P	P	P	P	P	P
33	TCA2409049	ARUN	P	P	P	P	P	P	P	P
34	TCA2409050	ARUN KUMAR	P	P	P	P	P	P	P	P
35	TCA2409052	ASHUTOSH KUMAR	P	P	P	P	P	P	P	P
36	TCA2409053	ASHUTOSH KUMAR RAI	P	P	P	P	P	P	P	
37	TCA2409055	ATUL KUMAR GUPTA	P	P	P	P	P	P	P	P
38	TCA2409056	AVADHESH KUMAR SHARMA	P	P	P	P	P	P	P	P
39	TCA2409058	AYUSH SINGH	P	P	P	P	P	P	P	P
40	TCA2409059	AZHAAN MOHAMMAD KHAN	P	P	P	P	P	P	P	
41	TCA2409060	DAKSH JAIN	P	P	P	P		P	P	P
42	TCA2409061	DAKSH RUHELA	P		P	P	P	P	P	P
43	TCA2409064	DIVYANSH BHARDWAJ		P	P	P	P	P	P	P
44	TCA2409066	DIVYANSHU KUMAR	P	P	P	P		P	P	P
45	TCA2409067	GAGANDEEP SHARMA	P		P	P	P	P	P	P

46	TCA2409072	GYAYAK PATODI	P		P	P	P	P	P	P
47	TCA2409073	HARSH JAIN	P	P	P	P		P	P	P
48	TCA2409075	HARSHIT JAIN		P	P	P	P	P	P	P
49	TCA2409077	HEMANT CHAHAL		P	P	P	P	P	P	P
50	TCA2409078	HIMANSHU JAIN	P		P	P	P	P	P	P
51	TCA2409081	HRITHIK PAWAR		P	P	P	P	P	P	P
52	TCA2409083	JAMSHED ALAM	P	P	P	P		P	P	P
53	TCA2409084	JAY RAM KUMAR MANDAL	P	P	P	P		P	P	P
54	TCA2409086	KAMAL	P		P	P	P	P	P	P
55	TCA2409087	KARTIK KUMAR SINGH		P	P	P	P	P	P	P
56	TCA2409089	KRATI JAIN		P	P	P	P	P	P	P
57	TCA2409091	KRISH PAL	P	P	P	P		P	P	P
58	TCA2409092	LAKSHYA GAHLOUT	P		P	P	P	P	P	P
59	TCA2409095	MAHAK JAIN		P	P	P	P	P	P	P
60	TCA2409096	MANAS MADHAV	P		P	P	P	P	P	P

Attendance for the month of Oct. 2024

		Day	4	7	8	9	15	16	24	25	28
		Month	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.
Sl.	Enrollment No.	Student Name									
1	TCA2409001	ABDUL MUNEEB KHAN	P	P		P	P	P	P	P	P
2	TCA2409002	ABDUS SUBOOR KHAN	P	P	P	P	P	P	P	P	P
3	TCA2409004	ABHAY RAJ SINGH	P		P	P	P	P	P	P	P
4	TCA2409005	ABHIMANYU RAI	P	P	P	P	P	P	P	P	P
5	TCA2409006	ABHINAV SUNIL		P	P	P	P	P	P	P	P

		PATIL										
6	TCA2409007	ABHISHEK JAIN	P	P		P	P	P	P	P	P	P
7	TCA2409008	ABHISHEK KUMAR	P	P	P	P	P	P		P	P	
8	TCA2409010	ABHISHEK SHUKLA	P	P	P	P	P	P	P	P	P	P
9	TCA2409013	ADI JAIN	P	P	P	P	P	P	P	P	P	P
10	TCA2409014	ADITYA	P	P	P	P	P	P	P	P	P	P
11	TCA2409016	AJAY KUMAR	P		P	P	P	P	P	P	P	P
12	TCA2409020	AKSHITA JAIN	P	P	P	P	P	P		P	P	
13	TCA2409021	AMAAN SHAHID	P	P	P	P		P	P	P	P	P
14	TCA2409022	AMAN THAPAN	P	P		P	P	P	P	P	P	P
15	TCA2409025	AMRUTA VILAS HUDDAR	P		P	P	P	P	P	P	P	P
16	TCA2409026	ANAMTA NAQVI		P	P	P	P	P	P	P	P	P
17	TCA2409027	ANAND MISHRA	P		P	P	P	P	P	P	P	P
18	TCA2409028	ANAND RAJ	P	P		P	P	P	P	P	P	P
19	TCA2409029	ANIMESH JAIN	P	P	P	P		P	P	P	P	P
20	TCA2409030	ANIMESH JAIN	P	P	P	P	P	P		P	P	
21	TCA2409032	ANKIT KUMAR	P	P	P	P	P	P	P	P		
22	TCA2409033	ANKIT KUMAR	P	P	P	P	P	P	P	P	P	P
23	TCA2409034	ANKIT KUMAR	P	P	P	P	P	P	P	P	P	P
24	TCA2409037	ANSH CHAUDHARY	P	P	P	P	P	P	P	P		
25	TCA2409038	ANSH JAIN	P	P	P	P	P	P		P	P	
26	TCA2409039	ANSHIK KUMAR GUPTA	P	P	P	P		P	P	P	P	P
27	TCA2409041	ANUJ PAL	P	P		P	P	P	P	P	P	P
28	TCA2409042	ANURAG YADAV		P	P	P	P	P	P	P	P	P
29	TCA2409044	ANVI JAIN	P	P	P	P		P	P	P	P	P
30	TCA2409045	ARCHANA KUMARI	P	P	P	P	P	P		P	P	
31	TCA2409047	ARPAN KUMAR	P	P	P	P	P	P	P	P		

32	TCA2409048	ARPIT JAIN	P	P	P	P	P	P	P	P	P	P
33	TCA2409049	ARUN	P	P	P	P	P	P	P	P	P	P
34	TCA2409050	ARUN KUMAR	P	P	P	P	P	P	P	P	P	P
35	TCA2409052	ASHUTOSH KUMAR	P	P	P	P	P	P	P	P		
36	TCA2409053	ASHUTOSH KUMAR RAI	P	P	P	P	P	P	P			P
37	TCA2409055	ATUL KUMAR GUPTA	P	P	P	P	P	P	P	P	P	P
38	TCA2409056	AVADHESH KUMAR SHARMA	P	P	P	P	P	P	P	P	P	P
39	TCA2409058	AYUSH SINGH	P	P	P	P	P	P	P	P		
40	TCA2409059	AZHAAN MOHAMMAD KHAN	P	P	P	P	P	P	P			P`
41	TCA2409060	DAKSH JAIN	P	P	P	P		P	P	P	P	P
42	TCA2409061	DAKSH RUHELA	P		P	P	P	P	P	P	P	P
43	TCA2409064	DIVYANSH BHARDWAJ		P	P	P	P	P	P	P	P	P
44	TCA2409066	DIVYANSHU KUMAR	P	P	P	P		P	P	P	P	P
45	TCA2409067	GAGANDEEP SHARMA	P		P	P	P	P	P	P	P	P
46	TCA2409072	GYAYAK PATODI	P		P	P	P	P	P	P	P	P
47	TCA2409073	HARSH JAIN	P	P	P	P		P	P	P	P	P
48	TCA2409075	HARSHIT JAIN		P	P	P	P	P	P	P	P	P
49	TCA2409077	HEMANT CHAHAL		P	P	P	P	P	P	P	P	P
50	TCA2409078	HIMANSHU JAIN	P		P	P	P	P	P	P	P	P
51	TCA2409081	HRITHIK PAWAR		P	P	P	P	P	P	P	P	P
52	TCA2409083	JAMSHED ALAM	P	P	P	P		P	P	P	P	P
53	TCA2409084	JAY RAM KUMAR MANDAL	P	P	P	P		P	P	P	P	P
54	TCA2409086	KAMAL	P		P	P	P	P	P	P	P	P
55	TCA2409087	KARTIK KUMAR		P	P	P	P	P	P	P	P	P

		SINGH									
56	TCA2409089	KRATI JAIN		P	P	P	P	P	P	P	P
57	TCA2409091	KRISH PAL	P	P	P	P		P	P	P	P
58	TCA2409092	LAKSHYA GAHLOUT	P		P	P	P	P	P	P	P
59	TCA2409095	MAHAK JAIN		P	P	P	P	P	P	P	P
60	TCA2409096	MANAS MADHAV	P		P	P	P	P	P	P	P

Attendance for the month of Nov. 2024

		Day	8	11	13	14	18	19	26	27
		Month	Nov.	Nov.	Nov.	Nov.	Nov.	Nov.	Nov.	Nov.
Sl.	Enrollment No.	Student Name								
1	TCA2409001	ABDUL MUNEEB KHAN	P	P		P	P	P	P	P
2	TCA2409002	ABDUS SUBOOR KHAN	P	P	P	P	P	P	P	P
3	TCA2409004	ABHAY RAJ SINGH	P		P	P	P	P	P	P
4	TCA2409005	ABHIMANYU RAI	P	P	P	P	P	P	P	P
5	TCA2409006	ABHINAV SUNIL PATIL		P	P	P	P	P	P	P
6	TCA2409007	ABHISHEK JAIN	P	P		P	P	P	P	P
7	TCA2409008	ABHISHEK KUMAR	P	P	P	P	P	P		P
8	TCA2409010	ABHISHEK SHUKLA	P	P	P	P	P	P	P	P
9	TCA2409013	ADI JAIN	P	P	P	P	P	P	P	P
10	TCA2409014	ADITYA	P	P	P	P	P	P	P	P
11	TCA2409016	AJAY KUMAR	P	P	P	P	P	P	P	
12	TCA2409020	AKSHITA JAIN	P	P	P	P	P	P		P
13	TCA2409021	AMAAN SHAHID	P	P	P	P		P	P	P
14	TCA2409022	AMAN THAPAN	P	P		P	P	P	P	P

15	TCA2409025	AMRUTA VILAS HUDDAR	P		P	P	P	P	P	P
16	TCA2409026	ANAMTA NAQVI		P	P	P	P	P	P	P
17	TCA2409027	ANAND MISHRA	P		P	P	P	P	P	P
18	TCA2409028	ANAND RAJ	P	P		P	P	P	P	P
19	TCA2409029	ANIMESH JAIN	P	P	P	P		P	P	P
20	TCA2409030	ANIMESH JAIN	P	P	P	P	P	P		P
21	TCA2409032	ANKIT KUMAR	P	P	P	P	P	P	P	P
22	TCA2409033	ANKIT KUMAR	P	P	P	P	P	P	P	P
23	TCA2409034	ANKIT KUMAR	P	P	P	P	P	P	P	P
24	TCA2409037	ANSH CHAUDHARY	P	P	P	P	P	P	P	P
25	TCA2409038	ANSH JAIN	P	P	P	P	P	P		P
26	TCA2409039	ANSHIK KUMAR GUPTA	P	P	P	P		P	P	P
27	TCA2409041	ANUJ PAL	P	P		P	P	P	P	P
28	TCA2409042	ANURAG YADAV		P	P	P	P	P	P	P
29	TCA2409044	ANVI JAIN	P	P	P	P		P	P	P
30	TCA2409045	ARCHANA KUMARI	P	P	P	P	P	P		P
31	TCA2409047	ARPAN KUMAR	P	P	P	P	P	P	P	P
32	TCA2409048	ARPIT JAIN	P	P	P	P	P	P	P	P
33	TCA2409049	ARUN	P	P	P	P	P	P	P	P
34	TCA2409050	ARUN KUMAR	P	P	P	P	P	P	P	P
35	TCA2409052	ASHUTOSH KUMAR	P	P	P	P	P	P	P	P
36	TCA2409053	ASHUTOSH KUMAR RAI	P	P	P	P	P	P	P	
37	TCA2409055	ATUL KUMAR GUPTA	P		P	P	P	P	P	P
38	TCA2409056	AVADHESH KUMAR SHARMA	P	P	P	P	P	P	P	P
39	TCA2409058	AYUSH SINGH	P	P	P	P	P	P	P	P

40	TCA2409059	AZHAAN MOHAMMAD KHAN	P	P	P	P	P	P	P	
41	TCA2409060	DAKSH JAIN	P	P	P	P		P	P	P
42	TCA2409061	DAKSH RUHELA	P		P	P	P	P	P	P
43	TCA2409064	DIVYANSH BHARDWAJ		P	P	P	P	P	P	P
44	TCA2409066	DIVYANSHU KUMAR	P	P	P	P		P	P	P
45	TCA2409067	GAGANDEEP SHARMA	P		P	P	P	P	P	P
46	TCA2409072	GYAYAK PATODI	P		P	P	P	P	P	P
47	TCA2409073	HARSH JAIN	P	P	P	P		P	P	P
48	TCA2409075	HARSHIT JAIN		P	P	P	P	P	P	P
49	TCA2409077	HEMANT CHAHAL		P	P	P	P	P	P	P
50	TCA2409078	HIMANSHU JAIN	P		P	P	P	P	P	P
51	TCA2409081	HRITHIK PAWAR		P	P	P	P	P	P	P
52	TCA2409083	JAMSHED ALAM	P	P	P	P		P	P	P
53	TCA2409084	JAY RAM KUMAR MANDAL	P		P	P	P	P	P	P
54	TCA2409086	KAMAL	P		P	P	P	P	P	P
55	TCA2409087	KARTIK KUMAR SINGH		P	P	P	P	P	P	P
56	TCA2409089	KRATI JAIN		P	P	P	P	P	P	P
57	TCA2409091	KRISH PAL	P	P	P	P		P	P	P
58	TCA2409092	LAKSHYA GAHLOUT	P		P	P	P	P	P	P
59	TCA2409095	MAHAK JAIN		P	P	P	P	P	P	P
60	TCA2409096	MANAS MADHAV	P		P	P	P	P	P	P

