Ref No:

# Sri Krishna Institute of Technology, Bengaluru



## COURSE PLAN

## Academic Year 2019-20

Program:	B E
Semester :	1
Course Code:	18PHY12
Course Title:	Engineering Physics
Credit / L-T-P:	4 / 3-2-0
Total Contact Hours:	50
Course Plan Author:	Dr. Savita B Hosur

## Academic Evaluation and Monitoring Cell

### Hesaraghatta Main Road Chikkabanavara – 560090, Karnataka, India 08023721477 / Fax :+91-080-23721315 Web: www.skit.org , e-mail: skitprinci1@gmail.com

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Note : Remove "Table of Content" before including in CP Book Each Course Plan shall be printed and made into a book with cover page Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

## A. COURSE INFORMATION

### 1. Course Overview

Degree:	BE	Program:	All
Year / Semester :	2019 / 1	Academic Year:	2019-2020
Course Title:	Engineering Physics	Course Code:	18PHY12
Credit / L-T-P:	3-2-0	SEE Duration:	180 Minutes
Total Contact Hours:	50	SEE Marks:	60 Marks
CIA Marks:	40	Assignment	1 / Module
Course Plan Author:	Dr. Savita B. Hosur	Sign	Dt:

Checked By:	Prof. Ravi S	Sign	Dt:		
CO Targets	CIA Target : 80 %	SEE Target:	70 %		

Note: Define CIA and SEE % targets based on previous performance.

### 2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Mod	Content	Teachi	Identified	Blooms
ule		ng	Module	Learning
		Hours	Concepts	Levels
1	Definition of SHM, Characteristics, Examples and	10	Oscillations and	Understand
	Derivation of differential equation of motion for SHM		waves	L2,
	starting from Hooke's law and mention its solution.			Analyze L4
	Mechanical simple harmonic oscillator: Mass suspended			-
	to spring (vertical vibrations) - Description, Mention of			
	Expression for time period/frequency, Definition of force			
	constant and its significance, Derivation of expressions			
	for force constants for series and parallel combination			
	of springs. Complex notation of simple harmonic motion			
	$(Aei(\omega t + \epsilon))$ , Phasor representation of simple harmonic			
	motion. Theory of damped oscillations (over damping			
	critical and under damping) forced oscillations and			
	resonance, sharpness of resonance. Example for			
	mechanical resonance.			
	Mach number, properties of shock waves, control			
	volume. Laws of conservation of mass, energy and			
	momentum. Construction and working of Reddy shock			
	tube. Applications.			
	Numerical Problems			
2	Concept of elasticity, plasticity, stress, strain, tensile	10	Elasticity and	
	stress, shear stress, compressive stress, strain		Torque	
	hardening and strain softening, failure. Hooke's law,			L4-Analyze
	Poison's ratio, Expression for Young's modulus (Y),			
	Bulk modulus ( K ) and Rigidity modulus (n). Relation			
	petween Y, K & n. Limits of Poisson's ratio. Neutral			
	bonding moment. Bonding momentum of a beam with			
	circular and rectangular cross section. Single cantilever			
	Expression for couple per unit test of a solid cylinder			
	(Derivation) Torsional Pendulum Numerical problems			
3	Fundamentals of vector calculus. Divergence and curl of	10	Electric and	14 -
	electric field and magnetic field (static) Gauss'	10	magnetic field	Analyze
	divergence theorem and Stokes' theorem. Description		TIR	/
	of laws of electrostatics, magnetism and Faraday's laws			
	of EMI. Current density & equation of Continuity:			
	displacement current (with derivation) Maxwell's			
	equations in vacuum. The wave equation in differential			
	form in free space (Derivation of the equation using			
	Maxwell's equations), Plane electromagnetic waves in			
	vacuum, their transverse nature, polarization of EM			
	waves (Qualitative). Propagation mechanism, angle of			
	acceptance. Numerical aperture. Modes of propagation			
	and Types of optical fibers. Attenuation: Causes of			
	attenuation and Mention of expression for attenuation			
	coefficient. Discussion of block diagram of point to point			
	communication. Merits and demerits			
	Numerical problems			
4	Introduction to Quantum mechanics, Wave nature of	10	Heisenberg's	
	particles,		uncertainty,	L4 -

5	Heisenberg's uncertainty principle and applications (non confinement of electron in the nucleus), Schrodinger time independent wave equation, Significance of Wave function, Normalization, Particle in a box, Energy eigen values of a particle in a box and probability densities. Review of spontaneous and stimulated processes, Einstein's coefficients (derivation of expression for energy density). Requisites of a Laser system. Conditions for laser action. Principle, Construction and working of CO2 and semiconductor Lasers. Application of Lasers in Defense (Laser range finder) and Engineering (Data storage). Numerical problems	10	Interaction of Radiation with matter	Analyze
5	failures. Assumptions of Quantum Free electron theory, Mention of expression for density of states, Fermi-Dirac statistics (qualitative), Fermi factor, Fermi level, Derivation of the expression for Fermi energy, Success of QFET. Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band, Hole concentration in valance band (only mention the expression), Conductivity of semiconductors(derivation), Hall effect, Expression for Hall coefficient(derivation) polar and non-polar dielectrics, internal fields in a solid, Clausius - Mossotti equation (Derivation), mention of solid, liquid and gaseous dielectrics with one example each. Application of dielectrics in transformers. Numerical problems	10	Free electron Theory, Materials	L4 - Analyze
-	Total	50	-	-

### 3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes

2. Design: Simulation and design tools used – software tools used ; Free / open source

3. Research: Recent developments on the concepts – publications in journals; conferences etc.

			lerenees eter
Modul	Details	Chapter	Availability
es		s in	
		book	
Α	Text books (Title, Authors, Edition, Publisher, Year.)	-	-
	A Text book of Engineering Physics – M. N. Avadhanulu and P. G.	1,10,20,	In Lib
	Kshirsagar, S Chand & Co., 10 <sup>th</sup> Revised Ed	24	
1-5	Engineering Physics - Gaur and Gupta, Dhanpat Rai Publications -	2, 4	In Lib/ In dept
	2017	1-10	
	Engineering Physics - S. P. Basavaraju, Subash Publications -		
	2018		
В	Reference books (Title, Authors, Edition, Publisher, Year.)	-	-
1, 2	Introduction to Mechanics – M. K. Verma, 2 <sup>nd</sup> Ed, University Press,		In Lib
3,4	Laser and Non Linear Optics – B B Laud, 3rd Ed., New age		In Lib
	international publishers		
5	Solid State Physics - S. O. Pillai, 8th Ed., New age international	5,6,10,1	In lib
	publishers	1	
С	Concept Videos or Simulation for Understanding	-	-

C1 - C10	<ul> <li>Basic Physics: <u>https://www.physicsclassroom.com</u></li> <li>Elasticity:<u>https://www.youtube.com/watchv=OAK7CZSu9DA</u></li> <li>Quantum Mechanics: NPTEL: <u>https://www.youtube.com/watch?</u></li> <li><u>v=pGerRhxNQJE</u></li> </ul>		web
D	Software Tools for Design	-	-
E	Recent Developments for Research	-	-
F	Others (Web, Video, Simulation, Notes etc.)	-	-
1	NPTEL		

### 4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

SNo	Course Code	Course Name	Module / Topic / Description	Sem	Remarks	Blooms Level
1	18PHY1 2	Engineering Physics	Oscillations and Waves	Low er Stan dard s	Knowledge of Motion, vibrations, conservation laws	L1, L2
2	18PHY1 2	Engineering Physics	Elastic Properties of Materials	Low er Stan dard s	Size, Shape of materials, Application of forces	L1, L2
3	18PHY1 2	Engineering Physics	Maxwell's equations, EM waves and Optical Fibers	Low er Stan dard s	Study of Vector, Scalar, Electromagnetic waves	L2
4	18PHY1 2	Engineering Physics	Quantum Mechanics and Lasers	Low er Stan dard s	Understanding of Classical Physics, Emission and absorption processes	L2
5	18PHY1 2	Engineering Physics	Material Science	Low er Stan dard s	Band theory of Solids, Conductivity in Semiconductors	L1, L2

#### Students must have learnt the following Courses / Topics with described Content . . .

#### 5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.

Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

cour.		JAIL TOPICS	, g. Mi TEE Videos, n. Swayani vi	ucos cic.
Mod	Topic / Description	Area	Remarks	Blooms
ules				Level

## B. OBE PARAMETERS

### 1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Mod	Course	Course Outcome	Teach.	Concept	Instr	Assessm	Blooms'
ules	Code.#	At the end of the course,	Hours		Method	ent	Level
		student should be able to				Method	
1	CO1	Students should be able to	06	Oscillation	Lecture,	Slip Test	L2
		Understand the types of	1	S	PPT,		Understan
		oscillations and their	1		Classro		d
		implications.			om		
					Expt.		
1	CO2	Illustrate production of shock	04	Shock	Lecture,	Slip Test	L4
		waves by using waves in Reddy		waves	PPT		Illustrate
		Shock tube					
2	CO3	Analyze the elastic properties of	07	Elasticity	Lecture,	Slip Test	L4
		materials for engineering field			PPT,		Analyze
		using Hook's Law and Possions'			Classro		
		ratio.			om		
					Expt.		
2	CO4	Calculate the couple per unit	03	Torque	Lecture,	Slip Test	L3
		twist of a solid cylinder and			PPT,		Analyze
		period of oscillations for			Classro		
		Torsional pendulum.			om		
					Expt.		
3	CO5	Analyze the Maxwell's equation	06	Electric	Lecture,	Slip Test	L4
		by using EM waves.		and	PPT,		Analyze
				Magnetic	Classro		
				field	om		
					Expt.		
3	CO6	Illustrate the point to point	04	Total	Lecture,	Slip Test	L4
		communication using optical		Internal	PPI,		Illustrate
		fibers.		reflection	Classro		
					om		
			05		Expt.		
4	C07	Compute the Eigen values and	05	Heisenber	Lecture,	Slip Test	L4
		eigen function by using the time		gʻs	PPI		Compute
		Independent ID Schrödinger	]	Uncertaint			
	C00	wave equation	05	y Principle	Loctura	Clip Toot	
4	CUS	analyze the production and	05	niceractio		Silp rest	
		applications of laser.		radiation	Classre		Analyze
				radiation	Classio		
				with	Evet		
5	C00	Applyze the electrical and	04	Free	Expt.	Slip Tost	1.4
ן כ	09	thormal properties of conductor	04	oloctron		Silb Test	
		using Quantum theory		theory			Analyze
F		Applyze the clockfield	06	Motoriol	Locture	Clip Tact	1.4
) C	CO10	Analyze the electrical	00		Lecture,	Silp rest	
	010	using hand theory of solids		PHYSICS	rr1,		Analyze
		Total	<b>E</b> 0				
<b>-</b>		IULdi	00	-	-	-	-

### 2. Course Applications

Write 1 or 2 applications per CO.

Students should be able to employ / apply the course learnings to . . .

Mod	Application Area	CO	Level
ules			
1	Understand the car shock absorbers and musical instruments.	CO1	L2

2	Analyze the concrete structures.	CO2	L4
3	Analyze the materials in mechanical engineering.	CO3	L4
4	Analyze the civil engineering structural elements.	CO4	L3
5	Analyze the EM communication and wireless communication.	CO5	L4
6	Used in the medical field, communication system.	CO6	L4
7	Used in materials engineering, photonics, MRI.	C07	L4
8	Used in medical field, communication, Industry applications.	CO8	L4
9	Used in electrical and electronics engineering.	CO9	L4
10	Design of active electronic components.	CO10	L4