Attendance Sheet (Month-wise) Section-B

Attendance for the month of Sep 2024

		Day	11	12	14	17	18	19	25	26
		Month	Sep	Sep	Sep	Sep	Sep	Sep	Sep	Sep
Sl.	Enrollment No.	Student Name								
1	TCA2409097	MANISEN GUPTA	P	P		P	P	P	P	P
2	TCA2409099	MANYA JAIN	P	P	P	P	P	P	P	P
3	TCA2409100	MANYUPMA KUMARI	P		P	P	P	P	P	P
4	TCA2409105	MISHIKA JAIN	P	P	P	P	P	P	P	P
5	TCA2409106	MOHAMMAD AMAAN		P	P	P	P	P	P	P
6	TCA2409107	MOHAMMAD FAIZ	P	P		P	P	P	P	P
7	TCA2409109	MOHAMMAD HANZALA GAZI	P	P	P	P	P	P		P
8	TCA2409111	MOHD AYAN	P	P	P	P	P	P	P	P
9	TCA2409112	MUSKAN	P	P	P	P	P	P	P	P
10	TCA2409113	NAMAN JAIN	P	P	P	P	P	P	P	P
11	TCA2409114	NAVED ALAM	P	P	P	P	P	P	P	
12	TCA2409115	NIKET JAIN	P	P	P	P	P	P		P
13	TCA2409116	NIKSHAY JAIN	P	P	P	P		P	P	P
14	TCA2409119	OMPRAKASH	P	P		P	P	P	P	P
15	TCA2409120	PALAK JAIN	P		P	P	P	P	P	P
16	TCA2409121	PALAK SHARMA		P	P	P	P	P	P	P
17	TCA2409122	PANKAJ KUMAR	P		P	P	P	P	P	P
18	TCA2409124	PARTH JAIN	P	P		P	P	P	P	P
19	TCA2409125	PARTH SHARMA	P	P	P	P		P	P	P
20	TCA2409127	PRAJJAWAL SINGH	P	P	P	P	P	P		P
21	TCA2409128	PRAPHOOL KUMAR	P	P	P	P	P	P	P	P
22	TCA2409129	PRATEEK JAIN	P	P	P	P	P	P	P	P

23	TCA2409130	PRINCE JAIN	P	P	P	P	P	P	P	P
24	TCA2409131	PRINCE KUMAR PATEL	P	P	P	P	P	P	P	P
25	TCA2409132	PRITAN KUMAR	P	P	P	P	P	P		P
26	TCA2409135	PUNEET CHAUHAN	P	P	P	P		P	P	P
27	TCA2409137	RADHIKA	P	P		P	P	P	P	P
28	TCA2409138	RADHIKA VERMA		P	P	P	P	P	P	P
29	TCA2409139	RANJEET KUMAR	P	P	P	P		P	P	P
30	TCA2409143	RIDDHI JAIN	P	P	P	P	P	P		P
31	TCA2409146	ROCKEY RAJ	P	P	P	P	P	P	P	P
32	TCA2409148	SAMEER	P	P	P	P	P	P	P	P
33	TCA2409149	SAMYAK JAIN	P	P	P	P	P	P	P	P
34	TCA2409150	SANSKAR PATIL	P	P	P	P	P	P	P	P
35	TCA2409152	SATYAM JAIN	P	P	P	P	P	P	P	P
36	TCA2409155	SEHWAG GOUR	P	P	P	P	P	P	P	
37	TCA2409156	SHAFIA KHATOON	P	P	P	P	P	P	P	P
38	TCA2409158	SHALABH CHAUDHARY	P	P	P	P	P	P	P	P
39	TCA2409159	SHASHANK KUMAR MISHRA	P	P	P	P	P	P	P	P
40	TCA2409160	SHEETAL	P	P	P	P	P	P	P	
41	TCA2409161	SHIMPU	P	P	P	P		P	P	P
42	TCA2409162	SHIVANG YADAV	P		P	P	P	P	P	P
43	TCA2409164	SHREYA PANDEY		P	P	P	P	P	P	P
44	TCA2409166	SNEHA JAIN	P	P	P	P		P	P	P
45	TCA2409167	SONU KUMAR	P		P	P	P	P	P	P
46	TCA2409169	SRISTI RANI	P		P	P	P	P	P	P
47	TCA2409171	TANISH CHAUHAN	P	P	P	P		P	P	P
48	TCA2409172	TANZILA BASIR		P	P	P	P	P	P	P
49	TCA2409175	URJA JAIN		P	P	P	P	P	P	P
50	TCA2409176	UTKARSH CHAUHAN	P		P	P	P	P	P	P

51	TCA2409177	UTKARSH GUPTA		P	P	P	P	P	P	P
52	TCA2409179	VANDANA KUMARI	P	P	P	P		P	P	P
53	TCA2409181	VANSH JAIN	P	P	P	P		P	P	P
54	TCA2409182	VANSH KUMAR	P		P	P	P	P	P	P
55	TCA2409183	VARSHA		P	P	P	P	P	P	P
56	TCA2409185	VINAYAK AGRAHARI		P	P	P	P	P	P	P
57	TCA2409187	VISHVAMOHAN SHARMA	P	P	P	P		P	P	P
58	TCA2409189	VISHWAS RASTOGI	P		P	P	P	P	P	P
59	TCA2409190	VIVEK YADAV		P	P	P	P	P	P	P
60	TCA2409193	ZAINAB AYYOOB	P		P	P	P	P	P	P

Attendance for the month of Oct. 2024

		Day	4	7	8	9	15	16	24	25	28
		Month	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.
Sl.	Enrollment No.	Student Name									
1	TCA2409097	MANISEN GUPTA	P	P		P	P	P	P	P	P
2	TCA2409099	MANYA JAIN	P	P	P	P	P	P	P	P	P
3	TCA2409100	MANYUPMA KUMARI	P		P	P	P	P	P	P	P
4	TCA2409105	MISHIKA JAIN	P	P	P	P	P	P	P	P	P
5	TCA2409106	MOHAMMAD AMAAN		P	P	P	P	P	P	P	P
6	TCA2409107	MOHAMMAD FAIZ	P	P		P	P	P	P	P	P
7	TCA2409109	MOHAMMAD HANZALA GAZI	P	P	P	P	P	P		P	P
8	TCA2409111	MOHD AYAN	P	P	P	P	P	P	P	P	P
9	TCA2409112	MUSKAN	P	P	P	P	P	P	P	P	P
10	TCA2409113	NAMAN JAIN	P	P	P	P	P	P	P	P	P

11	TCA2409114	NAVED ALAM	P		P	P	P	P	P	P	P	P
12	TCA2409115	NIKET JAIN	P	P	P	P	P	P		P	P	
13	TCA2409116	NIKSHAY JAIN	P	P	P	P		P	P	P	P	
14	TCA2409119	OMPRAKASH	P	P		P	P	P	P	P	P	P
15	TCA2409120	PALAK JAIN	P		P	P	P	P	P	P	P	P
16	TCA2409121	PALAK SHARMA		P	P	P	P	P	P	P	P	P
17	TCA2409122	PANKAJ KUMAR	P		P	P	P	P	P	P	P	P
18	TCA2409124	PARTH JAIN	P	P		P	P	P	P	P	P	P
19	TCA2409125	PARTH SHARMA	P	P	P	P		P	P	P	P	P
20	TCA2409127	PRAJJAWAL SINGH	P	P	P	P	P	P		P	P	
21	TCA2409128	PRAPHOOL KUMAR	P	P	P	P	P	P	P	P		
22	TCA2409129	PRATEEK JAIN	P	P	P	P	P	P	P	P	P	P
23	TCA2409130	PRINCE JAIN	P	P	P	P	P	P	P	P	P	P
24	TCA2409131	PRINCE KUMAR PATEL	P	P	P	P	P	P	P	P		
25	TCA2409132	PRITAN KUMAR	P	P	P	P	P	P		P	P	
26	TCA2409135	PUNEET CHAUHAN	P	P	P	P		P	P	P	P	P
27	TCA2409137	RADHIKA	P	P		P	P	P	P	P	P	P
28	TCA2409138	RADHIKA VERMA		P	P	P	P	P	P	P	P	P
29	TCA2409139	RANJEET KUMAR	P	P	P	P		P	P	P	P	P
30	TCA2409143	RIDDHI JAIN	P	P	P	P	P	P		P	P	
31	TCA2409146	ROCKEY RAJ	P	P	P	P	P	P	P	P		
32	TCA2409148	SAMEER	P	P	P	P	P	P	P	P	P	P
33	TCA2409149	SAMYAK JAIN	P	P	P	P	P	P	P	P	P	P
34	TCA2409150	SANSKAR PATIL	P	P	P	P	P	P	P	P	P	P
35	TCA2409152	SATYAM JAIN	P	P	P	P	P	P	P	P		
36	TCA2409155	SEHWAG GOUR	P	P	P	P	P	P	P			P
37	TCA2409156	SHAFIA KHATOON	P	P	P	P	P	P	P	P	P	P
38	TCA2409158	SHALABH CHAUDHARY	P	P	P	P	P	P	P	P	P	P

39	TCA2409159	SHASHANK KUMAR MISHRA	P	P	P	P	P	P	P	P	P	
40	TCA2409160	SHEETAL	P	P	P	P	P	P	P	P		P`
41	TCA2409161	SHIMPU	P	P	P	P		P	P	P	P	P
42	TCA2409162	SHIVANG YADAV	P		P	P	P	P	P	P	P	P
43	TCA2409164	SHREYA PANDEY		P	P	P	P	P	P	P	P	P
44	TCA2409166	SNEHA JAIN	P	P	P	P		P	P	P	P	P
45	TCA2409167	SONU KUMAR	P		P	P	P	P	P	P	P	P
46	TCA2409169	SRISTI RANI	P		P	P	P	P	P	P	P	P
47	TCA2409171	TANISH CHAUHAN	P	P	P	P		P	P	P	P	P
48	TCA2409172	TANZILA BASIR		P	P	P	P	P	P	P	P	P
49	TCA2409175	URJA JAIN		P	P	P	P	P	P	P	P	P
50	TCA2409176	UTKARSH CHAUHAN	P		P	P	P	P	P	P	P	P
51	TCA2409177	UTKARSH GUPTA		P	P	P	P	P	P	P	P	P
52	TCA2409179	VANDANA KUMARI	P	P	P	P		P	P	P	P	P
53	TCA2409181	VANSH JAIN	P	P	P	P		P	P	P	P	P
54	TCA2409182	VANSH KUMAR	P		P	P	P	P	P	P	P	P
55	TCA2409183	VARSHA		P	P	P	P	P	P	P	P	P
56	TCA2409185	VINAYAK AGRAHARI		P	P	P	P	P	P	P	P	P
57	TCA2409187	VISHVAMOHAN SHARMA	P	P	P	P		P	P	P	P	P
58	TCA2409189	VISHWAS RASTOGI	P		P	P	P	P	P	P	P	P
59	TCA2409190	VIVEK YADAV		P	P	P	P	P	P	P	P	P
60	TCA2409193	ZAINAB AYYOOB	P		P	P	P	P	P	P	P	P

Attendance for the month of Nov. 2024

		Day	8	11	13	14	18	19	26	27
		Month	Nov.	Nov.	Nov.	Nov.	Nov.	Nov.	Nov.	Nov.
Sl.	Enrollment No.	Student Name								
1	TCA2409097	MANISEN GUPTA	P	P		P	P	P	P	P
2	TCA2409099	MANYA JAIN	P	P	P	P	P	P	P	P
3	TCA2409100	MANYUPMA KUMARI	P		P	P	P	P	P	P
4	TCA2409105	MISHIKA JAIN	P	P	P	P	P	P	P	P
5	TCA2409106	MOHAMMAD AMAAN		P	P	P	P	P	P	P
6	TCA2409107	MOHAMMAD FAIZ	P	P		P	P	P	P	P
7	TCA2409109	MOHAMMAD HANZALA GAZI	P	P	P	P	P	P		P
8	TCA2409111	MOHD AYAN	P	P	P	P	P	P	P	P
9	TCA2409112	MUSKAN	P	P	P	P	P	P	P	P
10	TCA2409113	NAMAN JAIN	P	P	P	P	P	P	P	P
11	TCA2409114	NAVED ALAM	P	P	P	P	P	P	P	
12	TCA2409115	NIKET JAIN	P	P	P	P	P	P		P
13	TCA2409116	NIKSHAY JAIN	P	P	P	P		P	P	P
14	TCA2409119	OMPRAKASH	P	P		P	P	P	P	P
15	TCA2409120	PALAK JAIN	P		P	P	P	P	P	P
16	TCA2409121	PALAK SHARMA		P	P	P	P	P	P	P
17	TCA2409122	PANKAJ KUMAR	P		P	P	P	P	P	P
18	TCA2409124	PARTH JAIN	P	P		P	P	P	P	P
19	TCA2409125	PARTH SHARMA	P	P	P	P		P	P	P
20	TCA2409127	PRAJJAWAL SINGH	P	P	P	P	P	P		P
21	TCA2409128	PRAPHOOL KUMAR	P	P	P	P	P	P	P	P
22	TCA2409129	PRATEEK JAIN	P	P	P	P	P	P	P	P
23	TCA2409130	PRINCE JAIN	P	P	P	P	P	P	P	P

24	TCA2409131	PRINCE KUMAR PATEL	P	P	P	P	P	P	P	P
25	TCA2409132	PRITAN KUMAR	P	P	P	P	P	P		P
26	TCA2409135	PUNEET CHAUHAN	P	P	P	P		P	P	P
27	TCA2409137	RADHIKA	P	P		P	P	P	P	P
28	TCA2409138	RADHIKA VERMA		P	P	P	P	P	P	P
29	TCA2409139	RANJEET KUMAR	P	P	P	P		P	P	P
30	TCA2409143	RIDDHI JAIN	P	P	P	P	P	P		P
31	TCA2409146	ROCKEY RAJ	P	P	P	P	P	P	P	P
32	TCA2409148	SAMEER	P	P	P	P	P	P	P	P
33	TCA2409149	SAMYAK JAIN	P	P	P	P	P	P	P	P
34	TCA2409150	SANSKAR PATIL	P	P	P	P	P	P	P	P
35	TCA2409152	SATYAM JAIN	P	P	P	P	P	P	P	P
36	TCA2409155	SEHWAG GOUR	P	P	P	P	P	P	P	
37	TCA2409156	SHAFIA KHATOON	P		P	P	P	P	P	P
38	TCA2409158	SHALABH CHAUDHARY	P	P	P	P	P	P	P	P
39	TCA2409159	SHASHANK KUMAR MISHRA	P	P	P	P	P	P	P	P
40	TCA2409160	SHEETAL	P	P	P	P	P	P	P	
41	TCA2409161	SHIMPU	P	P	P	P		P	P	P
42	TCA2409162	SHIVANG YADAV	P		P	P	P	P	P	P
43	TCA2409164	SHREYA PANDEY		P	P	P	P	P	P	P
44	TCA2409166	SNEHA JAIN	P	P	P	P		P	P	P
45	TCA2409167	SONU KUMAR	P		P	P	P	P	P	P
46	TCA2409169	SRISTI RANI	P		P	P	P	P	P	P
47	TCA2409171	TANISH CHAUHAN	P	P	P	P		P	P	P
48	TCA2409172	TANZILA BASIR		P	P	P	P	P	P	P
49	TCA2409175	URJA JAIN		P	P	P	P	P	P	P
50	TCA2409176	UTKARSH CHAUHAN	P		P	P	P	P	P	P
51	TCA2409177	UTKARSH GUPTA		P	P	P	P	P	P	P

52	TCA2409179	VANDANA KUMARI	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>		<i>P</i>	<i>P</i>	<i>P</i>
53	TCA2409181	VANSH JAIN	<i>P</i>		<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>
54	TCA2409182	VANSH KUMAR	<i>P</i>		<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>
55	TCA2409183	VARSHA		<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>
56	TCA2409185	VINAYAK AGRAHARI		<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>
57	TCA2409187	VISHVAMOHAN SHARMA	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>		<i>P</i>	<i>P</i>	<i>P</i>
58	TCA2409189	VISHWAS RASTOGI	<i>P</i>		<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>
59	TCA2409190	VIVEK YADAV		<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>
60	TCA2409193	ZAINAB AYYOOB	<i>P</i>		<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>	<i>P</i>

List of Slow Learner Students of Class Test and Action Taken

Section-A

Identification of slow Learners after CT-1

1.	TCA2409001	ABDULMUNEEBKHAN	4.67
2.	TCA2409002	ABDUSSUBOORKHAN	1
3.	TCA2409004	ABHAYRAJSINGH	3.33
4.	TCA2409005	ABHIMANYURAI	3.33
5.	TCA2409006	ABHINAVSUNILPATIL	3.67
6.	TCA2409008	ABHISHEKKUMAR	1
7.	TCA2409010	ABHISHEKSHUKLA	4
8.	TCA2409013	ADIJAIN	0.67
9.	TCA2409014	ADITYA	0.67
10.	TCA2409016	AJAYKUMAR	2.33
11.	TCA2409021	AMAANSHAHID	2.33
12.	TCA2409022	AMANTHAPAN	3.33
13.	TCA2409025	AMRUTAVILASHUDDAR	3
14.	TCA2409027	ANANDMISHRA	1.67
15.	TCA2409028	ANANDRAJ	2
16.	TCA2409029	ANIMESHJAIN	4.67
17.	TCA2409030	ANIMESHJAIN	3.33
18.	TCA2409032	ANKITKUMAR	4
19.	TCA2409033	ANKITKUMAR	4
20.	TCA2409034	ANKITKUMAR	2.67
21.	TCA2409037	ANSHCHAUDHARY	4
22.	TCA2409042	ANURAGYADAV	3.67
23.	TCA2409049	ARUN	2.33
24.	TCA2409050	ARUNKUMAR	2
25.	TCA2409052	ASHUTOSHKUMAR	2.67
26.	TCA2409053	ASHUTOSHKUMARRAI	2.33
27.	TCA2409055	ATULKUMARGUPTA	2.67
28.	TCA2409059	AZHAANMOHAMMAD KHAN	2.67

29.	TCA2409064	DIVYANSHBHARDWAJ	4.33
30.	TCA2409066	DIVYANSHUKUMAR	2.33
31.	TCA2409067	GAGANDEEPSHARMA	2.67
32.	TCA2409072	GYAYAKPATODI	2.67
33.	TCA2409075	HARSHITJAIN	1
34.	TCA2409081	HRITHIKPAWAR	3
35.	TCA2409083	JAMSHEDALAM	2
36.	TCA2409084	JAYRAMKUMAR MANDAL	2.33
37.	TCA2409086	KAMAL	1
38.	TCA2409091	KRISHPAL	3
39.	TCA2409092	LAKSHYAGAHLOUT	3.33
40.	TCA2409096	MANASMADHAV	1.33

Special classes with attendance sheet of slow learners with ATR after CT-I

- Topics have been identified for slow learners after CT-1 as given below
 - Theory of Fresnel's Bi-Prism
 - Michelson's interferometer
 - Newton's ring
 - Rayleigh's criterion of resolution, resolving power of diffraction grating and telescope.
 - Single slit diffraction
- After special/remedial classes circular, classes had been taken as per below attendance sheet

Attendance Sheet

Classes for Slow Learners After First CT			Date/Month			
S.NO.	Enrollment No.	Name	21/09	28/09	04/10	11/10
1.	TCA2409001	ABDULMUNEEBKHAN	P	P	A	P
2.	TCA2409002	ABDUSSUBOORKHAN	P	P	P	P
3.	TCA2409004	ABHAYRAJSINGH	P	A	P	P
4.	TCA2409005	ABHIMANYURAI	P	P	P	P

5.	TCA2409006	ABHINAVSUNILPATIL	P	P	P	P
6.	TCA2409008	ABHISHEKKUMAR	P	P	P	P
7.	TCA2409010	ABHISHEKSHUKLA	P	P	P	P
8.	TCA2409013	ADIJAIN	P	P	P	P
9.	TCA2409014	ADITYA	P	P	A	P
10.	TCA2409016	AJAYKUMAR	P	P	P	P
11.	TCA2409021	AMAANSHAHID	A	P	P	P
12.	TCA2409022	AMANTHAPAN	P	P	P	P
13.	TCA2409025	AMRUTAVILASHUDDAR	P	P	P	P
14.	TCA2409027	ANANDMISHRA	P	P	P	P
15.	TCA2409028	ANANDRAJ	P	P	P	P
16.	TCA2409029	ANIMESHJAIN	P	P	P	P
17.	TCA2409030	ANIMESHJAIN	P	P	P	P
18.	TCA2409032	ANKITKUMAR	P	P	P	P
19.	TCA2409033	ANKITKUMAR	P	P	P	P
20.	TCA2409034	ANKITKUMAR	P	P	P	P
21.	TCA2409037	ANSHCHAUDHARY	P	P	P	A
22.	TCA2409042	ANURAGYADAV	P	P	P	P
23.	TCA2409049	ARUN	P	P	P	P
24.	TCA2409050	ARUNKUMAR	P	P	P	P
25.	TCA2409052	ASHUTOSHKUMAR	A	P	P	P
26.	TCA2409053	ASHUTOSHKUMARRAI	P	P	P	P
27.	TCA2409055	ATULKUMARGUPTA	P	P	P	P
28.	TCA2409059	AZHAANMOHAMMAD KHAN	P	P	P	P
29.	TCA2409064	DIVYANSHBHARDWAJ	P	P	P	P
30.	TCA2409066	DIVYANSHKUMAR	P	P	A	P
31.	TCA2409067	GAGANDEEPSHARMA	P	P	P	P
32.	TCA2409072	GYAYAKPATODI	P	P	P	P

33.	TCA2409075	HARSHITJAIN	P	P	P	P
34.	TCA2409081	HRITHIKPAWAR	P	P	P	P
35.	TCA2409083	JAMSHEDALAM	P	A	P	P
36.	TCA2409084	JAYRAMKUMAR MANDAL	P	P	P	P
37.	TCA2409086	KAMAL	P	P	P	P
38.	TCA2409091	KRISHPAL	P	P	P	P
39.	TCA2409092	LAKSHYAGAHLOUT	P	P	P	P
40.	TCA2409096	MANASMADHAV	P	P	P	P

Identification of slow Learners after CT-2

1	TCA2409004	ABHAYRAJSINGH	4.67
2	TCA2409005	ABHIMANYURAI	3.67
3	TCA2409006	ABHINAVSUNILPATIL	4
4	TCA2409013	ADIJAIN	1.33
5	TCA2409014	ADITYA	1
6	TCA2409016	AJAYKUMAR	4
7	TCA2409025	AMRUTAVILASHUDDAR	3.67
8	TCA2409027	ANANDMISHRA	2.67
9	TCA2409028	ANANDRAJ	1
10	TCA2409034	ANKITKUMAR	3.33
11	TCA2409037	ANSHCHAUDHARY	0.33
12	TCA2409041	ANUJPAL	4.33
13	TCA2409042	ANURAGYADAV	1.33
14	TCA2409048	ARPITJAIN	4.33
15	TCA2409056	AVADHESHKUMAR SHARMA	1
16	TCA2409059	AZHAANMOHAMMAD KHAN	3.33
17	TCA2409064	DIVYANSHBHARDWAJ	3.33
18	TCA2409066	DIVYANSHUKUMAR	3.33

19	TCA2409067	GAGANDEEPSHARMA	4
20	TCA2409075	HARSHITJAIN	2
21	TCA2409083	JAMSHEDALAM	3.33
22	TCA2409086	KAMAL	2.33
23	TCA2409091	KRISHPAL	3
24	TCA2409092	LAKSHYAGAHLOUT	3.33

Special classes with attendance sheet of slow learners with ATR after CT-II

- Topics have been identified for slow learners after CT-2 as given below
 - Theory of production of plane circular and elliptically polarized light, Quarter & half wave plate, Specific rotation.
 - What is LASER, He-Ne Laser, Ruby LASER
- After special/remedial classes circular, classes had been taken as per below attendance sheet

Classes for Slow Learners After Second CT			Date/Month			
Sr.No.	Enrollment No.	Name	25/10	08/11	16/1	22/11
1.	TCA2409004	ABHAYRAJSINGH	P	P	P	P
2.	TCA2409005	ABHIMANYURAI	P	P	A	P
3.	TCA2409006	ABHINAVSUNILPATIL	P	P	P	P
4.	TCA2409013	ADIJAIN	P	P	P	P
5.	TCA2409014	ADITYA	P	P	P	P
6.	TCA2409016	AJAYKUMAR	A	P	P	A
7.	TCA2409025	AMRUTAVILASHUDDAR	P	A	P	P
8.	TCA2409027	ANANDMISHRA	P	P	P	A
9.	TCA2409028	ANANDRAJ	P	P	P	P
10.	TCA2409034	ANKITKUMAR	P	P	P	P
11.	TCA2409037	ANSHCHAUDHARY	P	P	P	P

12.	TCA2409041	ANUJPAL	A	P	P	P
13.	TCA2409042	ANURAGYADAV	P	P	A	P
14.	TCA2409048	ARPITJAIN	P	P	P	A
15.	TCA2409056	AVADHESHKUMAR SHARMA	P	P	P	P
16.	TCA2409059	AZHAANMOHAMMAD KHAN	P	P	P	P
17.	TCA2409064	DIVYANSHBHARDWAJ	P	P	P	P
18.	TCA2409066	DIVYANSHKUMAR	P	A	P	P
19.	TCA2409067	GAGANDEEPSHARMA	P	P	P	P
20.	TCA2409075	HARSHITJAIN	P	P	P	P
21.	TCA2409083	JAMSHEDALAM	P	P	A	P
22.	TCA2409086	KAMAL	P	P	P	P
23.	TCA2409091	KRISHPAL	P	P	P	P
24.	TCA2409092	LAKSHYAGAHLOUT	P	P	P	P

Identification of slow Learners after CT-3

1	TCA2409004	ABHAYRAJSINGH	1
2	TCA2409008	ABHISHEKKUMAR	1.33
3	TCA2409010	ABHISHEKSHUKLA	2.67
4	TCA2409013	ADIJAIN	3.67
5	TCA2409016	AJAYKUMAR	3.33
6	TCA2409021	AMAANSHAHID	3.33
7	TCA2409022	AMANTHAPAN	2
8	TCA2409025	AMRUTAVILASHUDDAR	0.33
9	TCA2409027	ANANDMISHRA	2.67
10	TCA2409028	ANANDRAJ	2.67
11	TCA2409030	ANIMESHJAIN	1
12	TCA2409032	ANKITKUMAR	4
13	TCA2409033	ANKITKUMAR	4.67
14	TCA2409034	ANKITKUMAR	0.33

15	TCA2409042	ANURAGYADAV	1.67
16	TCA2409044	ANVIJAIN	4.33
17	TCA2409047	ARPANKUMAR	4.33
18	TCA2409049	ARUN	0.33
19	TCA2409050	ARUNKUMAR	1.33
20	TCA2409052	ASHUTOSHKUMAR	4.67
21	TCA2409059	AZHAANMOHAMMAD KHAN	0.67
22	TCA2409064	DIVYANSHBHARDWAJ	4
23	TCA2409066	DIVYANSHKUMAR	1.67
24	TCA2409067	GAGANDEEPSHARMA	0.67
25	TCA2409073	HARSHJAIN	2
26	TCA2409075	HARSHITJAIN	2
27	TCA2409083	JAMSHEDALAM	3
28	TCA2409086	KAMAL	3.33
29	TCA2409089	KRATIJAIN	4.67
30	TCA2409092	LAKSHYAGAHLOUT	4.67
31	TCA2409095	MAHAKJAIN	3.33
32	TCA2409096	MANASMADHAV	2.67