### 3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair. To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Mod	od Mapping Mappi			Justification for each CO-PO pair	Level
ules			g Level		
-	СО	PO	-	'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'	-
1	C01	PO1	3	Engineering Knowledge: Acquisition of Engineering Knowledge of oscillation is required to accomplish the study of engineering subjects	L2 Under stand
1	C01	PO2	3	Problem Analysis: Analyzing problems require knowledge of Identifying the oscillations in mechanical and electrical oscillators.	L2 Under stand
1	C01	PO3	3	Design and development of Solutions: Designing of shock absorbers for vehicles requires the knowledge of oscillations.	L2 Under stand
1	C01	PO4	3	Conduct investigations of complex problems: Investigation of new designs of shock absorbers require knowledge of oscillations.	L2 Under stand
1	C01	PO5	2	Modern tool Usage: The modern tools help to understand the types of oscillation and their limitations.	L2 Under stand
1	C01	PO6	-	No Mapping – This learning is not relevant with societal, health, safety, legal and cultural issues.	L2 Under stand
1	C01	PO7	-	No Mapping – This learning does not have any impact on society environmental contexts.	L2 Under stand
1	C01	PO8	-	No Mapping – The content is not related to professional ethics norms and practice.	L2 Under stand
1	C01	PO9	3	Individual and Team work: The knowledge oscillation is required to do mini projects on different types of oscillators.	L2 Under stand
1	C01	PO10	-	No Mapping – No design documentation activity with engineering community.	L2 Under stand
1	C01	PO11	-	No Mapping – There is no finance management involved.	L2 Under stand
1	C01	PO12	3	Life long learning: The study of Oscillations is applicable to the technology and Life long learning in industry.	L2 Under stand
1	CO2	PO1	3	Engineering Knowledge: Acquisition of Engineering knowledge of Shock waves required to study shock wave tube	L4 Illustr ate
1	CO2	PO2	3	Problem Analysis: The knowledge of analyzing the waves requires	L4

				to study the speed of Aircrafts.	lllustr ate						
_	CO2	PO3	3	Design and development of solutions: Designing of building structures and aircraft requires the knowledge of waves.	L4 Illustr						
			_		ate						
	C02	PO4	3	Conduct investigations of complex problems: To conduct the	L4						
				investigation of new designs of aircraft requires the knowledge of	Illustr						
				waves.	ate						
	C02	PO5	2	Modern tool usage: To understand the principle of shock waves	L4						
				vith limitation.							
1			-		ate						
	C02	PO6	2	The Engineer and Society: The study of waves and its properties	L4						
				help in the development of society.	Illustr						
1					ate						
	C02	PO7	2	Environment and sustainability: The study of shockwaves and its	L4						
				application help in the development of the society and Nation.	Illustr						
1					ate						
	CO2	PO8	-	No Mapping – The content is not related to professional ethics	L4						
				norms and practice	Illustr						
1					ate						
	CO2	PO9	3	Individual and Team work: The study of Experiments on	L4						
				production of shock waves can be done individually or in a team.	Illustr						
1					ate						
	CO2	PO10	-	No Mapping – No design documentation activity with engineering	L4						
				community.	Illustr						
1					ate						
	CO2	PO11	_	No Mapping – There is no finance management involved.	14						
	001				Illustr						
1					ate						
<u> </u>	CO2	PO12	_	No Mapping - No independent learning	14						
	002	1012			Illustr						
1					ate						
-	CO3	PO1	З	Engineering Knowledge: The knowledge of elasticity required to							
		101	5	understand different concents in civil and mechanical engineering	Δnalv						
2				field	70						
<u> </u>	CO3	PO2	3	Problem Analysis: The problem analyzing knowledge on elasticity							
	05	102	J	is required to analyse different materials	L4 Analy						
2				is required to analyse different materials.							
<u> </u>	<u> </u>		2	Design and Development of colution. The knowledge of designing	20						
	03	FUS	2	and development Designing of bridges and monuments							
2				and development besigning of bridges and monuments.							
<b>_</b>	002			No Monning	28						
	103	PU4	-	ivo Mapping – There is no investigation.							
2					Analy						
<u> </u>	602	DOF		No monning . No tool contant							
	103	rU5	-	ino mapping - no tool content.	L4 Analys						
_					Analy						
2	000	DOC			ze						
	C03	PO6	-	No Mapping – This learning is not relevant with societal, health,	L4						
-				satety, legal and cultural issues.	Analy						
2					ze						
	CO3	PO7	-	No Mapping – This learning does not have any impact on society	L4						
_				environmental contexts.	Analy						
2					ze						
	CO3	PO8	-	No Mapping - The content is not related to professional ethics	L4						
				norms and practice.	Analy						
2					ze						
	CO3	PO9	3	Individual and Team work: Study of Experiments on determining	L4						
			-	, , , , , , , , , , , , , , , , , , ,							
			-	different moduli of the materials requires individual /Team work.	Analy						

	2	CO3	PO10	-	No Mapping – No design documentation activity with engineering community.	L4 Analy ze
	_	CO3	PO11	-	No Mapping – There is no finance management involved.	L4
	2					ze
		CO3	PO12	3	Life long learning - The study of elastic properties involves life	L4
	2				long learning of the concepts.	Analy
$\vdash$	2	CO4	PO1	3	Engineering Knowledge: Engineering knowledge of torgue is	L3
				-	required in study in motion of the body	Analy
	2	<u> </u>	002	2	Problem Analysis, The Problem analyzing technique using the	ze
		C04	PUZ	2	knowledge of torgue is required in analyzing the mechanism in	Analv
	2				electric motors.	ze
		CO4	PO3	3	Design and Development of solution: The knowledge of designing	L3
	2				oscillations.	ze
	_	CO4	PO4	3	No Mapping – There is no investigation.	L3
	2					Analy
$\vdash$	Z	C04	PO5		No mapping - No tool content	ze I 3
		004	105			Analy
	2					ze
		CO4	PO6	-	No Mapping – This learning is not relevant with societal, health, safety legal and cultural issues	L3 Analy
	2				safety, legal and cultural issues.	ze
		CO4	PO7	-	No Mapping – This learning does not have any impact on society	_L3
	2				environmental contexts.	Analy
	2	CO4	PO8	-	No Mapping – The content is not related to professional ethics	L3
	_				norms and practice.	Analy
	2	<u> </u>		2	Individual and Team work. The study of rigidity modulus using	ze
		C04	FU9	2	torsional pendulum Experiment requires the Individual / Team	Analy
	2				work.	ze
		CO4	PO10	-	No Mapping – No design documentation activity with engineering	L3
	2				community.	ze
		CO4	PO11	-	No Mapping – There is no finance management involved.	L3
	2					Analy
$\vdash$	2	CO4	PO12	-	No Mapping - No independent learning.	L3
		•				Analy
	2	COF	DO1	2	Engineering Knowledge, The engineering knowledge of electrical	ze
		05	PUI	3	and magnetic field in required in the study of Maxwell's equation	L4 Analv
	3					ze
		CO5	PO2	3	Problem Analysis: The knowledge of EM field is required in	L4
	3				analyzing the problems in communication system.	analy ze
	-	CO5	PO3	3	Design and Development of solution:	 L4
	<u>م</u>				The Design and development of solutions for various electro	Analy
$\vdash$	3	C05	PO4	3	magnetic waves requires the knowledge using Maxwell's Equation. Conduct Investigations of Complex Problems:	ze I 4
		205		2	The investigations of Analysis and interpretation of Maxwell's	Analy
	3	005	<b>DC-</b>		equation requires the knowledge electromagnetic wave theory.	ze
	3	CO5	PO5	-	No mapping - No tool content.	L4 Analy
						, undry

					70
	COL	DOC		No. Menusian . This leaves is a structure with resident leavest	_ze
	C05	P06	-	No Mapping – This learning is not relevant with societal, health,	L4
_				safety, legal and cultural issues.	Analy
3					ze
	CO5	PO7	-	No Mapping – This learning does not have any impact on society	L4
				environmental contexts.	Analy
3					ze
	CO5	PO8	-	No Mapping - The content is not related to professional ethics	L4
				norms and practice.	Analy
3					70
5	COF			No Manning No projects involved	14
		FU9	-	no mapping – no projects involved.	L4
					Analy
3					ze
	CO5	PO10	-	No Mapping – No design documentation activity with engineering	L4
				community.	Analy
3					ze
	CO5	PO11	-	No Mapping – There is no finance management involved.	L4
					Analy
3					70
<u> </u>	COF	DO12		No Manning - No independent loarning	11
		POTZ	-		L4 Analy
2					Analy
3					ze
	CO6	PO1	3	Engineering Knowledge: The engineering knowledge of TIR is	L4
				required in the study of optical fiber communication system.	Analy
3					ze
	CO6	PO2	3	Problem Analysis: The Problem analyzing in Optical fiber	L4
			-	communication require the knowledge of TIR	Analy
2					70
<u> </u>	COE		2	Design and Development of colution. The knowledge of Optical	14
	000	PU3	5	besign and Development of solution: The knowledge of Optical	L4
				nders is required to design Point to point communication system.	Analy
3					ze
	CO6	PO4	3	Conduct Investigations of complex problems:	L4
				Various investigation on the experimental setup on study of	Analy
				Acceptance angle and Numerical aperture of the fiber requires the	ze
3				knowledge of Optical fibers properties.	
	C06	PO5	-	No tool content. No mapping.	L4
					Analy
3					70
<b>–</b>	C06	DO6		The angineer and Society: The knowledge of Optical fibers is used	14
		FUU	-	in communication for cosistal cafety incurs	L4 Apoly
2				in communication for societal safety issues.	Allaly
5	000	<b>D</b> 07			ze
	CO6	P07	-	Environment and Sustainability: The study of optical fibers helps	L4
				in development of the communication system in society.	Analy
3					ze
	CO6	PO8	-	No Mapping - The content is not related to professional ethics	L4
				norms and practice.	Analy
3					ze
	00	POQ	٦	Individual and Team Work. The study of different properties of	14
		109	5	ontical fibers by different lab experiments requires the individual	Analy
2				and Team work	
<u>د</u>	600			anu reann WUIK.	20
	100	POTO	-	wapping - no design documentation activity with engineering	
				community.	Analy
3					ze
3	CO6	PO11	-	No Mapping – There is no finance management involved.	L4
					Analy
					ze
З	C06	PO12	З	Life Long Learning: The study of optical fibers is a Life long	14
				learning in day to day technological application	Analy
					70

4	C07	PO1	3	Engineering Knowledge: Acquisition of engineering Knowledge of HUP is required to calculate the Eigen energy values	L4 Analy
4	C07	PO2	3	Problem Analysis: Analyzing problems on atomic structure requires the knowledge knowledge of Heisenberg uncertainty principle and Eigen values.	L4 Analy ze
4	C07	PO3	3	Design and Development of solution:	L4
				Analyzing the processes of Einstein's energy values & Heisenberg	Analy
				uncertainty principle.	ze
4	C07	PO4	-	No Mapping – There is no investigation.	L4
					Analy
	607	DOF			ze
4	01	P05	-	No tool content. No mapping.	L4 Analy
1	C07	PO6		No Manning - This learning is not relevant with societal health	1/
-	01	100	_	safety legal and cultural issues	Analy
				Salety, legal and calcular issues.	ze
4	C07	PO7	-	No Mapping – This learning does not have any impact on society	L4
				environmental contexts.	Analy
					ze
4	C07	PO8	-	No Mapping - The content is not related to professional ethics	L4
				norms and practice.	Analy
_	607	<b>DOO</b>			ze
4	C07	PO9	-	No project involved. No mapping.	L4
					Analy
1	C07	PO10	_	No Manning - No design documentation activity with engineering	14
-	01	1010	_	community	Analy
				communey.	ze
4	C07	PO11	-	No Mapping – There is no finance management involved.	L4
					Analy
					ze
4	C07	PO12	-	No Mapping - No independent learning.	L4
					Analy
_	600	<b>DO1</b>			ze
4	C08	POT	3	Engineering Knowledge: The acquisition of engineering knowledge	L4
				of interaction of radiation with matter is required in the study of communication system	Analy
1	C08	PO2	2	Problem Analysis: Analysing problem requires the knowledge of	
-	000	102	J	understanding of interaction of radiation with matter to	Analy
				accomplish the understanding of CO2 and semiconductor lasers.	ze
4	C08	PO3	3	Design and Development of solution: The design and	L4
				development of solution for designing the laser production	Analy
				techniques.	ze
4	CO8	PO4	3	Conduct Investigations of complex problems: The knowledge to	L4
				analyze the production and applications is required to solve the	Analy
	<u> </u>	DOF	2	complex problems.	ze
4	108	PU5	2	modern tool usage: the modern tool usage is required to analyze	L4 Apoly
				annlications	70
4	COS	PO6	2	The engineer and society. The knowledge of Laser radiation	14
<sup>r</sup>			£	effects in health issues in the society.	Analy
					ze
4	C08	PO7	2	Environment and sustainability: Analyzing and understanding the	L4
				knowledge of laser radiation impact on environment and its	Analy
				sustainability.	ze
4	C08	PO8	-	No Mapping – The content is not related to professional ethics	L4
				norms and practice.	Analy

					1
	<u> </u>	DOO		Individual and Teams work. Chudu of averaging at an enadystice of	ze
4	08	PO9	3	laser requires the Individual and Team work.	L4 Analy
1	C08	PO10		No Manning - No design documentation activity with engineering	ze
4	00	1010	-	community.	Analv
					ze
4	C08	PO11	-	No Mapping – There is no finance management involved.	L4
					Analy
Δ	C08	PO12	З	life long learning: The life long learning of Laser applications is	2e
-	000	1012	5	essential in day to day applications.	Analv
					ze
5	CO9	PO1	3	Engineering Knowledge: The acquisition of Engineering knowledge	L4
				of of free electron theory is required to understand electrical and	Analy
5	C00	PO2	З	Inermal properties of materials.	ze
	COS	r Oz	J	properties and structure requires the knowledge of free electron	Analy
				theory.	ze
5	CO9	PO3	3	Design and Development of solution: Design and development of	L4
				solution is required to analyze the process of conductivity in	Analy
5	<u> </u>			CONductor. No Mapping – There is no investigation	ze
	COS	104	-	No Mapping – mere is no investigation.	Analy
					ze
5	CO9	PO5	-	No tool content. No mapping.	L4
					Analy
5	<u> </u>	DO6		No Manning This loarning is not relevant with societal health	ze
	COS	FUU	-	safety, legal and cultural issues.	Analy
					ze
5	CO9	PO7	-	No Mapping – This learning does not have any impact on society	L4
				environmental contexts.	Analy
5	C00	POS		No Manning - The content is not related to professional ethics	ze
	005	100	_	norms and practice.	Analv
					ze
5	CO9	PO9	3	Individual and Team work: The individual and Team work is	_L4
				required to demonstrate the lab experiments on Fermi energy.	Analy
5	C09	PO10	_	No Mapping - No design documentation activity with engineering	14
				community.	Analy
				-	ze
5	CO9	PO11	-	No Mapping – There is no finance management involved.	L4
					Analy
5	C09	PO12	_	No Mapping - No independent learning.	14
	000				Analy
					ze
5	CO1	PO1	3	Engineering Knowledge: The acquisition of engineering knowledge	L4
	U			of different devices	Analy
5	C01	PO2	3	Problem analysis: Analyzing problems require the knowledge of	
	0		-	Identifying the different materials using band theory of solids.	Analy
					ze
5	C01	PO3	3	Design and Development of solution: The design and	L4
	U			conductivity in semiconductor	Analy
5	C01	PO4	3	Modern tool usage: The Modern tool usage is required in analysis	L4
i					