Special classes with attendance sheet of slow learners with ATR after CT-III

- Topics have been identified for slow learners after CT-3 as given below
 - Special Theory of Relativity: Introduction, Inertial and non-inertial frames of Reference,
 - Galilean and Lorentz Transformations, Length contraction and Time Dilation.
- After special/remedial classes circular, classes had been taken as per below attendance sheet

Classes for Slow Learners After Second CT			Date/Month			
Sr.No.	Enrollment No.	Name	22/12	23/12	29/12	30/12
1.	TCA2409004	ABHAYRAJSINGH	P	P	P	P

2.	TCA2409008	ABHISHEKKUMAR	P	P	P	P
3.	TCA2409010	ABHISHEKSHUKLA	P	P	P	P
4.	TCA2409013	ADIJAIN	P	P	P	P
5.	TCA2409016	AJAYKUMAR	P	P	P	P
6.	TCA2409021	AMAANSHAHID	P	P	P	P
7.	TCA2409022	AMANTHAPAN	P	A	P	P
8.	TCA2409025	AMRUTAVILASHUDDAR	P	P	P	P
9.	TCA2409027	ANANDMISHRA	P	P	P	P
10.	TCA2409028	ANANDRAJ	P	P	P	P
11.	TCA2409030	ANIMESHJAIN	P	P	P	P
12.	TCA2409032	ANKITKUMAR	P	P	P	P
13.	TCA2409033	ANKITKUMAR	P	P	P	P
14.	TCA2409034	ANKITKUMAR	P	P	P	P
15.	TCA2409042	ANURAGYADAV	P	P	A	P
16.	TCA2409044	ANVIJAIN	P	P	P	P
17.	TCA2409047	ARPANKUMAR	P	P	P	P
18.	TCA2409049	ARUN	P	P	P	P
19.	TCA2409050	ARUNKUMAR	P	P	P	P
20.	TCA2409052	ASHUTOSHKUMAR	P	P	P	P
21.	TCA2409059	AZHAANMOHAMMAD KHAN	P	P	P	P
22.	TCA2409064	DIVYANSHBHARDWAJ	P	P	P	P
23.	TCA2409066	DIVYANSHKUMAR	P	P	P	P
24.	TCA2409067	GAGANDEEPSHARMA	P	P	P	P
25.	TCA2409073	HARSHJAIN	P	P	P	P
26.	TCA2409075	HARSHITJAIN	P	P	P	P
27.	TCA2409083	JAMSHEDALAM	P	P	P	P
28.	TCA2409086	KAMAL	P	P	P	P
29.	TCA2409089	KRATIJAIN	P	A	P	P

30.	TCA2409092	LAKSHYAGAHLOUT	P	P	P	P
31.	TCA2409095	MAHAKJAIN	P	P	P	P
32.	TCA2409096	MANASMADHAV	P	P	P	P

List of Slow Learner Students of Class Test and Action Taken

Section-B

Identification of slow Learners after CT-1

1	TCA2409097	MANISENGUPTA	3.67
2	TCA2409099	MANYAJAIN	4.33
3	TCA2409100	MANYUPMAKUMARI	3
4	TCA2409112	MUSKAN	4.67
5	TCA2409114	NAVEDALAM	2.33
6	TCA2409116	NIKSHAYJAIN	3.33
7	TCA2409119	OMPRAKASH	1.33
8	TCA2409120	PALAKJAIN	1
9	TCA2409121	PALAKSHARMA	4.33
10	TCA2409122	PANKAJKUMAR	2
11	TCA2409124	PARTHJAIN	3.33
12	TCA2409125	PARTHSHARMA	1
13	TCA2409127	PRAJJAWALSINGH	2.33
14	TCA2409130	PRINCEJAIN	4.67
15	TCA2409132	PRITANKUMAR	1.67
16	TCA2409135	PUNEETCHAUHAN	3
17	TCA2409138	RADHIKAVERMA	4
18	TCA2409139	RANJEETKUMAR	2
19	TCA2409143	RIDDHIJAIN	3
20	TCA2409155	SEHWAGGOUR	1.33
21	TCA2409160	SHEETAL	2
22	TCA2409161	SHIMPU	3
23	TCA2409164	SHREYAPANDEY	3
24	TCA2409166	SNEHAJAIN	2
25	TCA2409167	SONUKUMAR	2.67
26	TCA2409169	SRISTIRANI	1.33
27	TCA2409171	TANISHCHAUHAN	1

28	TCA2409175	URJA JAIN	3.67
29	TCA2409176	UTKARSHCHAUHAN	3
30	TCA2409177	UTKARSHGUPTA	4.67
31	TCA2409179	VANDANAKUMARI	1
32	TCA2409183	VARSHA	4.33
33	TCA2409185	VINAYAKAGRAHARI	1.33
34	TCA2409187	VISHVAMOHANSHARMA	4.33
35	TCA2409193	ZAINABAYYOOB	3

Special classes with attendance sheet of slow learners with ATR after CT-I

- Topics have been identified for slow learners after CT-1 as given below
 - Theory of Fresnel's Bi-Prism
 - Michelson's interferometer
 - Newton's ring
 - Rayleigh's criterion of resolution, resolving power of diffraction grating and telescope.
 - Single slit diffraction
- After special/remedial classes circular, classes had been taken as per below attendance sheet

Attendance Sheet

Classes for Slow Learners After First CT			Date/Month			
S.NO.	Enrollment No.	Name	21/10	28/10	04/11	11/11
1.	TCA2409097	MANISENGUPTA	P	P	P	P
2.	TCA2409099	MANYAJAIN	P	P	P	P
3.	TCA2409100	MANYUPMAKUMARI	P	P	P	P
4.	TCA2409112	MUSKAN	P	P	P	P

5.	TCA2409114	NAVEDALAM	P	P	P	P
6.	TCA2409116	NIKSHAYJAIN	P	P	P	P
7.	TCA2409119	OMPRAKASH	P	P	P	P
8.	TCA2409120	PALAKJAIN	P	P	P	P
9.	TCA2409121	PALAKSHARMA	P	P	P	P
10.	TCA2409122	PANKAJKUMAR	P	P	P	P
11.	TCA2409124	PARTHJAIN	P	P	P	P
12.	TCA2409125	PARTHSHARMA	P	P	P	P
13.	TCA2409127	PRAJJAWALSINGH	P	P	P	P
14.	TCA2409130	PRINCEJAIN	P	P	P	P
15.	TCA2409132	PRITANKUMAR	P	P	P	P
16.	TCA2409135	PUNEETCHAUHAN	P	P	P	P
17.	TCA2409138	RADHIKAVERMA	P	P	P	P
18.	TCA2409139	RANJEETKUMAR	P	P	P	P
19.	TCA2409143	RIDDHIJAIN	P	P	P	P
20.	TCA2409155	SEHWAGGOUR	P	P	P	P
21.	TCA2409160	SHEETAL	P	P	P	P
22.	TCA2409161	SHIMPU	P	P	P	P
23.	TCA2409164	SHREYAPANDEY	P	P	P	P
24.	TCA2409166	SNEHAJAIN	P	P	P	P
25.	TCA2409167	SONUKUMAR	P	P	P	P
26.	TCA2409169	SRISTIRANI	P	P	P	P
27.	TCA2409171	TANISHCHAUHAN	P	P	P	P
28.	TCA2409175	URJA JAIN	P	P	P	P
29.	TCA2409176	UTKARSHCHAUHAN	P	P	P	P
30.	TCA2409177	UTKARSHGUPTA	P	P	P	P
31.	TCA2409179	VANDANAKUMARI	P	P	P	P
32.	TCA2409183	VARSHA	P	P	P	P

33.	TCA2409185	VINAYAKAGRAHARI	P	P	P	P
34.	TCA2409187	VISHVAMOHANSHARMA	P	P	P	P
35.	TCA2409193	ZAINABAYYOOB	P	P	P	P

Identification of slow Learners after CT-2

1	TCA2409109	MOHAMMAD HANZALA GAZI	4
2	TCA2409114	NAVEDALAM	3
3	TCA2409119	OMPRAKASH	3.33
4	TCA2409120	PALAKJAIN	3
5	TCA2409122	PANKAJKUMAR	3
6	TCA2409124	PARTHJAIN	3
7	TCA2409125	PARTHSHARMA	1.33
8	TCA2409128	PRAPHOOLKUMAR	1.33
9	TCA2409130	PRINCEJAIN	4
10	TCA2409132	PRITANKUMAR	0
11	TCA2409135	PUNEETCHAUHAN	3
12	TCA2409138	RADHIKAVERMA	4.67
13	TCA2409143	RIDDHIJAIN	4.67
14	TCA2409150	SANSKARPATIL	0.67
15	TCA2409155	SEHWAGGOUR	2.33
16	TCA2409160	SHEETAL	4.67
17	TCA2409164	SHREYAPANDEY	4.33
18	TCA2409166	SNEHAJAIN	3.33
19	TCA2409167	SONUKUMAR	1.67
20	TCA2409169	SRISTIRANI	2.33
21	TCA2409171	TANISHCHAUHAN	3
22	TCA2409179	VANDANAKUMARI	3.33
23	TCA2409185	VINAYAKAGRAHARI	3.33
24	TCA2409187	VISHVAMOHANSHARMA	0.67
25	TCA2409190	VIVEKYADAV	4.33

Special classes with attendance sheet of slow learners with ATR after CT-II

- Topics have been identified for slow learners after CT-2 as given below
 - Theory of production of plane circular and elliptically polarized light, Quarter & half wave plate, Specific rotation.
 - What is LASER, He-Ne Laser, Ruby LASER
- After special/remedial classes circular, classes had been taken as per below attendance sheet

Classes for Slow Learners After Second CT			Date/Month			
Sr.No.	Enrollment No.	Name	25/10	08/11	16/1	20/11
1.	TCA2409109	MOHAMMAD HANZALA GAZI	P	P	P	P
2.	TCA2409114	NAVEDALAM	P	P	A	P
3.	TCA2409119	OMPRAKASH	P	P	P	P
4.	TCA2409120	PALAKJAIN	P	P	P	P
5.	TCA2409122	PANKAJKUMAR	P	P	P	P
6.	TCA2409124	PARTHJAIN	A	P	P	A
7.	TCA2409125	PARTHSHARMA	P	A	P	P
8.	TCA2409128	PRAPHOOLKUMAR	P	P	P	A
9.	TCA2409130	PRINCEJAIN	P	P	P	P
10.	TCA2409132	PRITANKUMAR	P	P	P	P
11.	TCA2409135	PUNEETCHAUHAN	P	P	P	P
12.	TCA2409138	RADHIKAVERMA	A	P	P	P
13.	TCA2409143	RIDDHIJAIN	P	P	A	P
14.	TCA2409150	SANSKARPATIL	P	P	P	A
15.	TCA2409155	SEHWAGGOUR	P	P	P	P

16.	TCA2409160	SHEETAL	P	P	P	P
17.	TCA2409164	SHREYAPANDEY	P	P	P	P
18.	TCA2409166	SNEHAJAIN	P	A	P	P
19.	TCA2409167	SONUKUMAR	P	P	P	P
20.	TCA2409169	SRISTIRANI	P	P	P	P
21.	TCA2409171	TANISHCHAUHAN	P	P	A	P
22.	TCA2409179	VANDANAKUMARI	P	P	P	P
23.	TCA2409185	VINAYAKAGRAHARI	P	P	P	P
24.	TCA2409187	VISHVAMOHANSHARMA	P	P	P	P
25.	TCA2409190	VIVEKYADAV				

Identification of slow Learners after CT-3

1	TCA2409097	MANISENGUPTA	2.67
2	TCA2409100	MANYUPMAKUMARI	4.67
3	TCA2409112	MUSKAN	4.33
4	TCA2409116	NIKSHAYJAIN	3.33
5	TCA2409120	PALAKJAIN	0.33
6	TCA2409121	PALAKSHARMA	3.33
7	TCA2409122	PANKAJKUMAR	3.33
8	TCA2409125	PARTHSHARMA	0.67
9	TCA2409127	PRAJJAWALSINGH	1.67
10	TCA2409128	PRAPHOOLKUMAR	3
11	TCA2409131	PRINCEKUMARPATEL	3.33
12	TCA2409132	PRITANKUMAR	1.33
13	TCA2409135	PUNEETCHAUHAN	0.33

14	TCA2409138	RADHIKAVERMA	3
15	TCA2409139	RANJEETKUMAR	3.33
16	TCA2409143	RIDDHIJAIN	1.67
17	TCA2409148	SAMEER	1.33
18	TCA2409155	SEHWAGGOUR	1.67
19	TCA2409158	SHALABHCHAUDHARY	3
20	TCA2409159	SHASHANKKUMAR MISHRA	4.67
21	TCA2409160	SHEETAL	3.67
22	TCA2409161	SHIMPU	3.67
23	TCA2409164	SHREYAPANDEY	4.33
24	TCA2409167	SONUKUMAR	3.33
25	TCA2409169	SRISTIRANI	2.67
26	TCA2409171	TANISHCHAUHAN	1.33
27	TCA2409179	VANDANAKUMARI	3.33
28	TCA2409185	VINAYAKAGRAHARI	3.67
29	TCA2409187	VISHVAMOHANSHARMA	3.33
30	TCA2409190	VIVEKYADAV	4.67
31	TCA2409193	ZAINABAYYOOB	2

Special classes with attendance sheet of slow learners with ATR after CT-III

- Topics have been identified for slow learners after CT-3 as given below
 - Special Theory of Relativity: Introduction, Inertial and non-inertial frames of Reference,
 - Galilean and Lorentz Transformations, Length contraction and Time Dilation.
- After special/remedial classes circular, classes had been taken as per below attendance sheet

Classes for Slow Learners After Second CT			Date/Month			
Sr.No.	Enrollment No.	Name	22/12	23/12	29/12	30/12
1.	TCA2409097	MANISENGUPTA	P	P	P	P
2.	TCA2409100	MANYUPMAKUMARI	P	P	P	P
3.	TCA2409112	MUSKAN	P	P	P	P
4.	TCA2409116	NIKSHAYJAIN	P	P	P	P
5.	TCA2409120	PALAKJAIN	P	P	P	P
6.	TCA2409121	PALAKSHARMA	P	P	P	P
7.	TCA2409122	PANKAJKUMAR	P	A	P	P
8.	TCA2409125	PARTHSHARMA	P	P	P	P
9.	TCA2409127	PRAJJAWALSINGH	P	P	P	P
10.	TCA2409128	PRAPHOOLKUMAR	P	P	P	P
11.	TCA2409131	PRINCEKUMARPATEL	P	P	P	P
12.	TCA2409132	PRITANKUMAR	P	P	P	P
13.	TCA2409135	PUNEETCHAUHAN	P	P	P	P
14.	TCA2409138	RADHIKAVERMA	P	P	P	P
15.	TCA2409139	RANJEETKUMAR	P	P	A	P
16.	TCA2409143	RIDDHIJAIN	P	P	P	P
17.	TCA2409148	SAMEER	P	P	P	P
18.	TCA2409155	SEHWAGGOUR	P	P	P	P
19.	TCA2409158	SHALABHCHAUDHARY	P	P	P	P
20.	TCA2409159	SHASHANKKUMAR MISHRA	P	P	P	P
21.	TCA2409160	SHEETAL	P	P	P	P
22.	TCA2409161	SHIMPU	P	P	P	P
23.	TCA2409164	SHREYAPANDEY	P	P	P	P

24.	TCA2409167	SONUKUMAR	P	P	P	P
25.	TCA2409169	SRISTIRANI	P	P	P	P
26.	TCA2409171	TANISHCHAUHAN	P	P	P	P
27.	TCA2409179	VANDANAKUMARI	P	P	P	P
28.	TCA2409185	VINAYAKAGRAHARI	P	P	P	P
29.	TCA2409187	VISHVAMOHANSHARMA	P	A	P	P
30.	TCA2409190	VIVEKYADAV	P	P	P	P
31.	TCA2409193	ZAINABAYYOOB	P	P	P	P

List of Fast Learner Students of Class Test and Action Taken

Section-A

Identification of fast Learners after CT-1

1	TCA2409039	ANSHIKKUMAR GUPTA	9.33
2	TCA2409077	HEMANTCHAHAL	9.67

Identification of fast Learners after CT-2

1	TCA2409038	ANSHJAIN	9.33
---	------------	----------	------

Identification of fast Learners after CT-3

1	TCA2409007	ABHISHEKJAIN	9
---	------------	--------------	---

Note: Assign the Advance Level Problems

List of Fast Learner Students of Class Test and Action Taken

Section-B

Identification of fast Learners after CT-1

1	TCA2409146	ROCKEYRAJ	9
2	TCA2409162	SHIVANGYADAV	9
3	TCA2409181	VANSHJAIN	9.33

Identification of fast Learners after CT-2

1.	TCA2409107	MOHAMMADFAIZ	9.33
2.	TCA2409113	NAMANJAIN	9.33
3.	TCA2409115	NIKETJAIN	9
4.	TCA2409137	RADHIKA	10
5.	TCA2409152	SATYAMJAIN	9.33
6.	TCA2409156	SHAFIAKHATOON	9
7.	TCA2409162	SHIVANGYADAV	9.67

Identification of fast Learners after CT-3

1.	TCA2409156	SHAFIAKHATOON	9.67
2.	TCA2409183	VARSHA	9.67

Note: Assign the Advance Level Problems

Previous Year Question Papers

B.Tech I (First) Semester Examination 2021-22

Course Code: EAS112

Paper ID: 09619112

Engineering Physics

Time: 3 Hours

Max. Marks: 60

Note: Attempt **all** questions.

Q1.	Answer the following (limit your answer to 50 words):	Marks
a)	What is principle of superposition?	2
	Or	
	Light of wavelength $6000 \text{ \AA}$ falls normally on a thin wedge shaped film of refractive index 1.4, forming fringes that are 2 mm apart. Find the angle of wedge.	2
b)	What is the difference between interference and diffraction?	2
	Or	
	Differentiate between limit of resolution and resolving power of an optical instrument.	2
c)	If the plane of vibration of the incident beam makes an angle of 30° with the optic axis, compare the intensities of extraordinary and ordinary light.	2
	Or	
	What is specific rotation?	2
d)	What are extrinsic semiconductors?	2
	Or	
	What information can be obtained by the sign of Hall coefficient?	2
e)	Galilean transformations violate both the postulates of special theory of relativity. Comment on it.	2
	Or	

	State the fundamental requirement for the existence of massless particles on the basis of special theory of relativity. Give one example of such a particle.	2
2.	What is meant by the interference due to the division of wavefront? Discuss the theory of Fresnel's biprism and apply it to determine the wavelength of monochromatic light.	10
	Or	
	Explain different types of bonds that exist in metals. List the important physical properties of metallic crystals.	10
3.	Classify Fresnel and Fraunhofer types of diffraction. Obtain intensity distribution in the diffraction pattern due to a single slit. Also plot the intensity distribution. What is the angular width of central maximum?	10
	Or	
	Explain Rayleigh's criterion of resolution. Deduce an expression for the resolving power of a telescope.	10
4.	Discuss the working of quarter and half wave plates. Calculate the thickness of (i) a quarter wave plate, and (ii) a half wave plate. Given that: $\mu_E = 1.553$, $\mu_O = 1.544$ and $\lambda = 5000\text{\AA}$.	10
	Or	
	What is Hall effect and Hall voltage? A sample of silicon is doped with 10^{17} phosphorus atoms/cm ³ . What would you expect to measure for its resistivity? What Hall voltage would you expect in a sample $100\text{ }\mu\text{m}$ thick if $I_x = 1\text{mA}$ and $B_z = 10^{-5}\text{ Wb/cm}^2$? Given that $\mu_n = 700\text{ cm}^2/\text{V-s}$.	10
5.	Distinguish between Polarized and unpolarized light. Explain Brewster's law and examine that if the angle of incidence of unpolarized light is equal to the polarizing angle, the reflected and refracted rays are at right angles to each other. Determine the polarizing angle for crown glass if refractive index for it is 1.52.	10
	Or	
	What are inertial and non-inertial frames of reference? Explain with suitable examples. Obtain Galilean transformation equations and show that for $v \ll$	10

	c, Lorentz transformations reduce to them.	
6.	What are Newton's rings? For Newton's rings formed in reflected light show that the diameters of bright rings are proportional to the square root of odd natural numbers. What change is observed in the central spot for Newton's rings due to transmitted light?	10
	Or	
	Derive velocity addition theorem and make use of it to show that no signal can travel faster than velocity of light.	10

B.Tech I (First) Semester Examination 2022-23**Course Code:** EAS112**Paper ID:** 09622112**Engineering Physics****Time:** 3 Hours**Max. Marks:** 60**Note:** Attempt **all** questions.

Q1.	Answer the following (limit your answer to 50 words):	Marks
a)	Why coherent sources are needed for the interference phenomenon to occur?	2
	Or	
	What do you understand by localized interference fringes?	2
b)	Differentiate between Fresnel and Fraunhofer types of diffraction.	2
	Or	
	Define resolving power of an optical instrument and give its expression for the telescope.	2
c)	What is Brewster's law?	2
	Or	
	Find the thickness of a quarter wave plate for which: $n_o = 1.65836$, and $n_e = 1.48641$. Given $\lambda = 5893\text{\AA}$.	2
d)	State two methods used for increasing the electrical conductivity of semiconductors. Which one is more useful?	2
	Or	
	State important features of metallic bonding in solids.	2
e)	Differentiate between inertial and non-inertial frames of reference through suitable examples.	2
	Or	
	Calculate the percentage contraction of a rod moving with a velocity of $0.8c$ in a direction inclined at 60° to its own length.	2
2.	Discuss Young's double slit experiment and obtain an expression for the fringe width. How fringe width depends upon the separation between two slits? If in Young's experiment the separation between two slits is 1.9 mm and the fringe spacing is	10

	0.31 mm at a distance of 1 m from the slits, Evaluate the wavelength of light used.	
	Or	
	Describe the formation of different types of fringes in Michelson's interferometer. How it can be applied to determine the difference in wavelength between two neighbouring spectral lines? Calculate the distance between the two successive positions of a movable mirror of a Michelson's interferometer giving best fringes in the case of sodium having lines of wavelength 5890 Å and 5896 Å..	10
3.	Explain Fraunhofer diffraction due to a single slit and Identify the formation of different kinds of maxima and minima in the diffraction pattern using monochromatic light. What changes are observed in the diffraction pattern if white light is used?	10
	Or	
	Obtain an expression for the resolving power of a diffraction grating. How it can be increased? What should be the minimum number of lines in a grating which will just resolve in the second order the lines whose wavelengths are 5890 Å and 5896 Å.	10
4.	What do you understand by the phenomenon of double refraction? Explain in terms of ordinary and extraordinary rays. Analyse what happens (i) when the light is allowed to enter the crystal along the optic axis? (ii) a ray of light is incident perpendicular to the optic axis in the calcite crystal?	10
	Or	
	Define specific rotation. Analyse the functioning of Laurent's half shade polarimeter for the determination of specific rotation of an optically active substance	10
5.	What are covalent crystals? State important physical properties of covalently bonded crystals.	10
	Or	
	Describe Hall effect in semiconductors and show that: $R_H = -\frac{1}{ne}$ Where symbols have usual meanings. Discuss applications of Hall effect.	10
6.	State the two postulates of special theory of relativity and apply them to obtain the Lorentz transformation equations between the coordinates of an event in two inertial frames of reference.	10
	Or	
	Show that	5+5=10

- | | | |
|--|---|--|
| | <ul style="list-style-type: none">a) The space-time interval remains invariant under the Lorentz transformations.b) The circle $x^2 + y^2 = a^2$ in frame S will appear to be an ellipse in another frame S' moving at a speed v relative to S. | |
|--|---|--|

B.Tech I (First) Semester Examination 2023-24

Course Code: EAS112

Paper ID: 09622112

Engineering Physics

Time: 3 Hours

Max. Marks: 60

Note: Attempt **all** questions.

Q1.	Answer the following (limit your answer to 50 words):	Marks	Category
a)	What is a Fresnel's biprism?	2	Remembering & Understanding
	Or		
	What are coherent sources?	2	Remembering & Understanding
b)	State the essential condition for diffraction of light to occur.	2	Remembering & Understanding
	Or		
	A parallel beam of monochromatic light is allowed to be incident normally on a plane transmission grating having 1250 lines per centimeter and a second order spectral line is observed to be deviated through 30° . Calculate the wavelength of the spectral line.	2	Remembering & Understanding
c)	What do you mean by specific rotation?	2	Remembering & Understanding
	Or		
	Find the thickness of quarter wave plate when the wavelength of light is equal to 5890 Å and $\mu_o = 1.55$ and $\mu_E = 1.54$.	2	Remembering & Understanding
d)	What are semiconductors? Give at least two examples.	2	Remembering &

			Understanding
	Or		
	Write the effect of temperature on the conductivity and resistivity of a semiconductor.	2	Remembering & Understanding
e)	Is earth an inertial frame of reference? Explain in brief.	2	Remembering & Understanding
	Or		
	What is the significance of mass energy relation?	2	Remembering & Understanding

2.	What is interference of light? Describe and explain young's experiment demonstrating interference of light.	10	Applying
	Or		
	Describe and explain the formation of Newton's rings in reflected monochromatic light. Explain briefly why Newton's rings are circular	10	Applying
3.	What do you mean by diffraction of light? Distinguish between Fresnel diffraction and Fraunhofer diffraction.	10	Applying
	Or		
	Give the construction and theory of plane transmission grating and explain the formation of spectra by it. Explain what are absent spectra in the grating.	10	Applying
4.	What is polarized light? How will you produce and detect plane, elliptically and circularly polarized lights?	10	Remembering & Understanding
	Or		

	Describe the construction and working of Laurent's half shade polarimeter. How will you use it to find the specific rotation of an optically active substance	10	Remembering & Understanding
5.	What do you mean by conduction band and valence band. Distinguish between insulators, semiconductors and conductors on the basis of band theory of solids.	10	Applying
	Or		
	An electric field of 200 volt/m is applied to a sample of n-type semiconductor whose Hall coefficient is -0.0145 m²/coulomb . Calculate the current density in the sample assuming mobility of electrons equals to 0.36 V⁻¹s⁻¹ .	10	Applying
6.	Deduce an expression for time dilation on the basis of Lorentz transformation equations. Give an example to show that time dilation is real effect.	10	Applying
	Or		
	Deduce an expression for the variation of mass with velocity.	10	Applying

Engineering Physics (EAS 112)

Question Bank (Unit 1)

Long Answer Type Question:

Q.1 : What is interference of light? Describe and explain Young's experiment demonstrating interference of light.

Q. 2: Give the theory of interference due to two coherent sources and deduce the expression for fringe width.

Q. 3: Explain the formation of interference fringes by means of Fresnel's biprism and derive the expression for fringe width.

Q. 4: Discuss the phenomena of interference of light due to thin films and find the condition of maxima and minima. Show that the interference pattern of reflected and transmitted monochromatic source of light is complementary in nature.

Q. 5: Explain the colours when a thin film illuminated by white light is observed in reflected light.

Q. 6: Discuss the formation of interference fringes due to a wedge shaped thin film seen by normally reflected sodium light and obtain an expression for fringe width.

Q. 7: Describe the formation of bright and dark circular fringes by reflected monochromatic light in the Newton's ring experiment. Discuss how these rings can be used to measure the wavelength of light.

Q. 8: Describe and explain the formation of Newton's ring in reflected monochromatic light. Prove that in reflected light (i) diameter of bright fringes are proportional to the square root of odd natural numbers and (ii) the diameters of dark rings are proportional to the square root of natural numbers.