	-				
	0			of semiconductors on doping concentration.	Analy
					ze
5	C01	PO5	-	No tool content. No mapping.	L4
	0				Analy
					ze
5	C01	PO6	-	No Mapping – This learning is not relevant with societal, health,	L4
	0			safety, legal and cultural issues.	Analy
					ze
5	C01	PO7	-	No Mapping – This learning does not have any impact on society	L4
	0			environmental contexts.	Analy
					ze
5	C01	PO8	-	No Mapping - The content is not related to professional ethics	L4
	0			norms and practice.	Analy
					ze
5	C01	PO9	3	Individual and Team work: To demonstrate the semiconductor lab	L4
	0			experiments like Photo diode and Transistor requires the	Analy
				Individual and team work.	ze
5	C01	PO10	-	No Mapping – No design documentation activity with engineering	L4
	0			community.	Analy
					ze
5	C01	PO11	-	No Mapping – There is no finance management involved.	L4
	0				Analy
					ze
5	C01	PO12	-	No Mapping - No independent learning.	L4
	0				Analy
					ze

### 4. Articulation Matrix

#### CO - PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes Program Outcomes												-				
Mod	CO.#	At the end of the course	At the end of the course POPOPOPOPOPOPOPOPOPOPOPOPOPOPOPOPOPOPO											Lev				
ules		student should be able to	1	2	3	4	5	6	7	8	9	10	11	12	01	02	03	el
1	CO1	Understand the types of	$\checkmark$				$$				$\checkmark$							L2
		oscillations and their	1															
		implications.	,					,	,									
1	CO2	Illustrate production of shock	$\checkmark$	√	√	$$	$ $ $\vee$	$\checkmark$	V		V							L2
		waves by using waves in																
	603	Reddy Snock tube	/								/			/				
2	03	Analyze the elastic properties	V	V	V						٧			V				LZ
		field using Hook's Low and																
		Possions' ratio																
2	CO4	Calculate the couple per unit		1	1						√						_	13
2	04	twist of a solid cylinder and	v	v	ľ						v							LJ
		period of oscillations for																
		Torsional pendulum.																
3	C05	Analyze the Maxwell's																L2
		equation by using EM waves.																
3	CO6	Illustrate the point to point				$\checkmark$		$\checkmark$	$\checkmark$					$\checkmark$				L2
		communication using optical																
		fibers.																
4	C07	Compute the Eigen values	$\checkmark$	√														L3
		and eigen function by using																
		the time independent 1D																
		Schrodinger wave equation																

	r	
4	CO8	Analyze the production and $\sqrt{  v  } \sqrt{  v  } \sqrt{  v  } \sqrt{  v  } \sqrt{  v  }$
		applications of laser
5	CO9	Analyze the electrical and $\sqrt{ v } \sqrt{ v } =  v  +  v  +  v  +  v $
		thermal properties of
		conductor using Quantum
		Conductor using Quantum
		theory.
5	CO10	Analyze the electrical $\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{$
	00-00	conductivity of
		semiconductors using band
		theory of solids.
-	CS501PC	Average attainment (1, 2, -
-	PO, PSO	1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development o
		Solutions: 4.Conduct Investigations of Complex Problems: 5.Modern Too
		Usage: 6 The Engineer and Society: 7 Environment and Sustainability: 8 Ethics
		orage, or the Engineer and Society, r.Environment and Sustainability, o.Ethics
		P.Individual and Teamwork; 10.Communication; 11.Project Management and
		Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base
		Management: S3 Web Design
	1	rianagement, somes besign

### 5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Mod	Gap Topic	Actions Planned	Schedule Planned	<b>Resources Person</b>	PO Mapping
ules					

### 6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Mod ules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping

## C. COURSE ASSESSMENT

### 1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Mod	Title	Teach		No. of	quest	Exam		CO		Levels	
ules			CIA-1	CIA-2	CIA-3	Asg	Extra	SEE	]		
		Hours					Asg				
1	Oscillations and Waves	10	2	-	-	1	1	2	CO1, (	CO2	L2,
											L3,L4
2	Elastic Properties of Materials	10	2	-	-	1	1	2	CO3, (	CO4	L2,
											L3,L4
3	Maxwell's Equation, EM waves	10	-	2	-	1	1	2	CO5, 0	CO6	L2,
	and Optical Fibers										L3,L4
4	Quantum Mechanics and Lasers	10	-	2	-	1	1	2	CO7, 0	C08	L2,
											L3,L4
5	Quantum Free electron theory,	10	-	-	4	1	1	2	COS	Э,	L2,
	Physics of semiconductors and								CO1	.0	L3,L4
	Dielectric materials										
-	Total	50	4	4	4	5	5	10	-		-

### 2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Mod	Evaluation	Weightage	СО	Levels
ules		in Marks		
4,1	CIA Exam – 1	30	CO1, CO2, CO3, CO4	L2, L3,L4
2,3	CIA Exam – 2	30	CO5, CO6, CO7, C08	L2, L3,L4
5	CIA Exam – 3	30	CO9, CO10	L2, L3,L4
4,1	Assignment - 1	10	CO1, CO2, CO3, CO4	L2, L3,L4
2,3	Assignment - 2	10	CO5, CO6, CO7, C08	L2, L3,L4
5	Assignment - 3	10	CO9, CO10	L2, L3,L4
	Final CIA Marks	40	-	-

## D1. TEACHING PLAN - 1

#### Module - 1

Title:	Oscillations and Waves	Appr Time	10 Hrs
а	Course Outcomes	- -	Blooms
-	The student should be able to:	_	Level
1	Understand the types of oscillations and their implications.	CO1	12
2	Illustrate production of shock waves by using waves in Reddy Shock tube	CO2	L3
D	Course Schedule	-	-
No	Module Content Covered	0	Levei
1	Definition of SHM, Characteristics, Examples and Derivation of differential equation of motion for SHM.	C01	L2,
2	Mechanical simple harmonic oscillator. (Mass suspended to spring oscillator) – Description.	CO1	L2
3	Complex notation of simple harmonic motion (Aei( $\omega t + \epsilon$ )), Phasor representation of simple harmonic motion. Equation of motion for free oscillations,	C01	L3
4	Natural frequency of oscillations. Theory of damped oscillations (over damping critical and under damping) forced oscillations	C01	L2
5	Resonance, sharpness of resonance. Example for mechanical resonance,	C01	L3
6	Mach number, Properties of Shock waves, control volume.	CO1	L2
7	Laws of conservation of mass, energy and momentum.	CO1	L3
8	Construction and working of Reddy shock tube	CO1	L4
9	Applications of shock waves.	CO1	L4
10	Numerical	CO1	L4
С	Application Areas	СО	Level
1	Understand the car shock absorbers and musical instruments.	CO1	L2
2	Analyze the concrete structures.	CO2	L4
d	Review Questions	-	-
1	Definition of SHM	CO1	L1
2	Derivation of equation for SHM	CO1	L3
3	Define Mechanical Simple harmonic oscillators	CO1	L2
4	Explain complex notation and phasor representation of simple harmonic motion	CO1	L4
5	Derive Equation of motion for free oscillations, Natural frequency of	CO1	L2

	oscillations		
6	Define over damping, critical & under damping, quality factor	C01	L2
7	Explain Theory of forced oscillations and resonance, Sharpness of	CO2	L2
	resonance.		
8	Explain One example for mechanical resonance	CO2	L3
9	Define Mach number and Mach Regimes	CO2	L4
10	Ex[plain Properties of Shock waves	CO2	L1
11	Ex[plain Properties of control volume	CO2	L4
12	Explain Laws of conservation of mass, energy and momentum	CO2	L4
13	Explain Construction and working of Reddy shock tube	CO2	L4
14	Explain applications of shock waves.	CO2	L2
е	Experiences	-	-
1			
2			

### Module – 2

Title:	Elastic Properties of Materials	Appr	10 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Analyze the elastic properties of materials for engineering field using Hook's Law and Poisson's ratio.	CO3	L4
2	Calculate the couple per unit twist of a solid cylinder and period of oscillations for Torsional pendulum.	CO4	L3
b	Course Schedule	_	_
Class	Module Content Covered	0	Level
No			Level
11	Concept of elasticity, plasticity, stress, strain, tensile stress, shear stress.	CO3	L3
12	Compressive stress, strain hardening and strain softening, failure (fracture/fatigue).	CO3	L3
13	Hooke's law, different elastic moduli: Poisson's ratio.	CO3	L3
14	Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of $\checkmark$ and $\beta$ .	Co4	L3
15	Relation between Y, n and K, Limits of Poisson's ratio.	Co4	L3
16	Neutral surface and neutral plane, Derivation of expression for bending moment.	Co4	L3
17	Bending moment of a beam with circular and rectangular cross section. Single cantilever, derivation of expression for young's' modulus	Co4	L3
18	Torsion of cylinder: Expression for couple per unit twist of a solid cylinder (Derivation),	Co4	L4
19	Torsional pendulum-Expression for period of oscillation.	Co4	L4
20	Numerical problems	Co4	L4
C	Application Areas	CO	Level
1	Analyze the materials in mechanical engineering.	CO3	L3
2	Analyze the civil engineering structural elements.	C04	L4
-	Poviow Overtiens		
12	neview Questions	-	-
12	Define plasticity	CO3	
12		CUS	

14	Define stress	CO3	L1
15	Define strain	CO3	L1
16	Define tensile stress	CO3	L1
17	Define shear stress	CO3	L1
18	Define compressive stres	CO3	L1
19	Define strain hardening	CO3	L1
20	Define strain softening	CO3	L1
21	Define fracture in Materials.	CO3	L1
22	Define Hooke's law.	CO3	L2
23	Explain Poisson's ratio.	CO3	L2
24	Derive Expression for Young's modulus (Y) in terms of $\checkmark$ and $\beta$ .	CO3	L4
25	Derive Bulk modulus (K) in terms of $\checkmark$ and $\beta$ .	CO3	L4
26	Derive Rigidity modulus (n) in terms of $\checkmark$ and $\beta$ .	CO3	L4
27	Derive Relation between Y, n and K.	CO3	L4
28	Explain Neutral surface and neutral plane.	CO3	L3
29	Derive expression for bending moment.	CO4	L3
30	Explain Bending moment of a beam with circular cross section.	CO4	L2
31	Explain Bending moment of a beam with rectangular cross section.	CO4	L2
32	Define Single cantilever.	CO4	L1
33	Derive expression for young's' modulus	CO4	L4
34	Derive Expression for couple per unit twist of a solid cylinder	CO4	L4
35	Explain Torsional pendulum.	CO4	L2
36	Derive an Expression for period of oscillation.	CO4	L4
е	Experiences	-	-
1			
2			
3			
4			

## E1. CIA EXAM - 1

## a. Model Question Paper - 1

Crs Cod	Crs 18PHY12 Sem: I Marks: 50 Time: 90 Code:		90 minut	es						
Cou	rse:	Engineerin	g Physics							
-	-	Note: Ansv	ver any 3 q	uestions, e	ach carry e	equal marks	5.	Marks	CO	Level
1	а	What are E oscillations	Damped vib 5	orations? Do	educe the t	heory of da	amped	8	co1	L3
	b	Define SHM mention its	4 and Deriv s solution.	e the equa	ition of mol	ion for SHN	4 and	7	co1	L2
	С	What is a subsonic a	Mach num nd superso	ber? Distin nic waves	guish betw based on M	een acoust lach numbe	ic, ultrason er	ic, 6	co2	L3
	d	For a particle Executing SHM, it's acceleration is found to be 15cm/s <sup>2</sup> when it is at 3cm from it's mean position. Calculate tim period.						ne 4	col	L4
					or					
2	а	Describe tl of a diagra	ne construc m.	tion and w	orking of P	leddy tube	with the he	elp 8	co2	L3
	b	Derive the series and	Expression parallel con	n for equiva mbination.	alent force	constant fo	or 2 springs	in 7	col	L3
	С	Define reso	onance, Ex	plain the sh	narpness of	resonance		6	co1	L2
	d	In a Reddy Tube experiment it was found that, the time taken to travel between the two sensors is 195 $\mu$ s. If the distance between the two sensors is 100 mm. Find the Mach Number. (given-speed of sound in air=333 m/s)						to 4 en ed	co2	L4
3	a	Derive the	Relation be	etween Y,	η&σ.			8	co3	L3

	b	S T for an elastic body shear Strain = Longitudinal strain + Compression strain.	7	co3	L3
	С	Explain The Nature of Elasticity with the help of stress – strain diagram	6	co3	L2
	d	Calculate the force required to produce an extension of 1mm in steel wire of length 2 m and diameter 1mm.(Young's modulus of the material of the beam is $2 \times 10^{11}$ N/m <sup>2</sup> .)	4	co3	L4
		or			
4	а	Derive the expression for couple per unit twist of solid Cylinder.	8	co4	L3
	b	Explain the different types of modulus of elasticity	7	co3	L3
	С	Mention the various types of beams with diagram and their Engineering Applications.	6	co3	L2
	d	A rectangular bar 2 cm ion breadth and 1 cm in thickness and 1 m in length is supported at its one ends and a load of 2 kg is applied at its middle. Calculate the dipression if the Young's modulus of the material of the beam is $2 \times 10^{11}$ N/m <sup>2</sup> .	4	co3	L4

## b. Assignment -1

Note: A distinct assignment to be assigned to each student.