Q. 9: Describe the construction and working of Michelson interferometer. How can it be used to determine the (i) wavelength of monochromatic light (ii) refractive index of a thin transparent film?

Short Answer Type Questions:

Q. 10: What do you mean by interference of light?

Q. 11: What are coherent sources?

Q.12: Why two independent sources can not be coherent?

Engineering Physics (EAS 112)

Question Bank 2 (Unit 2)

Long Answer Type Question:

Q.1: What is meant by diffraction of light? Distinguish between Fresnel's and Fraunhofer class of diffraction.

Q.2: Describe Fraunhofer diffraction due to single slit and deduce the position of maxima and minima. Show that the relative intensities of successive maxima are nearly 1: 1/22:1/61:1/121.

Q.3: Explain the difference between interference and diffraction.

Q.4: What is meant by resolving power of an optical instrument? Explain Rayleigh's criterion for just resolution.

Q.5: What do you understand by resolving power of a grating? Derive the necessary expression.

Short Answer Type Question:

Q. 6: State the essential condition for diffraction of light to occur.

Q.7: Explain the spreading of central diffraction maximum in a single slit.

Q. 8: What is Rayleigh criterion of resolution?

Q. 9: Discuss the effect of making slit narrower on the diffraction pattern due to single slit.

Numericals:

Q. 10: A plane wave of wavelength 5893×10^{-8} cm passes through a slit 0.5 mm wide and forms a diffraction pattern on a screen placed 1 meter away from the slit and parallel to it. Calculate the separation of the first dark band on either side of central maximum.

Q. 11: A lens whose focal length is 40 cm forms a Fraunhofer diffraction pattern of a slit 0.3 mm wide. Calculate the distance of first dark band from the axis. Wavelength of light used is $5890 \text{ \AA}$.

Q. 12: The resolving power of a grating is 90,000. Find the minimum wavelength difference in the region $5400 \text{ \AA}$ which can be resolved by the grating.

Engineering Physics (EAS 112)

Question Bank 3 (Unit 3)

- Q.1: Explain the phenomenon of double refraction in calcite crystal.
- Q.2: Describe the construction of a nicol prism. Explain how it can be used as a polarizer and as an analyser?
- Q.3: Explain Huygen's theory of double refraction in uniaxial crystal.
- Q.4: How can a phase retardation plate be obtained from calcite crystal? Give the construction and theory of (i) quarter wave plate (ii) half wave plate.
- Q.5: What do you understand by resolving power of a grating? Derive the necessary expression.
- Q. 6: Discuss the phenomenon of rotation of the plane of polarization of light by optically active material.
- Q. 7: Explain Fresnel's theory of optical activity.
- Q. 8: Define specific rotation Describe the construction and working of a Laurent's half shade polarimeter.
- Q. 9: Explain how a polarimeter is used to determine the specific rotation of a substance like Glucose.
- Q. 10: Describe the construction and working of a biquartz polarimeter. How will you use it to find the specific rotation of an optically active substance?
- Q. 11: Define is a plane polarized light?
- Q. 12: Define plane of polarization and plane of vibration.
- Q. 13: Define optic axis and principal section of the crystal.
- Q. 14: What are ordinary and extraordinary rays?
- Q. 15: What is optical activity? Discuss dextro-rotatory and leavo-rotatory substances?
- Q. 16: Discuss Biot's law of optical rotation.
- Q. 17: Calculate the thickness of a quarter wave plate of quartz for sodium light of wavelength $5893 \text{ \AA}$. The ordinary and extraordinary refractive indices for sodium are 1.544 and 1.553 respectively.

Q. 18: Calculate the thickness of a doubly refracting plate capable of producing a path difference of $\lambda/4$ between ordinary and extraordinary rays with light of wavelength 5890 Å. The refractive indices for O-ray and E-rays are 1.53 and 1.54 respectively.

Q. 19: The value of μ_e and μ_o for quartz are 1.5508 and 1.5418 respectively. Calculate the phase retardation for $\lambda=5000$ Å when the plate thickness is 0.032 mm.

Q. 20: Calculate the specific rotation, which rotates the plane of polarization 15.2° in 20% sugar solution of 25 cm length.

Q. 21: A sugar solution in a tube of length 20 cm produces optical rotation of 13° . The solution is then diluted to one-third of its previous concentration. Find the optical rotation produced by 30 cm long tube containing the diluted solution.

Question Bank 4 (Unit 4)

Q. 1: Explain the processes of absorption, spontaneous emission, and stimulated emission of radiation. How do these processes contribute to the working principle of a laser?

Q. 2: Define Einstein's coefficients AAA and BBB. Derive the relation between them and explain their significance in laser physics.

Q. 3: What is population inversion? Why is it essential for laser operation, and how is it achieved in practice?

Q. 4: Describe the principle of laser action. How does optical feedback contribute to sustained laser oscillation?

Q. 5: With the help of a schematic diagram, explain the construction and working of a Ruby laser. What role does the three-level system play in its operation?

Q. 6: Discuss the working of a Helium-Neon (He-Ne) laser. How is population inversion achieved in this gas laser system? Mention at least two applications of the He-Ne laser.

Question Bank 5 (Unit 5)

Q.1: What do you mean by frame of reference?

Q.2: Differentiate inertial and non-inertial frames of reference.

Q.3: Derive the Galilean transformation formula.

Q.4: State the fundamental postulates of special theory of relativity.

Q.5: Derive the Lorentz transformation equations for space and time coordinates.

Q. 6: What do you mean by length contraction at relativistic speed? Discuss the necessary expression for it.

Q. 7: What do you understand by time dilation? Deduce an expression for time dilation on the basis of Lorentz transformation equations. Give an example to show that time dilation is real effect.

Q. 8: Deduce the relativistic velocity addition theorem. Show that it is consistent with Einstein's second postulate.

Q. 9: Deduce an expression for the variation of mass with velocity.

Q. 10: Deduce Einstein's mass energy relation, $E=mc^2$ and discuss it.

Q. 11: Show that if the variation of mass with velocity is taken in to account, the kinetic energy of a particle of rest mass m_0 and moving with a velocity v is given by

$$K=m_0c^2 [(1-v^2/c^2)^{-1/2} -1]$$

Q. 12: A rod has length 100 cm. When the rod is in a satellite moving with a velocity that is one half of the velocity of light relative to laboratory, what is the length of the rod as determined by the rod as determined by an observer (a) in the satellite, (b) in the laboratory?

Q. 13: What is the mean life time of π meson moving with speed $0.73c$, when the proper life time is 2.5×10^{-8} second.

Q. 14: Two particles come towards each other with speed $0.8c$ with respect to laboratory. What is their relative speed?

Q. 15: Show that the circle, $x^2+y^2=a^2$ in frame S appears to be an ellipse in frame S' which is moving with velocity v relative to S .

Q. 16: Show that space time interval, $x^2+y^2+z^2-c^2t^2$ is invariant under Lorentz transformation.

Q. 17: Show that the distance between any two points in two inertial frames is invariant under Galilean transformation.

Q. 18: Calculate the percentage contraction in the length of the rod in a frame of reference, moving with velocity $0.8c$ in a direction parallel to its length.

Q.19: A clock measures the proper time. With what velocity it should travel relative to an observer so that it appears to go slow by 30 seconds in a day.

Q. 20: At what speed will the mass of a body be 2.25 times its rest mass?

Final Internal Marks

TEERTHANKER MAHAVEER UNIVERSITY

DELHI ROAD, MORADABAD U.P-244001

AWARD LIST

(INTERNAL ASSESSMENT THEORY)

PROGRAM: BACHELOR OF TECHNOLOGY **MAX. MARKS** : 40

(COMPUTER SCIENCE & ENGINEERING) **SESSION** : 2024-25

SEMESTER: FIRST SEMESTER **COURSE CODE:** EAS112

COURSE: ENGINEERING PHYSICS **DATE** : 14-12-2024

COLLEGE: FoE **SECTION:** A

SL. NO.	ENROLLMENT NO.	STUDENT'S NAME	ASSESSMENT BASES					TOTAL OBTAINED MARKS	
			CT1	CT2	CT3	ASN	ATT	IN FIGURE	IN WORDS
MARKS			10	10	10	10	10	40	FORTY
1	TCA2409001	ABDUL MUNEEB KHAN	4.67	6.67	7.67	10	9	33	THIRTY THREE
2	TCA2409002	ABDUS SUBOOR KHAN	1	7.67	7	10	8	33	THIRTY THREE
3	TCA2409004	ABHAY RAJ SINGH	3.33	4.67	1	10	9	27	TWENTY SEVEN
4	TCA2409005	ABHIMANYU RAI	3.33	3.67	5.67	9	7	25	TWENTY FIVE
5	TCA2409006	ABHINAV SUNIL PATIL	3.67	4	AB	9	8	25	TWENTY FIVE
6	TCA2409007	ABHISHEK JAIN	7	10	9	10	9	38	THIRTY EIGHT
7	TCA2409008	ABHISHEK KUMAR	1	6.67	1.33	9	8	25	TWENTY FIVE
8	TCA2409010	ABHISHEK SHUKLA	4	5.67	2.67	10	9	29	TWENTY NINE
9	TCA2409013	ADI JAIN	0.67	1.33	3.67	10	9	24	TWENTY FOUR
10	TCA2409014	ADITYA	0.67	1	AB	9	10	21	TWENTY ONE
11	TCA2409016	AJAY KUMAR	2.33	4	3.33	8	8	23	TWENTY THREE
12	TCA2409020	AKSHITA JAIN	7.33	8	5	10	8	33	THIRTY THREE
13	TCA2409021	AMAAN SHAHID	2.33	8	3.33	10	9	30	THIRTY
14	TCA2409022	AMAN THAPAN	3.33	6.33	2	10	9	29	TWENTY NINE

15	TCA2409025	AMRUTA VILAS HUDDAR	3	3.67	0.33	10	9	26	TWENTY SIX
16	TCA2409026	ANAMTA NAQVI	5.33	9	5.33	9	10	33	THIRTY THREE
17	TCA2409027	ANAND MISHRA	1.67	2.67	2.67	10	8	23	TWENTY THREE
18	TCA2409028	ANAND RAJ	2	1	2.67	10	9	24	TWENTY FOUR
19	TCA2409029	ANIMESH JAIN	4.67	7.33	6.67	9	8	31	THIRTY ONE
20	TCA2409030	ANIMESH JAIN	3.33	7	1	10	8	28	TWENTY EIGHT
21	TCA2409032	ANKIT KUMAR	4	8.67	4	9	8	30	THIRTY
22	TCA2409033	ANKIT KUMAR	4	6	4.67	9	7	27	TWENTY SEVEN
23	TCA2409034	ANKIT KUMAR	2.67	3.33	0.33	9	8	23	TWENTY THREE
24	TCA2409037	ANSH CHAUDHARY	4	0.33	AB	9	9	22	TWENTY TWO
25	TCA2409038	ANSH JAIN	8.33	9.33	AB	10	9	37	THIRTY SEVEN
26	TCA2409039	ANSHIK KUMAR GUPTA	9.33	8.67	AB	10	7	35	THIRTY FIVE
27	TCA2409041	ANUJ PAL	5	4.33	AB	10	9	28	TWENTY EIGHT
28	TCA2409042	ANURAG YADAV	3.67	1.33	1.67	9	9	23	TWENTY THREE
29	TCA2409044	ANVI JAIN	5.67	6	4.33	10	9	31	THIRTY ONE
30	TCA2409045	ARCHANA KUMARI	6.67	8.67	AB	10	9	34	THIRTY FOUR
31	TCA2409047	ARPAN KUMAR	7.33	8	4.33	10	10	35	THIRTY FIVE
32	TCA2409048	ARPIT JAIN	8.33	4.33	6.67	10	8	33	THIRTY THREE
33	TCA2409049	ARUN	2.33	AB	0.33	9	8	20	TWENTY
34	TCA2409050	ARUN KUMAR	2	5	1.33	9	9	25	TWENTY FIVE
35	TCA2409052	ASHUTOSH KUMAR	2.67	8.67	4.67	10	9	32	THIRTY TWO
36	TCA2409053	ASHUTOSH KUMAR RAI	2.33	5.33	5	9	8	27	TWENTY SEVEN
37	TCA2409055	ATUL KUMAR GUPTA	2.67	6.67	AB	9	8	26	TWENTY SIX
38	TCA2409056	AVADHESH KUMAR SHARMA	7	1	AB	9	7	24	TWENTY FOUR
39	TCA2409058	AYUSH SINGH	6	7.67	AB	10	9	33	THIRTY THREE
40	TCA2409059	AZHAAN MOHAMMAD KHAN	2.67	3.33	0.67	9	9	24	TWENTY FOUR
41	TCA2409060	DAKSH JAIN	6.67	6.67	7	10	10	34	THIRTY FOUR

42	TCA2409061	DAKSH RUHELA	5.67	9	7.67	10	9	36	THIRTY SIX
43	TCA2409064	DIVYANSH BHARDWAJ	4.33	3.33	4	9	9	26	TWENTY SIX
44	TCA2409066	DIVYANSHU KUMAR	2.33	3.33	1.67	10	8	24	TWENTY FOUR
45	TCA2409067	GAGANDEEP SHARMA	2.67	4	0.67	9	9	25	TWENTY FIVE
46	TCA2409072	GYAYAK PATODI	2.67	6.67	8	10	9	34	THIRTY FOUR
47	TCA2409073	HARSH JAIN	8.33	6.67	2	10	9	34	THIRTY FOUR
48	TCA2409075	HARSHIT JAIN	1	2	2	9	9	22	TWENTY TWO
49	TCA2409077	HEMANT CHAHAL	9.67	8.67	AB	10	9	37	THIRTY SEVEN
50	TCA2409078	HIMANSHU JAIN	6	5.67	AB	10	9	31	THIRTY ONE
51	TCA2409081	HRITHIK PAWAR	3	8	6.33	10	10	34	THIRTY FOUR
52	TCA2409083	JAMSHED ALAM	2	3.33	3	10	10	26	TWENTY SIX
53	TCA2409084	JAY RAM KUMAR MANDAL	2.33	6	AB	9	8	25	TWENTY FIVE
54	TCA2409086	KAMAL	1	2.33	3.33	10	9	25	TWENTY FIVE
55	TCA2409087	KARTIK KUMAR SINGH	7	8	AB	10	7	32	THIRTY TWO
56	TCA2409089	KRATI JAIN	6.33	7	4.67	10	7	30	THIRTY
57	TCA2409091	KRISH PAL	3	3	AB	10	9	25	TWENTY FIVE
58	TCA2409092	LAKSHYA GAHLOUT	3.33	3.33	4.67	10	9	27	TWENTY SEVEN
59	TCA2409095	MAHAK JAIN	7.33	8.33	3.33	10	8	34	THIRTY FOUR
60	TCA2409096	MANAS MADHAV	1.33	6	2.67	9	9	27	TWENTY SEVEN