	Model Assignment Questions										
Crs C	ode:	18PHY 2	1Sem:	1	Marks:	10		Time:	30 minu	tes	
Cours	se:	Enginee	ring Physic	S							
Note:	Eacl	n studen	t to answei	<sup>-</sup> 2-3 assigni	ments. Ead	h assig	gnme	nt carries e	qual ma	rk.	
SNo	ι	JSN		Assign	ment Des	scriptio	on		Mark s	СО	Level
1			Define SHN	1. Derivatio	n of equati	on for S	SHM.		5	CO1	L3
2			Explain Me	chanical si	mple harm	onic os	cillat	or.	5	CO1	L3
3			Explain co simple har	mplex nota monic motic	tion and p on.	hasor	repre	esentation o	of	C01	L4
4			Derive Equ	ation of mo	tion for fre	e oscill	lation	IS,	5	CO1	L3
5			Explain Na	tural freque	ncy of osc	illations	s.		5	CO1	L2
6			Define ove factor	r damping,	critical &	under	dam	ping, qualit	y 5	C01	L1
7			Explain th Sharpness	eory of fo of resonanc	rced oscil ce.	lations	and	resonance	<u>,</u>	C01	L2
8			Explain on	e example f	or mechan	ical res	sonar	nce	5	CO1	L2
9			Define Mac	h number a	nd Mach F	Regime	s		5	CO1	L1
10			Ex[plain Properties of Shock waves					5	CO1	L2	
11			Ex[plain Pr	operties of o	control vol	ume				CO1	L2
12			Explain La momentun	aws of cor	servation	of ma	ass,	energy an	d 5	C01	L3
13			Explain Co	nstruction a	nd working	g of Re	ddy s	hock tube	5	CO1	L3
14			Explain ap	olications of	shock wa	ves.			5	CO1	L3
15			Explain Ela	sticity and p	olasticity					CO1	L2
16			Define stre	ss and strai	n				5	CO2	L1
17			Define ten	sile stress a	and shear s	stress			5	CO2	L1
18			Define con	pressive st	ress				5	CO2	L1
19			Define stra	ain hardenir	ng and stra	in softe	ening	l		CO2	L1
20			Define frac	ture in Mate	erials.				5	CO2	L1
21			Define Hoo	ke's law.					5	CO2	L1
22			Explain Poi	sson's ratio					5	CO2	L2
23			Derive Exp and β.	ression for	Young's m	odulus	(Y) ii	n terms of 🗸		CO2	L3
24			Derive Bull	< modulus (	K) in terms	s of 🖌 a	and β	•	5	CO2	L3
25			Derive Rigi	dity modulu	ıs (n) in te	rms of	🖌 an	d β.	5	CO2	L3
26			Derive Rela	ation betwee	en Y, n and	1 K.			5	CO2	L3
27			Explain Ne	utral surface	e and neut	ral plar	ne.			CO2	L3

28	Derive expression for bending moment.	5	CO2	L3
29	Explain Bending moment of a beam with circular cross section.	5	CO2	L2
30	Explain Bending moment of a beam with rectangular cross section.	5	CO2	L2
31	Define Single cantilever.		CO2	L1
32	Derive expression for Young's modulus	5	CO2	L3
33	Derive Expression for couple per unit twist of a solid cylinder	5	CO2	L3
34	Explain Torsional pendulum.	5	CO2	L3
35	Derive an Expression for period of oscillation.		CO2	L3
36				

### D2. TEACHING PLAN - 2

### Module – 3

a       Course Outcomes       -       Blooms         -       The student should be able to:       -       Level         1       Analyze the Maxwell's equation by using EM waves.       CO5       L2         2       Illustrate the point to point communication using optical fibers.       CO6       L3         b       Course Schedule       CO       Level         Class       Module Content Covered       CO       Level         No       Module Content Covered       CO       Layle         21       Fundamentals of vector calculus. Divergence and curl of electric field (static)       CO5       L3         22       Gauss' divergence theorem and Stokes' theorem.       CO5       L3         23       Description of laws of electrostatics, magnetism and Faraday's laws of EMI.       CO5       L4         24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum       CO5       L3         25       The wave equation in differential form in free space (Derivation of the equation using Maxwell's equation: causes of attenuation and Meetion expression for attenuation: Causes of attenuation and Meetion expression for attenuation coefficient.       C05       L3         26       Plane electromagnetic waves (uagram of point to point to point copint copint copint copint copint copint copint copint communication. Merits	Title:	Maxwell's Equation, EM waves and Optical fibers	Appr	10 Hrs
a       Course Outcomes       -       Blooms         -       The student should be able to:       -       Level         1       Analyze the Maxwell's equation by using EM waves.       CO5       L2         2       Illustrate the point to point communication using optical fibers.       CO6       L3         b       Course Schedule       -       -         Class       Module Content Covered       CO       Level         No       -       Edvalue       -       -         21       Fundamentals of vector calculus. Divergence and curl of electric field (static)       CO5       L3         22       Gauss' divergence theorem and Stokes' theorem.       CO5       L4         1 aws of EMI.       -       Corrent density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum       CO5       L4         24       Current density & equation of continuity; displacement current (with derivation) Maxwell's equations), naveurum their transverse nature, polarization of EM waves(Qualitative)       CO5       L4         25       The wave equation in differential form in free space (Derivation of the equation expression for attenuation coefficient.       CO5       L3         28       Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.       CO5       <			Time:	Discuss
-       The student should be able to:       -       -       Level         1       Analyze the Maxwell's equation by using EM waves.       CO5       L2         2       Illustrate the point to point communication using optical fibers.       CO6       L3 <b>b</b> Course Schedule       CO       Level         No       No       CO       Level         21       Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static)       CO5       L3         22       Gauss' divergence theorem and Stokes' theorem.       CO5       L3         23       Description of laws of electrostatics, magnetism and Faraday's laws of EMI.       CO5       L3         24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum       CO5       L4         25       The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),       CO5       L3         26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture.       CO5       L3         28       Types of optical fibers. Attenuation coefficient.       CO5       L3         29	a	Course Outcomes	-	BIOOMS
1       Analyze the Maxwell's equation by using EM waves.       CO3       L2         2       Illustrate the point to point communication using optical fibers.       CO6       L3         2       Course Schedule       CO       Level         No       Course Schedule       CO       Level         No       Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static)       CO5       L3         22       Gauss' divergence theorem and Stokes' theorem.       CO5       L3         23       Description of laws of electrostatics, magnetism and Faraday's laws of EMI.       CO5       L4         24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum (with derivation Maxwell's equations),       CO5       L3         25       The wave equation in infferential form in free space (Derivation of CO5       L3         26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation for attenuation coefficient.       CO5       L3         29       Discussion of block diagram of point to point communication and merits and demerits       CO5       L4         20       Analyze the EM communication and wireless communication	-	The student should be able to:	-	Level
2       Indistrate the point to point communication using optical index.       Code       L3         b       Course Schedule       CO       Level         No       Course Schedule       CO       Level         21       Fundamentals of vector calculus. Divergence and curl of electric field (static)       CO5       L3,L4, field and magnetic field (static)         22       Gauss' divergence theorem and Stokes' theorem.       CO5       L4         23       Description of laws of electrostatics, magnetism and Faraday's laws of EMI.       CO5       L4         24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations), nequence (Derivation of CO5       L4         25       The wave equation in differential form in free space (Derivation of CO5       L3         26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.       CO5       L3         28       Types of optical fibers. Attenuation coefficient.       CO5       L3         29       Discussion of block diagram of point to point communication and wireless communication.       CO5       L4         c       Application Areas       CO5       L4         2	2	Analyze the Maxwell's equation by using EM waves.	<u> </u>	
b       Course Schedule       CO       Level         Class       Module Content Covered       CO       Level         No       21       Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static)       CO5       L3,L4,         22       Gauss' divergence theorem and Stokes' theorem.       CO5       L3         23       Description of laws of electrostatics, magnetism and Faraday's laws of EMI.       CO5       L4         24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum       CO5       L4         25       The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),       CO5       L3         26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.       CO5       L3         28       Types of optical fibers. Attenuation: Causes of attenuation and C05       L3         30       Numerical problems       CO5       L4         c       Application Areas       CO       Level         1       Analyze the EM communication and wireless communication.       CO5       L4         c       A	Z		000	LS
Class NoModule Content CoveredCOLevel21Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static)CO5L3,L4,22Gauss' divergence theorem and Stokes' theorem.CO5L323Description of laws of electrostatics, magnetism and Faraday's laws of EMI.CO5L424Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuumCO5L425The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),CO5L426Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)CO5L327Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.CO5L328Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.CO5L329Discussion of block diagram of point to point communication. Merits and demeritsCO5L430Numerical problemsCO5L42Optical fibers are used in the medical field, communication system.CO6L42Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L330Define curl of electric fieldCO5L44Evelow Questions1Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5 </td <td>b</td> <td>Course Schedule</td> <td></td> <td></td>	b	Course Schedule		
No	Class	Module Content Covered	СО	Level
21       Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static)       CO5       L3,L4, field and magnetic field (static)         22       Gauss' divergence theorem and Stokes' theorem.       CO5       L3         23       Description of laws of electrostatics, magnetism and Faraday's laws of EMI.       CO5       L4         24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum       CO5       L3         25       The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations), polarization of EM waves(Qualitative)       CO5       L3         26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.       CO5       L3         28       Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.       CO5       L3         29       Discussion of block diagram of point to point communication. Merits and demerits       CO5       L4         20       Optical fibers are used in the medical field, communication system.       CO6       L4         20       Optical fibers are used in the medical field, communication system.       CO6       L4         2	No			
21Gauss' divergence theorem and Stokes' theorem.CO5L322Gauss' divergence theorem and Stokes' theorem.CO5L423Description of laws of electrostatics, magnetism and Faraday's laws of EMI.CO5L424Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuumCO5L325The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),CO5L426Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)CO5L327Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.CO5L328Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.CO5L329Discussion of block diagram of point to point communication. Merits and demeritsCO5L430Numerical problemsCO5L44CotCO5L44CotL44CO5L45Define Fundamentals of vector calculus.CO5L46Review Questions1Define Fundamentals of vector calculus.CO5L32Define Eurof field (static)CO5L46Derive Gauss' divergence theorem.CO5L37Derive Gauss' divergence theorem.CO5L46Derive Stokes' theorem.CO5L3	21	Fundamentals of vector calculus. Divergence and curl of electric field	CO5	L3,L4,
23       Description of laws of electrostatics, magnetism and Faraday's laws of EMI.       CO5       L4         24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum       CO5       L3         25       The wave equation in differential form in free space (Derivation of CO5       L4         26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.       C05       L3         28       Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.       C05       L3         29       Discussion of block diagram of point to point communication. Merits and demerits       C05       L4         20       Application Areas       C0       Level         1       Analyze the EM communication and wireless communication. C05       L4         29       Optical fibers are used in the medical field, communication system.       C06       L4         20       Optical fibers are used in the medical field. communication system.       C06       L4         20       Define Fundamentals of vector calculus.       C05       L1         2       Define Eurodementals of vector calculus.       C05       <	22	Gauss' divergence theorem and Stokes' theorem.	CO5	13
23       Description of laws of electrostatics, magnetism and raradays       CO3       L4         24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum       CO5       L3         25       The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),       CO5       L4         26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.       CO5       L3         28       Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.       CO5       L3         29       Discussion of block diagram of point to point communication. Merits and demerits       CO5       L4         30       Numerical problems       CO5       L4         4       CO5       L4         2       Optical fibers are used in the medical field, communication system.       CO6       L4         4       CO5       L4         5       Define Fundamentals of vector calculus.       CO5       L1         6       Review Questions       -       -       -         1       Define Eundamentals of vector calculus.	22	Description of laws of electrostatics, magnetism and Earaday's	CO5	
24       Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum       CO5       L3         25       The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),       CO5       L4         26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.       CO5       L3         28       Types of optical fibers. Attenuation: Causes of attenuation and communication. Merits and demerits       CO5       L3         30       Numerical problems       CO5       L4 <b>c Application Areas CO</b> Level         1       Analyze the EM communication and wireless communication. Define Fundamentals of vector calculus.       CO5       L1         2       Define Fundamentals of vector calculus.       CO5       L1         2       Define Fundamentals of vector calculus.       CO5       L3         3       Define Rundamentals of vector calculus.       CO5       L1         2       Define Fundamentals of vector calculus.       CO5       L1         2       Define Fundamentals of vector calculus.       CO5       L1         3 <td< td=""><td>25</td><td>laws of EMI.</td><td>05</td><td>L4</td></td<>	25	laws of EMI.	05	L4
25The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),CO5L426Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)CO5L327Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.CO5L328Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.CO5L329Discussion of block diagram of point to point communication. Merits and demeritsCO5L430Numerical problemsCO5L4cApplication AreasCOLevel1Analyze the EM communication and wireless communication.CO5L4CO5L12Discussion of block diagram of point to point communication. Merits and demeritsCO5L4CO5L4CO5L4CO5L4CO5L4CO5L4Policial fibers are used in the medical field, communication system.CO6Level1Define Fundamentals of vector calculus.CO5L12Define curl of electric fieldCO5L4CO5L4Define Fundamentals of vector ca	24	Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum	CO5	L3
26       Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)       CO5       L3         27       Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.       CO5       L3         28       Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.       CO5       L3         29       Discussion of block diagram of point to point communication. Merits and demerits       CO5       L4         30       Numerical problems       CO5       L4         c       Application Areas       CO       Level         1       Analyze the EM communication and wireless communication.       CO5       L4         d       Review Questions       -       -         1       Define Fundamentals of vector calculus.       CO5       L1         2       Define Curl of electric field       CO5       L2         4       Define magnetic field (static)       CO5       L3         3       Define wagnetic field (static)       CO5       L4         f       Derive Stokes' theorem.       CO5       L3         6       Derive Stokes' theorem.       CO5       L3         7       Describe laws of electrostatics       CO5       L3 <td>25</td> <td>The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),</td> <td>CO5</td> <td>L4</td>	25	The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),	CO5	L4
27Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.CO5L328Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.CO5L329Discussion of block diagram of point to point communication. Merits and demeritsCO5L430Numerical problemsCO5L4C Application Areas1Analyze the EM communication and wireless communication.29Optical fibers are used in the medical field, communication system.CO5L41Analyze the EM communication and wireless communication system.CO6L42Optical fibers are used in the medical field, communication system.CO6L41Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L46Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L3	26	Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)	CO5	L3
28       Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.       CO5       L3         29       Discussion of block diagram of point to point communication. Merits and demerits       CO5       L4         30       Numerical problems       CO5       L4         C Application Areas       CO       Level         1       Analyze the EM communication and wireless communication.       CO5       L4         2       Optical fibers are used in the medical field, communication system.       CO6       L4         0       Mexiew Questions       -       -         1       Define Fundamentals of vector calculus.       CO5       L1         2       Define Divergence       CO5       L2         3       Define curl of electric field       CO5       L2         4       Define magnetic field (static)       CO5       L2         4       Define magnetic field (static)       CO5       L4         5       Derive Gauss' divergence theorem.       CO5       L2         6       Derive Stokes' theorem.       CO5       L5         7       Describe laws of electrostatics       CO5       L2	27	Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.	CO5	L3
29Discussion of block diagram of point to point communication. Merits and demeritsCO5L330Numerical problemsCO5L4cApplication AreasCOLevel1Analyze the EM communication and wireless communication.CO5L42Optical fibers are used in the medical field, communication system.CO6L4dReview Questions1Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L25Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2	28	Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.	CO5	L3
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cApplication AreasCOLevel1Analyze the EM communication and wireless communication.CO5L42Optical fibers are used in the medical field, communication system.CO6L44Review Questions1Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2	30	Numerical problems	CO5	L4
cApplication AreasCOLevel1Analyze the EM communication and wireless communication.CO5L42Optical fibers are used in the medical field, communication system.CO6L4dReview Questions1Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2				
1Analyze the EM communication and wireless communication.CO5L42Optical fibers are used in the medical field, communication system.CO6L4 <b>dReview Questions</b> 1Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2	С	Application Areas	СО	Level
2Optical fibers are used in the medical field, communication system.CO6L4dReview Questions1Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2	1	Analyze the EM communication and wireless communication.	CO5	L4
dReview Questions-1Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2	2	Optical fibers are used in the medical field, communication system.	CO6	L4
dReview Questions1Define Fundamentals of vector calculus.CO5L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2	4	Poviour Questiens		
1Define Fundamentals of vector calculus.CO3L12Define DivergenceCO5L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2	1 1	Review Questions	-	-
2Define DivergenceCO3L33Define curl of electric fieldCO5L24Define magnetic field (static)CO5L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO5L2	2	Define Divergence	<u> </u>	
4Define magnetic field (static)CO5L25Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO512	<u>ר</u> ר	Define curl of electric field		12
4Define magnetic neid (static)CO3L45Derive Gauss' divergence theorem.CO5L26Derive Stokes' theorem.CO5L57Describe laws of electrostaticsCO512		Define magnetic field (static)	CO5	
6Derive Stokes' theorem.CO5L27Describe laws of electrostaticsCO5L2		Derive Gauss' divergence theorem	<u> </u>	12
7 Describe laws of electrostatics CO5 12	6	Derive Stokes' theorem	 	15
	7	Describe laws of electrostatics	C05	L2

8	Describe laws of magnetism	CO5	L3
9	Describe laws of Faraday's laws of EMI.	CO5	L4
10	Define Current density.	CO5	L1
11	Explain equation of Continuity.	CO5	L4
12	Derive displacement current Maxwell's equations in vacuum	CO5	L3
13	Derive wave equation in differential form in free space using Maxwell's equations.	CO5	L3
14	Explain Plane electromagnetic waves in vacuum.	CO5	L2
15	Define transverse nature.	CO5	L1
16	Define polarization of EM waves.	CO5	L1
17	Explain Propagation mechanism in an optical fiber.	CO6	L2
18	Define angle of acceptance.	CO6	L1
19	Define Numerical aperture.	CO6	L1
20	Based on Modes of propagation Explain Types of optical fibers	CO6	L2
21	Mention the Causes of attenuation in an optical fiber.	CO6	L2
22	Mention the expression for attenuation coefficient.	CO6	L1
23	Discuss point to point communication system of an optican fiber.	CO6	L3
24	Explain Merits and demerits of an Optical Fibers.	CO6	L3
е	Experiences	-	-
1			
2			

### Module - 4

Title:	Quantum Mechanics and Lasers	Appr	10 Hrs
		Time:	
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Compute the Eigen values and eigen function by using the time	C07	L3,L4
	independent 1D Schrodinger wave equation		
2	Analyze the production and applications of laser.	CO8	L4
b	Course Schedule		
Class	Module Content Covered	СО	Level
No			
1	Introduction to Quantum mechanics, Wave nature of particles.	C07	L2
2	Heisenberg's uncertainty principle and applications (non	C07	L3
	confinement of electron in the nucleus).		
3	Schrodinger time independent wave equation.	C07	L4
4	Significance of Wave function, Normalization.	C07	L4
5	Particle in a box, Energy eigen values of a particle in a box and	C07	L4
	probability		
	densities		
6	Review of spontaneous and stimulated processes, Einstein's	CO8	L2
	coefficients (derivation of expression for energy density).		
	Requisites of a Laser system. Conditions for laser action.		
7	Principle, Construction and working of CO2.	CO8	L3
8	Principle, Construction and working of semiconductor Lasers.	CO8	L3
9	Application of Lasers in Defense (Laser range finder) and	CO8	L4
	Engineering (Data storage)		
10	Numerical problems	C07,C0	L4
		8	
С	Application Areas	CO	Level

1	Used in materials engineering, photonics, MRI.	CO8	L3
2	Used in medical field, communication, Industry applications.	C07	L4
d	Review Questions	-	-
1	Define Quantum mechanics	C07	L1
2	Explain Wave nature of particles	C07	L3
3	State Heisenberg's uncertainty principle.	C07	L2
4	Show that non confinement of electron in the atomic nucleus.	C07	L4
5	Derive Schrodinger time independent wave equation.	C07	L2
6	Define Significance of Wave function.	C07	L5
7	Define Significance of Normalization.	C07	L2
8	Define Particle in a box.	C07	L3
9	Derive Energy eigen values of a particle in a box.	C07	L4
10	Explain probability densities.	C07	L1
11	Define spontaneous Emission processes.	CO8	L4
12	Define stimulated Emission processes.	CO8	L1
13	Derive expression for energy density of radiation interms of	CO8	L3
	Einstein's coefficients.		
14	Explain Requisites of a Laser system.	CO8	L2
15	Define Conditions for laser action	CO8	L1
16	Explain Principle, Construction and working of CO2 Lasers.	CO8	L3
17	Explain Principle, Construction and working of semiconductor	CO8	L3
	Lasers.		
18	Explain Laser range finder.	C08	L3
19	Explain Data storage.	C08	L4
е	Experiences	-	-
1			
2			

## E3. CIA EXAM – 2

## a. Model Question Paper - 2

Crs Code	e: 18PHY12 Sem: I Marks: 30 Time: 7			75 miı	nutes					
Cour	rse:	Engineerin	g Physics							
-	-	Note: Ans	swer any 2	2 question	is, each ca	arry equ	al marks.	Ma s	rk CO	Level
1	а	With neat and Acceptanc	diagram, d ce angle.	erive an ex	pression fo	or numeri	cal aperture	8	9	L3
	b	With neat	diagram e>	plain the d	lifferent typ	pes of opt	ical fiber	8	9	L3
	С	Explain point to point communication system using optical fibers. & 5 9 L4 write any four advantages of optical communication system								
	d	An optical fiber has a core material with refractive index 1.50 and 4 its cladding material has a refractive index of 1.45. The light is launched into it in air. Calculate its numerical aperture and the fractional index change								L4
		Or								
2	а	Describe t theorem.	the conce	pt of dive	rgence. D	erive Ga	uss diverger	ice 8	9	L3
	b	Mention M from Maxw wave in fre	laxwell's e well's equa e space.	equations fation deduc	for electro ce the wa	magnetic ve equat	field. Start ion for a pla	ing 8 ine	9	L3

	С	What is displacement current? Obtain the expression for displacement current.	5	9	L4
	d	Calculate the curl of $\vec{A}$ , given $\vec{A} = (1+yz^2)\hat{a}+xy^2\hat{a}+x^2y\hat{a}$	4	9	L4
3	а	Derive expression for energy density of radiation in terms of Einstein's coefficients.	8	10	L4
	b	Explain Construction and working of Semiconductor Diode Laser With Diagram.	8	10	L4
	С	Explain Range Finder and Compact Disc.	5	10	L4
	d	The average output power of laser source emitting a laser beam of wavelength 6328 A <sup>0</sup> is 5mW. Find the number of emitted photons emitted per second by the laser source.	4	10	L4
		Or			
4	а	Obtain the solution of Schroedinger's time independent wave equation, When applied to a potential well of infinite height.	8	10	L4
	b	Derive Time independent Schrödinger wave equation.	8	10	L3
	С	Explain Heisenberg's uncertainty principle and give its physical significance.	5	10	L4
	d	An electron is bound in a one dimensional potential well of width 0.18nm. Find its energy value in eV in the second excited state. (Given $h = 6.63 \times 10^{-34}$ JS, $m = 9.11 \times 10^{-31}$ Kg)	4		L4

### b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

	Model Assignment Questions									
Crs C	Code:	18PHY 2	1Sem:	I	Marks:	10	Time:	30 minu	tes	
Cour	se:	Enginee	ring Physics							
Note	: Eac	h studen	t to answer	2-3 assig	nments. Eacł	n assigr	nment carries e	qual ma	rk.	
SNo	l	USN		Assig	Inment Des	criptio	n	Mark s	со	Level
1			Define Fund	lamentals	s of vector ca	lculus.		5	CO5	L1
2			Define Dive	rgence ar	nd curl of ele	ctric fie	ld.	5	CO5	L1
3			Define ma divergence	gnetic f theorem.	ield (static)	and	Derive Gauss	s' 5	C05	L1
4			Derive Stok	es' theore	em.			5	CO5	L3
5			Describe lav	vs of elec	trostatics an	d laws	of magnetism.	5	CO5	L2
6	6 Describe laws of Faraday's laws of EMI and Curren density.					t 5	CO5	L2		
7			Explain equ	ation of C	Continuity.			5	CO5	L3
8			Derive disp vacuum	blacemen	t current M	laxwell	's equations i	n 5	CO5	L3
9			Derive disp vacuum	blacemen	t current M	laxwell	's equations i	n 5	CO5	L3
10			Derive wav using Maxw	e equatio ell's equa	on in differen ations.	tial for	m in free spac	e 5	C05	L3
11			Explain Plar	ie electro	magnetic wa	ves in v	vacuum.	5	CO5	L2
12			Define trans	sverse na	ture and pola	rizatio	n of EM waves.	5	CO5	L1
13			Explain Prop	bagation i	mechanism iı	h an op	tical fiber.	5	CO6	L2
14			Define angle	e of accep	otance and N	umeric	al aperture.	5	CO6	L1
15			Based on M fibers	odes of p	propagation E	Explain	Types of optica	al 5	CO6	L3
16			Explain the Mention the	Causes o expressi	of attenuation on for attenu	n in an ation c	optical fiber an oefficient.	d 5	CO6	L3