TEERTHANKER MAHAVEER UNIVERSITY

DELHI ROAD, MORADABAD U.P-244001

AWARD LIST

(INTERNAL ASSESSMENT THEORY)

ROGRAM: BACHELOR OF TECHNOLOGY **MAX. MARKS** : 40(COMPUTER SCIENCE & ENGINEERING) **SESSION** : 2024-25**SEMESTER:** FIRST SEMESTER **COURSE CODE:** EAS112**COURSE:** ENGINEERING PHYSICS **DATE :** 14-12-2024**COLLEGE:** FoE **SECTION:** B

SL. NO.	ENROLLMENT NO.	STUDENT'S NAME	ASSESSMENT BASES					TOTAL OBTAINED MARKS	
			CT1	CT2	CT3	ASN	ATT	IN FIGURE	IN WORDS
MARKS			10	10	10	10	10	40	FORTY
1	TCA2409097	MANISEN GUPTA	3.67	6.33	2.67	9	10	29	TWENTY NINE
2	TCA2409099	MANYA JAIN	4.33	7.67	10	10	10	38	THIRTY EIGHT
3	TCA2409100	MANYUPMA KUMARI	3	6.67	4.67	10	9	30	THIRTY
4	TCA2409105	MISHIKA JAIN	AB	7.67	AB	9	8	25	TWENTY FIVE
5	TCA2409106	MOHAMMAD AMAAN	7.67	7.67	6	10	10	35	THIRTY FIVE
6	TCA2409107	MOHAMMAD FAIZ	7.67	9.33	AB	9	9	35	THIRTY FIVE
7	TCA2409109	MOHAMMAD HANZALA GAZI	7	4	AB	9	7	27	TWENTY SEVEN
8	TCA2409111	MOHD AYAN	7.33	7.33	AB	10	8	33	THIRTY THREE
9	TCA2409112	MUSKAN	4.67	7	4.33	10	10	32	THIRTY TWO
10	TCA2409113	NAMAN JAIN	9	9.33	AB	10	9	37	THIRTY SEVEN
11	TCA2409114	NAVED ALAM	2.33	3	AB	9	9	23	TWENTY THREE
12	TCA2409115	NIKET JAIN	8	9	AB	10	9	36	THIRTY SIX
13	TCA2409116	NIKSHAY JAIN	3.33	7	3.33	10	8	28	TWENTY EIGHT
14	TCA2409119	OMPRAKASH	1.33	3.33	5.33	9	10	28	TWENTY EIGHT

15	TCA2409120	PALAK JAIN	1	3	0.33	10	10	24	TWENTY FOUR
16	TCA2409121	PALAK SHARMA	4.33	AB	3.33	10	8	26	TWENTY SIX
17	TCA2409122	PANKAJ KUMAR	2	3	3.33	9	7	22	TWENTY TWO
18	TCA2409124	PARTH JAIN	3.33	3	AB	9	7	22	TWENTY TWO
19	TCA2409125	PARTH SHARMA	1	1.33	0.67	10	10	22	TWENTY TWO
20	TCA2409127	PRAJJAWAL SINGH	2.33	6.67	1.67	10	10	29	TWENTY NINE
21	TCA2409128	PRAPHOOL KUMAR	7	1.33	3	10	8	28	TWENTY EIGHT
22	TCA2409129	PRATEEK JAIN	5.67	6.33	AB	9	9	30	THIRTY
23	TCA2409130	PRINCE JAIN	4.67	4	AB	9	8	26	TWENTY SIX
24	TCA2409131	PRINCE KUMAR PATEL	5.67	5.33	3.33	10	8	29	TWENTY NINE
25	TCA2409132	PRITAN KUMAR	1.67	0	1.33	10	8	21	TWENTY ONE
26	TCA2409135	PUNEET CHAUHAN	3	3	0.33	10	9	25	TWENTY FIVE
27	TCA2409137	RADHIKA	8	10	AB	10	9	37	THIRTY SEVEN
28	TCA2409138	RADHIKA VERMA	4	4.67	3	9	9	27	TWENTY SEVEN
29	TCA2409139	RANJEET KUMAR	2	5	3.33	10	7	25	TWENTY FIVE
30	TCA2409143	RIDDHI JAIN	3	4.67	1.67	10	9	27	TWENTY SEVEN
31	TCA2409146	ROCKEY RAJ	9	8.33	AB	10	9	36	THIRTY SIX
32	TCA2409148	SAMEER	5.67	5.67	1.33	9	8	28	TWENTY EIGHT
33	TCA2409149	SAMYAK JAIN	8	8	5.33	10	9	35	THIRTY FIVE
34	TCA2409150	SANSKAR PATIL	6	0.67	AB	9	8	24	TWENTY FOUR
35	TCA2409152	SATYAM JAIN	7.67	9.33	8.33	10	10	38	THIRTY EIGHT
36	TCA2409155	SEHWAG GOUR	1.33	2.33	1.67	10	10	24	TWENTY FOUR
37	TCA2409156	SHAFIA KHATOON	6.33	9	9.67	10	10	39	THIRTY NINE
38	TCA2409158	SHALABH CHAUDHARY	6	8.67	3	9	9	33	THIRTY THREE
39	TCA2409159	SHASHANK KUMAR MISHRA	5	8.67	4.67	9	8	31	THIRTY ONE
40	TCA2409160	SHEETAL	2	4.67	3.67	9	9	26	TWENTY SIX
41	TCA2409161	SHIMPU	3	5.33	3.67	10	10	29	TWENTY NINE

42	TCA2409162	SHIVANG YADAV	9	9.67	AB	10	9	38	THIRTY EIGHT
43	TCA2409164	SHREYA PANDEY	3	4.33	4.33	10	10	29	TWENTY NINE
44	TCA2409166	SNEHA JAIN	2	3.33	AB	9	6	20	TWENTY
45	TCA2409167	SONU KUMAR	2.67	1.67	3.33	9	9	24	TWENTY FOUR
46	TCA2409169	SRISTI RANI	1.33	2.33	2.67	10	8	23	TWENTY THREE
47	TCA2409171	TANISH CHAUHAN	1	3	1.33	10	10	24	TWENTY FOUR
48	TCA2409172	TANZILA BASIR	9	AB	8.67	10	10	38	THIRTY EIGHT
49	TCA2409175	URJA JAIN	3.67	6.33	6.33	10	8	31	THIRTY ONE
50	TCA2409176	UTKARSH CHAUHAN	3	5	5.67	9	8	28	TWENTY EIGHT
51	TCA2409177	UTKARSH GUPTA	4.67	7	7.33	10	9	33	THIRTY THREE
52	TCA2409179	VANDANA KUMARI	1	3.33	3.33	10	10	27	TWENTY SEVEN
53	TCA2409181	VANSH JAIN	9.33	8.33	AB	10	9	37	THIRTY SEVEN
54	TCA2409182	VANSH KUMAR	5	7	7.33	10	10	34	THIRTY FOUR
55	TCA2409183	VARSHA	4.33	9	9.67	10	10	39	THIRTY NINE
56	TCA2409185	VINAYAK AGRAHARI	1.33	3.33	3.67	9	8	24	TWENTY FOUR
57	TCA2409187	VISHVAMOHAN SHARMA	4.33	0.67	3.33	9	8	25	TWENTY FIVE
58	TCA2409189	VISHWAS RASTOGI	6.67	6.67	AB	10	10	33	THIRTY THREE
59	TCA2409190	VIVEK YADAV	AB	4.33	4.67	9	8	26	TWENTY SIX
60	TCA2409193	ZAINAB AYYOOB	3	5.67	2	9	10	28	TWENTY EIGHT

End Semester Exam Analysis

Result and Analysis

CO Attainment of End Sem

Course Name	ENGINEERING PHYSICS
Course Code	EAS112
Batch	2024-2028
Semester	1st
Session	2024-2025
L:T:P	3.1.0

CO Attainment

Course Code	CO	CO Attainment
EAS112	CO1	67.7
	CO2	68
	CO3	69.86
	CO4	68.54
	CO5	65.06

CO-PO Mapping

Course Code	CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EAS112	CO1	EAS112.1	2											
	CO2	EAS112.2	2											
	CO3	EAS112.3	2											
	CO4	EAS112.4		2										
	CO5	EAS112.5		2										
Mapping Strength		EAS112	1.2	0.8										

PO Attainment

PO	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	P O 10	PO1 1	P O 12
Relevant COs	CO1 CO2 CO3	CO4 CO5										
Average of attainments of Relevant COs	68.52	66.8										
PO Attainment Attainment of PO = (Actual Mapping strength/Maximum Mapping Strength)* Average of attainments of relevant COs	27.41	17.81										
PO Attainment (normalized to 3)	0.82	0.53										

Course Code	CO		PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	P O1 0	PO1 1	P O 12
EAS112	CO1	EAS112.1	0.55											
	CO2	EAS112.2	0.55											
	CO3	EAS112.3	0.55											
	CO4	EAS112.4		0.36										
	CO5	EAS112.5		0.36										
PO Attainments		EAS112	0.33	0.14										

CO-PSO Mapping

Course Code	CO		PSO1	PSO2	PS O3
EAS112	CO1	EAS112.1			
	CO2	EAS112.2			
	CO3	EAS112.3			
	CO4	EAS112.4			
	CO5	EAS112.5			
Mapping Strength		EAS112			

PSO Attainment

PSO	PSO1	PSO2	PS O3
Relevant COs			
Average of attainments of Relevant COs			
PSO Attainment Attainment of PSO = (Actual Mapping strength/Maximum Mapping Strength)* Average of attainments of relevant COs			
PSO Attainment (normalized to 3)			

Course Code	CO		PSO1	PSO2	PS O3
EAS112	CO1	EAS112.1			
	CO2	EAS112.2			
	CO3	EAS112.3			
	CO4	EAS112.4			
	CO5	EAS112.5			
PSO Attainments		EAS112			

Direct CO Attainment –CTs & End Sem

Course Name	ENGINEERING PHYSICS
Course Code	EAS112
Batch	2024-2028
Semester	1st
Session	2024-2025
L:T:P	3.1.0

Direct CO Attainment using Semester End Examination (SEE)

S.No.	Univ. Roll No.	Name	Max Marks	SEE		
				60	>=60%	Level (3,2,1)
1	TCA2409001	ABDUL MUNEEB KHAN	39	65	3	Y
2	TCA2409002	ABDUS SUBOOR KHAN	37	61.67	3	Y
3	TCA2409004	ABHAY RAJ SINGH	30	50	2	N
4	TCA2409005	ABHIMANYU RAI	34	56.67	2	N
5	TCA2409006	ABHINAV SUNIL PATIL	27	45	2	N
6	TCA2409007	ABHISHEK JAIN	57	95	3	Y
7	TCA2409008	ABHISHEK KUMAR		0	1	N
8	TCA2409010	ABHISHEK SHUKLA	35		3	Y
9	TCA2409013	ADI JAIN	19	31.67	1	N
10	TCA2409016	AJAY KUMAR		0	1	N
11	TCA2409020	AKSHITA JAIN	35		3	Y
12	TCA2409021	AMAAN SHAHID	27	45	2	N
13	TCA2409022	AMAN THAPAN	30	50	2	N
14	TCA2409025	AMRUTA VILAS HUDDAR	25	41.67	1	N
15	TCA2409026	ANAMTA NAQVI	41	68.33	3	Y
16	TCA2409027	ANAND MISHRA		0	1	N
17	TCA2409028	ANAND RAJ			3	Y
18	TCA2409029	ANIMESH JAIN	45		3	Y
19	TCA2409030	ANIMESH JAIN	21	35	1	N
20	TCA2409032	ANKIT KUMAR	43	71.67	3	Y
21	TCA2409033	ANKIT KUMAR		0	1	N
22	TCA2409034	ANKIT KUMAR	20		3	Y
23	TCA2409037	ANSH CHAUDHARY	20	33.33	1	N
24	TCA2409038	ANSH JAIN	59	98.33	3	Y
25	TCA2409039	ANSHIK KUMAR GUPTA	58	96.67	3	Y
26	TCA2409041	ANUJ PAL	20	33.33	1	N

27	TCA2409042	ANURAG YADAV	33	55	2	N
28	TCA2409044	ANVI JAIN	33	55	2	N
29	TCA2409045	ARCHANA KUMARI	57	95	3	Y
30	TCA2409047	ARPAN KUMAR	48	80	3	Y
31	TCA2409048	ARPIT JAIN	56	93.33	3	Y
32	TCA2409049	ARUN	30	50	2	N
33	TCA2409050	ARUN KUMAR	34	56.67	2	N
34	TCA2409052	ASHUTOSH KUMAR	47	78.33	3	Y
35	TCA2409053	ASHUTOSH KUMAR RAI	35	58.33	2	
36	TCA2409055	ATUL KUMAR GUPTA		0	1	
37	TCA2409056	AVADHESH KUMAR SHARMA			3	
38	TCA2409058	AYUSH SINGH	43		3	
39	TCA2409059	AZHAAN MOHAMMAD KHAN	31	51.67	2	
40	TCA2409060	DAKSH JAIN	51	85	3	
41	TCA2409061	DAKSH RUHELA	38	63.33	3	
42	TCA2409064	DIVYANSH BHARDWAJ	43	71.67	3	
43	TCA2409066	DIVYANSHU KUMAR	21	35	1	
44	TCA2409067	GAGANDEEP SHARMA	19	31.67	1	
45	TCA2409072	GYAYAK PATODI	33	55	2	
46	TCA2409073	HARSH JAIN	47	78.33	3	
47	TCA2409075	HARSHIT JAIN	4	6.67	1	
48	TCA2409076	HARSHIT JAIN	33	55	2	
49	TCA2409077	HEMANT CHAHAL	43	71.67	3	
50	TCA2409078	HIMANSHU JAIN	40	66.67	3	
51	TCA2409081	HRITHIK PAWAR	44	73.33	3	
52	TCA2409083	JAMSHED ALAM	40	66.67	3	
53	TCA2409084	JAY RAM KUMAR MANDAL	29	48.33	2	
54	TCA2409086	KAMAL	35	58.33	2	
55	TCA2409087	KARTIK KUMAR SINGH	45	75	3	
56	TCA2409089	KRATI JAIN	57	95	3	
57	TCA2409091	KRISH PAL	50	83.33	3	
58	TCA2409092	LAKSHYA GAHLOUT	41	68.33	3	
59	TCA2409095	MAHAK JAIN	49	81.67	3	
60	TCA2409096	MANAS MADHAV	25	41.67	1	
61	TCA2409097	MANISEN GUPTA	16	26.67	1	
62	TCA2409099	MANYA JAIN	48	80	3	
63	TCA2409100	MANYUPMA KUMARI	39	65	3	
64	TCA2409105	MISHIKA JAIN	26	43.33	1	
65	TCA2409106	MOHAMMAD AMAAN	46	76.67	3	
66	TCA2409107	MOHAMMAD FAIZ		0	1	
67	TCA2409109	MOHAMMAD HANZALA GAZI	20		3	

68	TCA2409111	MOHD AYAN	56	93.33	3	
69	TCA2409112	MUSKAN	50	83.33	3	
70	TCA2409113	NAMAN JAIN	56	93.33	3	
71	TCA2409114	NAVED ALAM	33	55	2	
72	TCA2409115	NIKET JAIN	59	98.33	3	
73	TCA2409116	NIKSHAY JAIN	36	60	3	
74	TCA2409119	OMPRAKASH	22	36.67	1	
75	TCA2409120	PALAK JAIN	21	35	1	
76	TCA2409121	PALAK SHARMA	54	90	3	
77	TCA2409122	PANKAJ KUMAR	22	36.67	1	
78	TCA2409124	PARTH JAIN	12	20	1	
79	TCA2409125	PARTH SHARMA	18	30	1	
80	TCA2409127	PRAJJAWAL SINGH	45	75	3	
81	TCA2409128	PRAPHOOL KUMAR	44	73.33	3	
82	TCA2409129	PRATEEK JAIN	40	66.67	3	
83	TCA2409130	PRINCE JAIN	14	23.33	1	
84	TCA2409131	PRINCE KUMAR PATEL	45	75	3	
85	TCA2409132	PRITAN KUMAR		0	1	
86	TCA2409135	PUNEET CHAUHAN	24		3	
87	TCA2409137	RADHIKA	48	80	3	
88	TCA2409138	RADHIKA VERMA	18	30	1	
89	TCA2409139	RANJEET KUMAR	41	68.33	3	
90	TCA2409143	RIDDHI JAIN	40	66.67	3	
91	TCA2409146	ROCKEY RAJ	50	83.33	3	
92	TCA2409148	SAMEER	37	61.67	3	
93	TCA2409149	SAMYAK JAIN	41	68.33	3	
94	TCA2409150	SANSKAR PATIL	26	43.33	1	
95	TCA2409152	SATYAM JAIN	43	71.67	3	
96	TCA2409155	SEHWAG GOUR	21	35	1	
97	TCA2409156	SHAFIA KHATOON	49	81.67	3	
98	TCA2409158	SHALABH CHAUDHARY	35	58.33	2	
99	TCA2409159	SHASHANK KUMAR MISHRA	51	85	3	
100	TCA2409160	SHEETAL	29	48.33	2	
101	TCA2409161	SHIMPU	54	90	3	
102	TCA2409162	SHIVANG YADAV	55	91.67	3	
103	TCA2409164	SHREYA PANDEY	41	68.33	3	
104	TCA2409166	SNEHA JAIN		0	1	
105	TCA2409167	SONU KUMAR			3	
106	TCA2409169	SRISTI RANI	30		3	
107	TCA2409171	TANISH CHAUHAN	16	26.67	1	
108	TCA2409172	TANZILA BASIR	48	80	3	
109	TCA2409175	URJA JAIN	41	68.33	3	
110	TCA2409176	UTKARSH CHAUHAN	27	45	2	

111	TCA2409177	UTKARSH GUPTA	20	33.33	1	
112	TCA2409179	VANDANA KUMARI		0	1	
113	TCA2409181	VANSH JAIN			3	
114	TCA2409182	VANSH KUMAR	29		3	
115	TCA2409183	VARSHA	50	83.33	3	
116	TCA2409185	VINAYAK AGRAHARI	33	55	2	
117	TCA2409187	VISHVAMOHAN SHARMA		0	1	
118	TCA2409189	VISHWAS RASTOGI	35		3	
119	TCA2409190	VIVEK YADAV	21	35	1	
120	TCA2409193	ZAINAB AYYOOB	34	56.67	2	

No. of students scoring	3	66
	2	21
	1	33
Average		2.28

Course Code	CO	CO Attained of students getting $\geq 60\%$ marks)	(% CO Attained (On Scale of 3)
EAS112	CO1	55	1.65
	CO2	55	1.65
	CO3	55	1.65
	CO4	55	1.65
	CO5	55	1.65

Indirect CO Attainment-Course Exit Survey

Overall CO Attainment – (Direct and Indirect Assessment)

	Course outcome Attainment	SESSION-2024-25
		SEM- 1st

Course Name	ENGINEERING PHYSICS
Course Code	EAS112
Batch	2024-2028
Semester	1st
Session	2024-2025
L:T:P	3.1.0

**CO Attainment and
Analysis**

**Direct CO Attainment using
Continuous Internal Examination
(CIE)**

Course Code	CO	CO Attained (% of students getting ≥ 60% marks)	CO Attained (On Scale of 3)
EAS112	CO1	69.17	2.08
	CO2	67.5	2.03
	CO3	73.33	2.2
	CO4	69.17	2.08
	CO5	58.33	1.75

**Direct CO Attainment
using Semester End
Examination (SEE)**

Course Code	CO	CO Attained (% of students getting ≥ 60% marks)	CO Attained (On Scale of 3)
EAS112	CO1	55	1.65
	CO2	55	1.65
	CO3	55	1.65
	CO4	55	1.65
	CO5	55	1.65

**Direct CO Attainment
(CO_Direct)**

Course Code	CO	CO Attained Using CIE (CO_CIE)	CO Attained using SEE (CO_SEE)	Direct CO Attainment (CO_Direct = $0.33*CO_CIE + 0.67*CO_SEE$)	Direct CO Attainment (On Scale of 3)
EAS112	CO1	69.17	55	60.67	1.82
	CO2	67.5	55	60	1.8
	CO3	73.33	55	62.33	1.87
	CO4	69.17	55	60.67	1.82
	CO5	58.33	55	56.33	1.69

Indirect CO Attainment (CO_Indirect)

Course Code	CO	Indirect CO Attainment (CO_Indirect)	Indirect CO Attainment (On scale of 3)
EAS112	CO1	95.83	2.87
	CO2	100	3
	CO3	100	3
	CO4	100	3
	CO5	100	3

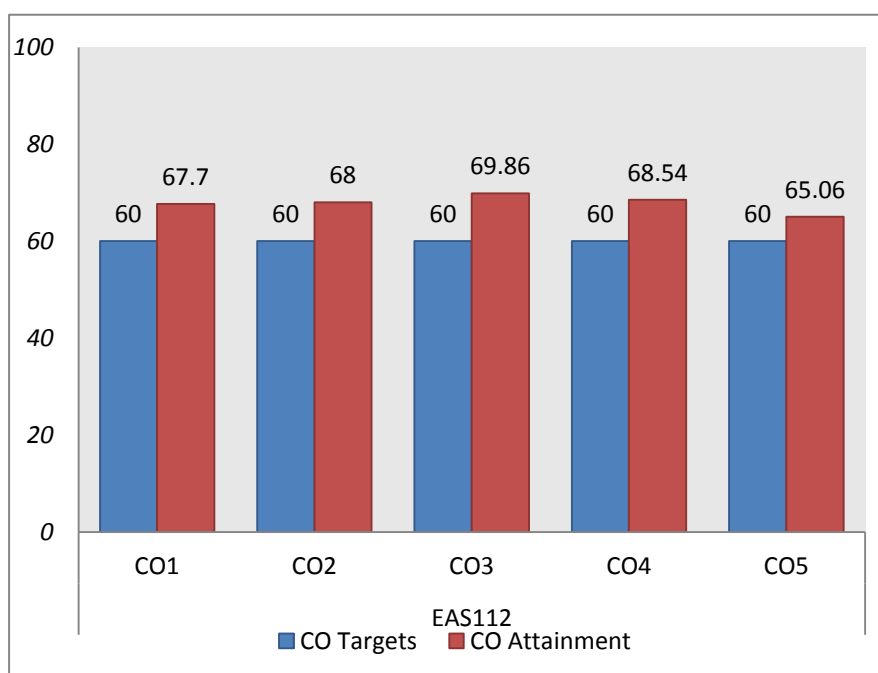
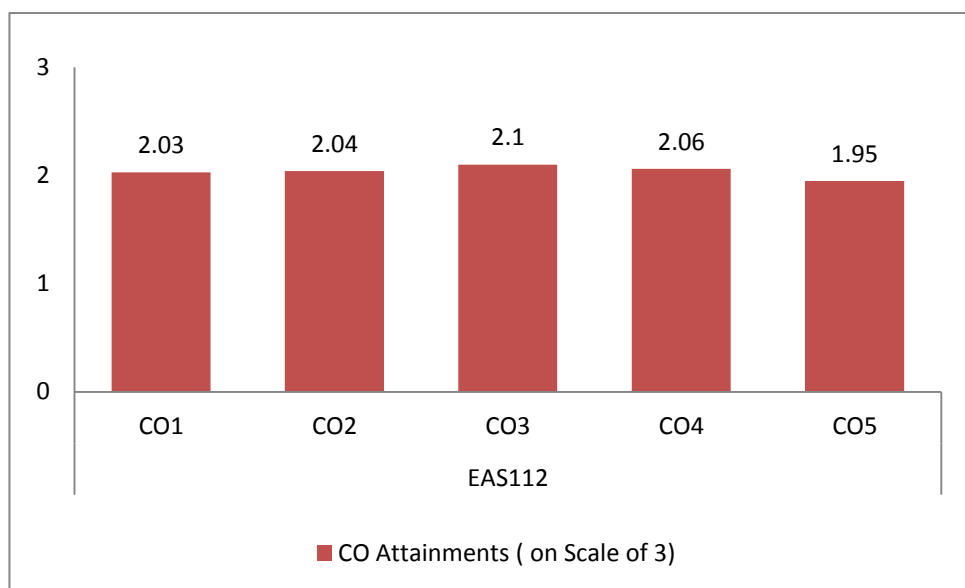
CO Attainment

Course Code	CO	Direct CO Attainment (CO_Direct)	Indirect CO Attainment (CO_Indirect)	CO Attainment (CO = $0.9*CO_Direct + 0.1*CO_Indirect$)	CO Attainment (On scale of 3)	
EAS112	CO1	60.67	95.83	67.7	2.03	
	CO2	60	100	68	2.04	
	CO3	62.33	100	69.86	2.1	
	CO4	60.67	100	68.54	2.06	
	CO5	56.33	100	65.06	1.95	

Course Code	CO	CO Targets	CO Attainment	Y/N
EAS112	CO1	60	67.7	Y
	CO2	60	68	Y
	CO3	60	69.86	Y

	CO4	60	68.54	Y
	CO5	60	65.06	Y

Course Code	CO	CO Attainment (On Scale of 3)
EAS112	CO1	2.03
	CO2	2.04
	CO3	2.1
	CO4	2.06
	CO5	1.95



Course File Closure Report



FACULTY OF ENGINEERING DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Year: 1st Sem: 1st Branch: CSE Batch: A & B
Engineering Physics(EAS112)
A.Y.: 2024-25 ODD SEM

COURSE FILE CLOSURE REPORT

Course file consists of the following details:

- ☐ Vision & Mission of Institute
- ☐ Vision & Mission of Department
- ☐ Program Educational Objectives (PEOs)
- ☐ Program Outcomes (POs)
- ☐ Program Specific Outcomes (PSOs)
- ☐ Institute Academic Calendar
- ☐ Course Evaluation Scheme
- ☐ Course Outcomes
- ☐ CO-PO-PSO Mapping
- ☐ Lecture Plan & Course Coverage
- ☐ Time Table-Faculty
- ☐ Time Table- Sections
- ☐ List of Assignments/Quizzes
- ☐ Class Test Paper (CT1, CT2, and CT3)
- ☐ Class Test Marks (CT1, CT2, and CT3)
- ☐ Class Test Solution
- ☐ Assignments/Quizzes Solution
- ☐ List of Slow Learner Students of Class test and action taken
- ☐ List of Fast Learner Students of Class test and action taken
- ☐ Previous Year Question Papers
- ☐ **End Semester Exam Analysis**
- ☐ Direct and Indirect CO Attainment- CTs & End Sem

Subject Teacher Name

Verified by IQAC

HOD