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17	Discuss point to point communication system of an	5	CO6	L4
	optical fiber.			
18	Explain Merits and demerits of an Optical Fibers.	5	CO6	L2
19	Explain the necessity of Quantum mechanics and Wave nature of particles	5	C07	L2
20	State and Explain Heisenberg's uncertainty principle.	5	C07	L2
21	Show that non confinement of electron in the atomic nucleus.	5	C07	L3
22	Derive the Schrodinger time independent wave equation.	5	C07	L4
23	Define Significance of Wave function and Normalization.	5	C07	L1
24	Define Particle in a box and Derive Energy eigen values of a particle in a box and Probability density.	5	C07	L1
25	Define spontaneous Emission processes and stimulated Emission processes.	5	CO8	L1
26	Derive expression for energy density of radiation in terms of Einstein's coefficients.	5	CO8	L3
27	Explain the Requisites and Conditions for laser action.	5	CO8	L2
28	Explain Principle, Construction and working of CO2 Lasers.	5	CO8	L2
29	Explain Principle, Construction and working of semiconductor Lasers.	5	CO8	L4
30	Explain Laser range finder and Data storage.	5	CO8	L4
31	Explain Laser Cutting, laser welding and Laser Drilling.	5	CO8	L3
32				

## D3. TEACHING PLAN - 3

## Module - 5

Title:	Material Science	ppr	10 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Analyze the electrical and thermal properties of conductor using Quantum theory.	CO9	L4
2	Analyze the electrical conductivity of semiconductors using band theory of solids.	CO10	L4
b	Course Schedule		
Class No	Module Content Covered	CO	Level
41	Quantum Free electron theory of metals: Review of classical free electron theory, mention of failures.	CO9	L3
42	Assumptions of Quantum Free electron theory, Mention of expression for density of states.	CO9	L3
43	Fermi-Dirac statistics (qualitative), Fermi factor, Fermi level,	CO9	L4
44	Derivation of the expression for Fermi energy, Success of QFET.	CO9	L4
45	Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band, Hole concentration in valance band (only mention the expression),	CO9	L4
46	Conductivity of semiconductors(derivation),	CO9	L3
47	Hall effect, Expression for Hall coefficient(derivation)	CO9	L3
48	Polar and non-polar dielectrics, Internal fields in a solid, Clausius- Mossotti equation(Derivation),	CO9	L3
49	Mention of solid, liquid and gaseous dielectrics with one example each. Application of dielectrics in transformers.	CO9	L3
50	Numerical problems	CO9	L4

С	Application Areas	СО	Level
1	Used in electrical and electronics engineering.	CO10	L4
2	Design of active electronic components.	CO9	L4
d	Review Questions	-	-
1	Define classical free electron theory.	CO9	L1
2	Define Failures of classical free electron theory.	CO9	L3
3	Explain Assumptions of Quantum Free electron theory.	CO9	L2
4	Mention of expression for density of states.	CO9	L4
5	Mention of expression for Fermi-Dirac statistics	CO9	L2
6	Mention of expression for Fermi factor	CO9	L2
7	Mention of expression for Fermi level	CO9	L2
8	Derive the expression for Fermi energy, Success of QFET	CO9	L3
9	Explain Fermi levels in intrinsic semiconductors.	CO10	L4
10	Expression for concentration of electrons in conduction band.	CO10	L1
11	Mention the expression for Hole concentration in valance band.	CO10	L4
12	Derive the expression for Conductivity of semiconductors.	CO10	L3
13	Explain Hall effect.	CO10	L2
14	Derive the expression for Hall coefficient.	CO10	L3
15	Explain polar dielectrics.	CO10	L3
16	Explain non-polar dielectrics.	CO10	L2
17	Explain internal fields in a solid.	CO10	L2
18	Derive the Expression for Clausius-Mossotti equation.	CO10	L3
19	Mention Solid dielectrics with one example.	CO10	L2
20	Mention liquid dielectrics with one example.	CO10	L2
22	Mention gaseous dielectrics with one example.	CO10	L2
23	Explain Application of dielectrics in transformers.	CO10	L3
е	Experiences	-	-
1			
2			

## b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

	Model Assignment Questions										
Crs C	Code: 18PHY1Sem: I Marks: 10 Time:			30 minu	0 minutes						
		2									
Cours	se:	Engine	ering F	hysics							
Note	: Eacl	h stude	nt to a	nswer 2	2-3 assignr	nents. Eac	h assigni	ment carries e	qual ma	rk.	
SNo	ι	JSN			Assign	ment Des	cription		Mark	СО	Level
									S		
1			Define	e classi	cal free ele	ctron theo	ry.		5		L2
2	2 Define Failures of classical free electron theory.					5		L3			
3	3 Explain Assumptions of Quantum Free electron theory.						L4				
4			Menti	on of e	expression	for densit	y of sta	tes and Ferm	ni- 5		L3
			Dirac	statisti	cs.						
5			Mentio	on of ex	xpression f	or Fermi fa	ctor and	Fermi level.	5		L2
6			Derive	e the e>	pression fo	or Fermi er	nergy, Su	iccess of QFET	5		L3
7			Explai	n Ferm	i levels in i	ntrinsic se	micondu	ctors.	5		L3
8			Mentio	on the	expression	n for conce	ntration	of electrons	in 5		L3
	conduction band and Hole concentration in valance band					ł.					
9	9 Derive the expression for Conductivity of semiconductors.					s. 5		L4			
10			Exlain	Hall	effect. And	d Derive t	he expr	ession for Ha	all 5		L4
	coefficient.										

11	Explain polar dielectrics and non-polar dielectrics.	5	L3
12	Explain internal fields in a solid.	5	L2
13	Derive the Expression for Clausius-Mossotti equation.	5	L2
14	Mention Solid, liquid and gaseous dielectrics with one example.	5	L3
15	Explain Application of dielectrics in transformers.	5	L4

## E3. CIA EXAM – 3

## a. Model Question Paper - 3

Crs Code:		18PHY12 Sem: I	Marks:	30	Time:	75 minι	ites	
Cou	rse:	Engineering Physics	i.					
-	-	Note: Answer any	2 questions	, each	carry eq	ual Marl	c CO	Level
		marks.Derive the wave	equation in c	lifferentia	al form in fi	ree s		
		space using maxwell's	equation.					
1	а	Discuss the failures of clas	sical free electi	on theory		6	9	L3
	b	Give the assumptions of Q	FET.			5	9	L3
	С	Calculate the probabilities	of an electron	occupying	an energy le	vel 4	9	L4
		0.02 eV above the fermi le	evel and that in	an energy	level 0.02 e\	/		
		below the Fermi level at 2	00K.					
			Or					
2	а	What is Hall effect? Obtain	n the expression	ר for Hall א	oltage in ter	ms 6	9	L3
		of Hall Coefficient.			-			
	b	Define the Fermi factor.	Explain the vari	ation of fe	ermi factor w	ith 5	9	L3
		example.						
	С	The Hall coefficient is 3.6	3 x 10 <sup>-6</sup> m <sup>-3</sup> /C. V	Vhat is the	e type of cha	rge 4	9	L4
		carriers? Also calculate the	e carrier concer	tration.				
3	а	Obtain the relation betwe	en fermi energ	ly and end	ergy gap for	an 6	10	L4
		Intrinsic semiconductor.						
	b	Discuss the various types	of polarization.			5	10	L4
	С	The following data given	for intrinsic geri	manium at	: 300 K, ni =	2.4 4	10	L4
		X 10 19/m3, μο = 0.39 m	2v-1s-1, μh=0.1	9 m2v-1s-	1. Calculate	the		
		resistivity of sample.						
			Or					
	а	Derive the Expression for	Clausius-Mossot	ti equatio	n.	6	10	L4
	b	Explain Application of diel	ectrics in transf	ormers.		4	10	L3
	С	If a NaCl crystal is subject	ted to an elect	ric field of	f 1000 V/m a	and 5	10	L4
		the resulting polarizatio	n is 4.3 X 10	)-8 C/m2,	Calculate	the		
		dielectric constant of NaC	•					

### F. EXAM PREPARATION

## 1. University Model Question Paper

Cou	rse:	Engineering P	hysics				Month	/ Year	Jan /2	2019
Crs	Code:	18PHY12	Sem:	I	Marks:	100	Time:		180	
									minut	es
-	Note	Answer all FIV	'E full questi	ons. All que	stions carry	equal mark	<s.< td=""><td>Mark</td><td>СО</td><td>Leve</td></s.<>	Mark	СО	Leve
								S		
1	а	Define SHM. Derivation of equation for SHM.							CO1	L3
	b	Explain complex notation and phasor representation of simple harmonic motion.							C01	L3
	С	Derive Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of $\checkmark$ alpha and Beta.						5	CO2	L3
	d	Calculate the constant k=1	period of os 0 N/m.	cillation of	a mass 40k	g on a spri	ng with	4	CO2	L4

		OR			
2	2	Explain Construction and working of Beddy shock tube and	5	CO2	13
2	a	Applications of Shock Wayos	J		LJ
		Applications of Shock Waves.	6	CO1	1.2
	a	beine Resonance. Explain Sharphess of Resonance and give an	0		LJ
		example for Mechanical Resonance.		602	
	C	Define Elasticity, plasticity, stress, strain, tensile stress and shear	5	C02	LZ
		stress.		001	
	d	In a Reddy Tube experiment, it was found that, the time taken to	4	01	L4
		travel between the two sensors is 195µs. If the distance between			
		the two sensors is 100nm, find the Mach number.			
3	а	Explain strain hardening and strain softening.	5	C03	L3
	b	Derive Expression for Young's modulus (Y), Bulk modulus (K) and	6	C03	L3
		Rigidity modulus (n) in terms of $\checkmark$ and $\beta$ .			
	с	Explain Bending moment of a beam with circular cross section.	5	C04	L3
	d	A particle executes a SHM of period of 10s and amplitude of 1.5m.	4	C04	L4
		Calculate its maximum acceleration and velocity.			
		OR			
4	а	Derive the expression for bending moment.	5	CO4	L3
	b	Derive the Expression for couple per unit twist of a solid cylinder.	6	CO4	L3
	с	Explain Neutral surface and neutral plane.	5	CO3	L3
	d	Calculate the percentage change in the frequency of oscillations of	4	CO3	14
	G	a spring if the mass attached to the spring is increased by 50%	т		<b>_</b> -
		a spring is the mass accord to the spring is increased by 50%.			
5	2	Explain Attenuation mechanism and mention the equation of	5	CO7	12
	a	attenuation coefficient	J	007	LJ
	h	Derive the wave equation in differential form in free space using	6	C06	12
	U D	maxwell's equation	0		LJ
	-	Indxwell's equation Define Divergence and evel of electric and magnetic field	-	<u> </u>	12
	C	Define Divergence and curl of electric and magnetic field.	5	000	
	a	Find the ratio of population of two energy levels in a medium at	4	01	L4
		thermal equilibrium, if the wavelength of light emitted at 291K is			
		6928A°.			
		OR			
6	a	Discuss point to point communication system with Block Diagram.	5	C06	L3
	b	Derive angle of acceptance and Numerical aperture in an optical	6	C07	L3
		fiber.			
	С	Explain Applications of dielectrics in transformers.	5	CO6	L2
	d	Find the ratio of population of two energy levels in a medium at	4	C07	L4
		thermal equilibrium, if the wavelength of light emitted at 291K is			
		6928A°.			
7	а	Explain Heisenberg uncertainty principle with an example.	5	CO9	L3
	b	Explain Principle, Construction and working of CO2 Lasers.	6	CO8	L3
	С	Find Energy eigen values of a particle in a box.	5	C09	L4
	d	An electron is bound in a one dimensional potential well of width	4	CO9	L4
		0.18nm. Find its energy value in eV in the second excited state.			
		OR			
8	а	Derive time independent Schrodinger wave equation.	5	CO9	L3
	h	Explain Principle. Construction and working of semiconductor	6	C08	3
		Lasers.	0		
	ſ	Explain the Requisites, and Conditions for laser action	5	08	12
	<u>с</u>	A He-Ne laser is emitting a laser hear with an average nower of			L2
	u	4 5mW Find the number of photons emitted per second by the	-		
		laser The wavelength of emitted radiation is 632.8 <sup>\o</sup>			
0	-	Explain the failures of classical free electron theory	5	C00	12
9	a h	Derive the conductivity of comiconductor		C010	
	u 2	Explain the success of free electron theory	0 F	C010	L3
	C	Explain the success of free electron theory.	С	109	LZ

	d	A 5.00 $\mu$ F parallel plate capacitor has air between the plates. When an insulating material is placed between the plates, the capacitances increases to 13.5 $\mu$ F. Find the dielectric constant of the insulator.	4	CO10	L4
		OR			
10	а	Define Hall effect and Derive the Expression for Hall coefficient.	5	CO10	L3
	b	What are Dielectrics. Derive Clausius-Mossotti equation.	6	CO10	L3
	С	Explain Application of dielectrics in transformers.	5	C010	L3
	d	The Hall coefficient is $3.68 \times 10^{-6} \text{ m}^{-3}/\text{C}$ . What is the type of charge	4	CO10	L4
		carriers ? Also calculate the carrier concentration.			

## 2. SEE Important Questions

Crs Code:       18PHY12       Sem:       3       Marks:       100       Time:       180         Mote Answer all FIVE full questions. All questions carry equal marks.       -       -       -         Mo       Qno.       Important Questions       Mark       CO       Year         1       1       Define SHM. Derivation of equation for SHM.       5       CO1         2       Explain       complex       notation and phasor representation of simple       5       CO1         3       Define over damping, critical & under damping, quality factor       4       CO1       -         4       Define Resonance.       Explain       Construction and working of Reddy shock tube and for example for Mechanical Resonance.       6       CO2         5       Explain       Construction and working of Reddy shock tube and for stress.       6       CO3         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear for stress.       6       CO3         3       Derive the expression for Young's modulus (Y), Bulk modulus (K) and for CO3       6       CO4         4       d       5       CO4       5       CO4         5       Explain Bending moment of a beam with circular and rectangular       6       CO5         2 <th colspan="2">Course:</th> <th>Engineering P</th> <th>/ Year</th> <th colspan="2">Jan /2019</th>	Course:		Engineering P	/ Year	Jan /2019						
Note Answer all FIVE full questions. All questions carry equal marks.         -           Mo Qno.         Important Questions         Mark         CO         Year           dul         e         -         -         -         -           1         1         Define SHM. Derivation of equation for SHM.         5         CO1         -           2         Explain complex notation and phasor representation of simple for Que and phason representation of Que and phason representation of Que and phason representation of gue and phason representation of for Que and phason representation of Que and phason representation of for Que and phason representation of for Que and phason representation of for Que and phason representation for Phason representation for Phason representation phason represen	Crs	Code:	18PHY12	Sem:	3	Marks:	100	Time:		180	
Note Answer all FIVE full questions. All questions carry equal marks.         -         -           Mo dul e         Important Questions         Mark S         CO         Year           1         1         Define SHM. Derivation of equation for SHM.         5         CO1           2         Explain complex notation and phasor representation of simple harmonic motion.         5         CO1           3         Define Resonance. Explain Sharpness of Resonance and give an example for Mechanical Resonance.         5         CO2           5         Explain Construction and working of Reddy shock tube and Applications of Shock Waves.         6         CO3           2         1         Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.         6         CO3           2         Derive Expression for Young's modulus (Y), Bulk modulus (K) and stress.         6         CO4           3         Derive the expression for bending moment.         5         CO4           4         d         5         CO4         5           3         Derive the expression for bending moment.         5         CO3           4         d         5         CO4         5           5         Derive the expression for bending moment.         5         CO4           6         CO5 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>minut</td> <td>es</td>										minut	es
Mod dul e       Qno.       Important Questions       Mark s       CO       Year year         1       1       Define SHM. Derivation of equation for SHM.       5       CO1         2       Explain complex notation and phasor representation of simple harmonic motion.       5       CO1         3       Define over damping, critical & under damping, quality factor       4       CO1         4       Define Resonance. Explain Sharpness of Resonance and give an example for Mechanical Resonance.       5       CO2         5       Explain Construction and working of Reddy shock tube and Applications of Shock Waves.       6       CO3         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.       6       CO3         2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of → and β.       6       CO4         3       Derive the expression for bending moment.       5       CO4         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular cross section.       6       CO5         3       Derive the wave equation in differential form in free space using fiber.       5       CO6         3       Derive the wave equation mechanism and mention the equation of attenuation coefficient.		Note	Answer all FIV	'E full questi	ons. All que	stions carry	equal mark	s.	-	-	
dul       s         e       Lemony Lem	Мо	Qno.	. Important Questions								Year
e	dul								s		
1       Define SHM. Derivation of equation for SHM.       5       CO1         2       Explain complex notation and phasor representation of simple for anomic motion.       5       CO1         3       Define over damping, critical & under damping, quality factor       4       CO1         4       Define Resonance. Explain Sharpness of Resonance and give an sexample for Mechanical Resonance.       5       CO2         5       Explain Construction and working of Reddy shock tube and for Mechanical Resonance.       6       CO2         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.       6       CO3         2       1       Derive Expression for Young's modulus (Y), Bulk modulus (K) and for Stress.       6       CO3         3       Derive the expression for Young's modulus (Y), Bulk modulus (K) and for CO3       6       CO4         5       Explain Bending moment of a beam with circular and rectangular for CO4       CO4       CO5         3       Derive the wave equation in differential form in free space using for CO5       CO4       CO5         3       Derive the wave equation mechanism and mention the equation of for CO5       CO6       CO5         3       Derive the wave equation mechanism and mention the equation of for CO5       CO6       CO6         4       d       CO5	e										
2       Explain complex notation and phasor representation of simple 5       CO1         3       Define over damping, critical & under damping, quality factor       4       CO1         4       Define ever damping, critical & under damping, quality factor       4       CO1         4       Define ever damping, critical & under damping, quality factor       4       CO1         4       Define ever damping, critical & under damping, quality factor       4       CO2         5       Explain Construction and working of Reddy shock tube and 6       CO2         4       Define Elasticity, plasticity, stress, strain, tensile stress and shear 6       CO3         5       Explain Bending modulus (Y), Bulk modulus (K) and 6       CO3         7       Derive Expression for Young's modulus (Y), Bulk modulus (K) and 6       CO3         8       gigidity modulus (n) in terms of - and β.       5       CO4         5       Explain Bending moment of a beam with circular and rectangular 6       CO4         6       CO3       CO5       CO4       CO5         7       Define Divergence and curl of electric and magnetic field.       6       CO5         8       Derive angle of acceptance and Numerical aperture in an optical 6       CO5       CO6         1       Define Divergence and curl of electric and magnetic field. </td <td>1</td> <td>1</td> <td>Define SHM. D</td> <td>Derivation of</td> <td>equation fo</td> <td>or SHM.</td> <td></td> <td></td> <td>5</td> <td>CO1</td> <td></td>	1	1	Define SHM. D	Derivation of	equation fo	or SHM.			5	CO1	
harmonic motion.       A         2       Define over damping, critical & under damping, quality factor       4       CO1         4       Define Resonance. Explain Sharpness of Resonance and give an server damping for Mechanical Resonance.       5       CO2         5       Explain Construction and working of Reddy shock tube and 6       CO2         4       Define Elasticity, plasticity, stress, strain, tensile stress and shear after the expression for Young's modulus (Y), Bulk modulus (K) and 6       CO3         2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and 6       CO3         3       Derive the expression for bending moment.       5       CO4         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular for CO4       CO5         3       Derive the expression for bending moment.       6       CO3         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular for CO5       CO4       CO5         3       Derive angle of acceptance and Numerical aperture in an optical fiber.       6       CO5         3       Derive the wave equation in differential form in free space using maxwell's equation.       6       CO6         4       Explain Attenuation mechanism and mention the		2	Explain comp	olex notatio	n and phas	sor represe	ntation of	simple	5	CO1	
3       Define over damping, critical & under damping, quality factor       4       CO1         4       Define Resonance. Explain Sharpness of Resonance and give an example for Mechanical Resonance.       5       CO2         5       Explain Construction and working of Reddy shock tube and Applications of Shock Waves.       6       CO2         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear of stress.       6       CO3         2       2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and for Stress.       6       CO3         3       Derive the expression for bending moment.       5       CO4         5       Explain Bending moment of a beam with circular and rectangular for CO4       CO5         3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive the wave equation in differential form in free space using 5       CO6         3       Derive the wave equation.       5       CO6         4       4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       6       CO5         3       Derive the wave equation munication system with Block Diagram.       5       CO6         4       1       Explain Heisenberg uncertainty principle with an example.       5 <t< td=""><td></td><td></td><td>harmonic mot</td><td>ion.</td><td></td><td>•</td><td></td><td>•</td><td></td><td></td><td></td></t<>			harmonic mot	ion.		•		•			
4       Define Resonance. Explain Sharpness of Resonance and give an example for Mechanical Resonance.       5       CO2         5       Explain Construction and working of Reddy shock tube and Applications of Shock Waves.       6       CO2         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.       6       CO3         2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of < and β.		3	Define over d	amping, crit	ical & under	damping, g	uality facto	r	4	CO1	
example for Mechanical Resonance.       5         Splain Construction and working of Reddy shock tube and 6       CO2         Applications of Shock Waves.       6         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear 6       CO3         2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and 6       CO3         3       Derive the expression for bending moment.       5       CO4         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular 6       CO5         3       Derive the expresence and curl of electric and magnetic field.       6       CO5         3       Derive the wave equation in differential form in free space using 5       CO6         3       Derive the wave equation.       6       CO5         4       A       6       CO5         6       Derive the wave equation in differential form in free space using 5       CO6         7       Derive the wave equation.       6       CO7         4       Explain Attenuation mechanism and mention the equation of 6       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.		4	Define Reson	ance. Expla	in Sharpnes	s of Reson	ance and c	aive an	5	CO2	
5       Explain Construction and working of Reddy shock tube and Applications of Shock Waves.       6       CO2         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.       6       CO3         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.       6       CO3         2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and 6       CO3       CO3         3       Derive the expression for bending moment.       5       CO4         5       Explain Bending moment of a beam with circular and rectangular cross section.       6       CO5         4       d       5       CO4         5       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive the wave equation in differential form in free space using 5       CO6         6       Loss point to point communication system with Block Diagram.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         4       Explain Heisenberg uncertainty principle with an example.       5       CO6         4       Explain Principle, Construction and working of semiconduct			example for M	lechanical R	esonance.			,			
Applications of Shock Waves.       6       CO3         2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.       6       CO3         2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and figidity modulus (n) in terms of v and β.       6       CO3         3       Derive the expression for bending moment.       5       CO4         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular cross section.       CO5         3       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive the wave equation in differential form in free space using fiber.       5       CO6         3       Derive the wave equation.       6       CO5       CO6         4       4       5       CO6       CO5         3       Derive the wave equation in differential form in free space using for attenuation coefficient.       5       CO6         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       6       CO7		5	Explain Cons	truction an	d working	of Reddy	shock tub	e and	6	CO2	
2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear for stress.       6       CO3         2       1       Derive Expression for Young's modulus (Y), Bulk modulus (K) and for Rigidity modulus (n) in terms of v and β.       6       CO3         3       Derive the expression for bending moment.       5       CO4         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular for cross section.       6       CO4         6       CO5       1       Define Divergence and curl of electric and magnetic field.       6       CO5         3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         3       1       Derive the wave equation in differential form in free space using fiber.       6       CO5         3       1       Derive the wave equation mechanism and mention the equation of attenuation coefficient.       6       CO6         4       1       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         4       1       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         4       1       Explain Princi			Applications o	of Shock Way	ves.	<b>,</b>					
2       1       Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.       6       CO3         2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and 6       CO3         3       Derive the expression for bending moment.       5       CO3         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular cross section.       6       CO5         3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         3       1       Derive angle of acceptance and Numerical aperture in an optical fiber.       6       CO5         3       Derive the wave equation in differential form in free space using maxwell's equation.       6       CO6         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       5       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>											
stress.       2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of v and β.       3       Derive the expression for bending moment.       5       CO3         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular cross section.       6       CO5         3       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive the wave equation in differential form in free space using fiber.       6       CO5         3       Derive the wave equation in differential form in free space using fmaxwell's equation.       6       CO6         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         4       Explain Principle, Construction and working of Semiconductor for CO8       CO7         4       Explain Principle, Construction and working of semiconductor for CO8       CO8         5       Explain Principle, Construction and working of semiconductor for CO8       CO8 <td>2</td> <td>1</td> <td>Define Elastic</td> <td>ity, plasticit</td> <td>v, stress. st</td> <td>rain, tensile</td> <td>e stress and</td> <td>d shear</td> <td>6</td> <td>CO3</td> <td></td>	2	1	Define Elastic	ity, plasticit	v, stress. st	rain, tensile	e stress and	d shear	6	CO3	
2       Derive Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of → and β.       6       CO3         3       Derive the expression for bending moment.       5       CO3         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular cross section.       6       CO5         3       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive angle of acceptance and Numerical aperture in an optical fiber.       6       CO5         3       Derive the wave equation in differential form in free space using maxwell's equation.       5       CO6         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         4       Explain Principle, Construction and working of Semiconductor Lasers.       6       CO8         5       Explain Principle, Construction and working o			stress.								
Rigidity modulus (n) in terms of γ and β.       5         3       Derive the expression for bending moment.       5         4       d       5         5       Explain Bending moment of a beam with circular and rectangular cross section.       6         6       CO4         7       Define Divergence and curl of electric and magnetic field.       6         7       Define Divergence and curl of electric and magnetic field.       6         8       Derive angle of acceptance and Numerical aperture in an optical fiber.       6         9       Derive the wave equation in differential form in free space using 5       CO6         9       maxwell's equation.       6       CO5         4       Explain Attenuation mechanism and mention the equation of 6       CO6         9       Derive the wave equation in differential form in free space using 5       CO6         4       Explain Attenuation mechanism and mention the equation of 6       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         4       Explain Principle, Construction and working of Semiconductor 6       CO8         5       Explain Principle, Construction and working of semiconductor 6		2	Derive Expres	sion for Yo	ung's modu	lus (Y), Bulk	< modulus (	(K) and	6	CO3	
3       Derive the expression for bending moment.       5       CO3         4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular of cross section.       6       CO4         7       Explain Bending moment of a beam with circular and rectangular of cross section.       6       CO5         3       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive angle of acceptance and Numerical aperture in an optical fiber.       6       CO5         3       Derive the wave equation in differential form in free space using 5       CO6         3       Derive the wave equation.       6       CO5         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       5       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of Semiconductor for Lasers.       6       CO8         5       1       Explain the failures of classical free electron theory       5       CO9			Rigidity modu	lus (n) in tei	rms of 🗸 and	d β.					
4       d       5       CO4         5       Explain Bending moment of a beam with circular and rectangular cross section.       6       CO4         3       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive angle of acceptance and Numerical aperture in an optical fiber.       6       CO5         3       Derive the wave equation in differential form in free space using fmaxwell's equation.       5       CO6         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3       Explain the failures of classical free electron theory       5       CO9         4       Explain the failures of classical free electron theory       5       CO9		3	Derive the ex	pression for	bending mo	ment.			5	CO3	
5       Explain Bending moment of a beam with circular and rectangular 6       CO4         cross section.       CO5         3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive angle of acceptance and Numerical aperture in an optical 6       CO5         3       Derive the wave equation in differential form in free space using 5       CO6         3       Derive the wave equation mechanism and mention the equation of attenuation coefficient.       6       CO5         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of Semiconductor       6       CO8         5       Indian Principle, Construction and working of semiconductor       6       CO8         5       1       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3 <t< td=""><td></td><td>4</td><td>d</td><td>•</td><td></td><td></td><td></td><td></td><td>5</td><td>CO4</td><td></td></t<>		4	d	•					5	CO4	
a       cross section.       CO5         3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive angle of acceptance and Numerical aperture in an optical fiber.       6       CO5         3       Derive the wave equation in differential form in free space using maxwell's equation.       5       CO6         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of Semiconductor       6       CO8         5       I Explain Principle, Construction and working of semiconductor       6       CO8         5       1       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10 </td <td></td> <td>5</td> <td>Explain Bendi</td> <td>na moment</td> <td>of a beam</td> <td>with circula</td> <td>ar and recta</td> <td>angular</td> <td>6</td> <td>CO4</td> <td></td>		5	Explain Bendi	na moment	of a beam	with circula	ar and recta	angular	6	CO4	
3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive angle of acceptance and Numerical aperture in an optical fiber.       6       CO5         3       Derive the wave equation in differential form in free space using 5       CO6         4       Explain Attenuation mechanism and mention the equation of 6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of Semiconductor for Lasers.       6       CO8         5       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO9         3       Explain the success of free electron theory       5       CO9			cross section.	5				5			
3       1       Define Divergence and curl of electric and magnetic field.       6       CO5         2       Derive angle of acceptance and Numerical aperture in an optical fiber.       6       CO5         3       Derive the wave equation in differential form in free space using maxwell's equation.       5       CO6         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of Semiconductor for Lasers.       6       CO8         5       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Derive the conductivity of semiconductor.       5       CO10										CO5	
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fiber.       3       Derive the wave equation in differential form in free space using 5       CO6         4       Explain Attenuation mechanism and mention the equation of 6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10		2	Derive angle	of acceptar	ice and Nur	nerical aper	rture in an	optical	6	CO5	
3       Derive the wave equation in differential form in free space using 5       CO6         4       Explain Attenuation mechanism and mention the equation of 6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       1       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain Principle, Construction and working of semiconductor       6       CO8         5       1       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10			fiber.								
maxwell's equation.       maxwell's equation.         4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       1       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain Principle, Construction and working of semiconductor for Lasers.       6       CO8         5       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10		3	Derive the wa	ave equatio	n in differer	ntial form ir	n free space	e using	5	CO6	
4       Explain Attenuation mechanism and mention the equation of attenuation coefficient.       6       CO6         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       1       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO7         5       Explain Principle, Construction and working of semiconductor for Lasers.       6       CO8         5       1       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO9         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10			maxwell's equ	uation.				5			
attenuation coefficient.       -         5       Discuss point to point communication system with Block Diagram.       5       CO6         4       1       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain Principle, Construction and working of semiconductor       6       CO8         5       Explain Principle, Construction and working of semiconductor       6       CO8         5       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of classical free electron theory       5       CO9         2       Explain the success of free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10		4	Explain Atter	nuation me	chanism an	d mention	the equat	tion of	6	CO6	
5       Discuss point to point communication system with Block Diagram.       5       CO6         4       1       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain Principle, Construction and working of semiconductor Lasers.       6       CO8         5       1       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10			attenuation co	oefficient.			•				
4       1       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain Principle, Construction and working of semiconductor       6       CO8         5       Explain the failures of classical free electron theory       5       CO9         2       Explain the failures of free electron theory       5       CO9         2       Explain the success of free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10		5	Discuss point	to point con	nmunication	system wit	h Block Dia	gram.	5	CO6	
4       1       Explain Heisenberg uncertainty principle with an example.       5       CO7         2       Derive time independent schrodinger wave equation.       6       CO7         3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain Principle, Construction and working of semiconductor       6       CO8         5       Explain Principle, Construction and working of semiconductor       6       CO8         5       Explain Principle, Construction and working of semiconductor       6       CO8         5       Explain the failures of classical free electron theory       5       CO9         2       Explain the success of free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10         5       What are Dielectrics. Derive Clausius-Mossotti equation       6       CO10											
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3       Find Energy eigen values of a particle in a box.       6       CO7         4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain Principle, Construction and working of semiconductor Lasers.       6       CO8         5       1       Explain the failures of classical free electron theory       5       CO9         2       Explain the success of free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10		2	Derive time ir	ndependent	schrodinger	wave equat	tion.		6	C07	
4       Explain Principle, Construction and working of CO2 Lasers.       6       CO8         5       Explain Principle, Construction and working of semiconductor Lasers.       6       CO8         5       1       Explain the failures of classical free electron theory       5       CO9         2       Explain the success of free electron theory       5       CO9         3       Derive the conductivity of semiconductor.       5       CO10         4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10		3	Find Energy e	igen values	of a particle	in a box.			6	C07	
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Lasers.Image: Constraint of the second s		5	Explain Principle, Construction and working of semiconductor							CO8	
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3Derive the conductivity of semiconductor.5CO104Define Hall effect and Derive the Expression for Hall coefficient.6CO105What are Dielectrics, Derive Clausius-Mossotti equation6CO10		2	Explain the su	ccess of fre	e electron th	neory			5	CO9	
4       Define Hall effect and Derive the Expression for Hall coefficient.       6       CO10         5       What are Dielectrics, Derive Clausius-Mossotti equation       6       CO10		3	Derive the co	nductivity of	semicondu	ctor.			5	CO10	
5 What are Dielectrics, Derive Clausius-Mossotti equation 6 CO10		4	Define Hall ef	fect and Der	ive the Expr	ression for H	lall coefficie	ent.	6	CO10	
		5	What are Die	lectrics. Der	ive Clausius	-Mossotti ed	quation.		6	CO10	

## G. Content to Course Outcomes

### 1. TLPA Parameters

	Table 1: TLPA										
M d €	10Course Content or Syllabusul(Split module content into 2 parts whiche-have similar concepts)#	Conten t Teachin g Hours	Blooms' Learnin g Levels	Final Bloo ms' Leve	Identifie d Action Verbs for	Instructi on Method s for	Assessmen t Methods to Measure Learning				
			for Content	1	Learning	Learnin g					
	<b>B</b> <b>1</b> Definition of SHM, Characteristics, Examples and Derivation of differential equation of motion for SHM starting from Hookes' law and mention its solution. Mechanical simple harmonic oscillator: Mass suspended to spring (vertical vibrations) - Description, Mention of Expression for time period/frequency, Definition of force constant and its significance, Derivation of expressions for force constants for series and parallel combination of springs. Complex notation of simple harmonic motion (Aei( $\omega t + \varepsilon$ )), Phasor representation of simple harmonic motion. Theory of damped oscillations (over damping critical and under damping) forced oscillations and resonance, sharpness of resonance. Example for mechanical resonance	<u>C</u> 06	D L2 Underst and	E L2	F Underst and -	G Lecture, PPT, Classro om Expt.	H Slip Test				
-	<ol> <li>Mach number, properties of shock waves, control volume. Laws of conservation of mass, energy and momentum. Construction and working of Reddy shock tube. Applications. Numerical Problems</li> </ol>	04	L4 Illustrat e	L4	- Underst and, Illustrate -	Lecture, PPT	Slip Test				
	2 Concept of elasticity, plasticity, stress, strain, tensile stress, shear stress, compressive stress, strain hardening and strain softening, failure. Hookes law, Poison's ratio, Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n). Relation between Y, K & n. Limits of Poisson's ratio. Neutral surface and Neutral Plane, derivation of expression for bending moment. Bending momentum of a beam with circular and rectangular cross section.	07	L4 Analyze	L4	- Analyze -	Lecture, PPT, Classro om Expt.	Slip Test				
	2 Expression for couple per unit test of a solid cylinder (Derivation), Torsional Pendulum. Numerical problems.	03	L3 Analyze	L3	-Analyze -	Lecture, PPT, Classro om Expt.	Slip Test				
	Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static), Gauss' divergence theorem and Stokes' theorem. Description of laws of electrostatics,	06	L4 Analyze	L4	- Underst and -Analyze	Lecture, PPT, Classro om Expt.	Slip Test				

	magnetism and Faraday's laws of EMI. Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum. The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations), Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves (Qualitative).						
3	Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation and Types of optical fibers. Attenuation: Causes of attenuation and Mention of expression for attenuation coefficient. Discussion of block diagram of point to point communication. Merits and demerits Numerical problems	04	L4 Illustrat e	L4	- Underst and - Illustrate	Lecture, PPT, Classro om Expt.	Slip Test
4	Introduction to Quantum mechanics, Wave nature of particles, Heisenberg's uncertainty principle and applications (non confinement of electron in the nucleus), Schrodinger time independent wave equation, Significance of Wave function, Normalization, Particle in a box, Energy eigen values of a particle in a box and probability densities.	05	L4 Comput e	L4	- Underst and - Comput e	Lecture, PPT	Slip Test
4	Review of spontaneous and stimulated processes, Einstein's coefficients (derivation of expression for energy density). Requisites of a Laser system. Conditions for laser action. Principle, Construction and working of CO2 and semiconductor Lasers. Application of Lasers in Defense (Laser range finder) and Engineering (Data storage). Numerical problems	05	L4 Analyze	L4	- Underst and - Analyze	Lecture, PPT, Classro om Expt.	Slip Test
5	Review of classical free electron theory, mention of failures. Assumptions of Quantum Free electron theory, Mention of expression for density of states, Fermi- Dirac statistics (qualitative), Fermi factor, Fermi level, Derivation of the expression for Fermi energy, Success of QFET.	04	L4 Analyze	L4 Anal yze	-Analyze -	Lecture, PPT	Slip Test
5	Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band, Hole concentration in valance band (only mention the expression), Conductivity of semiconductors(derivation), Hall effect, Expression for Hall coefficient(derivation) polar and non-polar dielectrics, internal fields in a solid, Clausius - Mossotti equation (Derivation), mention of solid, liquid and gaseous dielectrics with one example each. Application of dielectrics in transformers. Numerical problems	06	L4 Analyze	L4 Anal yze	-Analyze -	Lecture, PPT,	Slip Test

## 2. Concepts and Outcomes:

	Table 2: Concept to Outcome										
Mo dul e- #	Learning or Outcome from study of the Content or Syllabus	Identified Concepts from Content	Final Concept	Concept Justification (What all Learning Happened from the study of Content / Syllabus. A short word for learning	CO Components (1.Action Verb, 2.Knowledge, 3.Condition / Methodology, 4.Benchmark)	Course Outcome Student Should be able to					
				or outcome)							
A	Motion	J Vibrations	K	L Ladorstand the	M	N Understand the					
Ţ	Motion	VIDIALIONS	Oscillations	concept of SHM, Damped and free oscillation.	-Oscillations -lecture	types of oscillations and their implications.					
1	Analysis and Application of shock waves	waves	Shock waves	Understand and Illustrate the shock waves	-Illustrate -Shock waves -lecture /PPT	Illustrate production of shock waves by using waves in Reddy Shock tube					
2	- forces - Size, shapes of materials	Properties of materials	Elasticity	Analyze the elastic properties of materials	-Analyze -Elastic properties - lecture	Analyze the elastic properties of materials for engineering field using Hook's Law and Poisson's ratio.					
2	- couple -forces	Applicatio n of forces	Torque	Understand the working of Torsional Pendulum	-Analyze -Torsional Pendulum -lecture	Calculate the couple per unit twist of a solid cylinder and period of oscillations for Torsional pendulum.					
3	- Study of Vector, scalar - Electromag netic waves	EM spectrum	Electric and Magnetic field	Understand and analyze the Maxwell's equations	-Analyze -Maxwell's equation -lecture	Analyze the Maxwell's equation by using EM waves.					
3	- Transmissi on of light -	- Reflection - Refraction	Total internal reflection	Illustrate the point to point communication	-Illustrate -Optical fibers -lecture	Illustrate the point to point communication using optical fibers.					
4	- Classical physics	Subatomic nature of particles	Heisenberg' s Uncertainty Principle	Compute Eigen values	-Apply -Eigen values - lecture	Compute the Eigen values and eigen function by using the time independent 1D Schrodinger wave equation					
4	-energy	Emission	Interaction	Understand and	-Analyze	Analyze the					

	level transitions	and absorption processes	of radiation with matter	analyze the process of interaction of radiation with matter	-interaction of photons with matter -lecture	production applications laser.	and of
5	- classificatio n of solids -	- band theory of solids -	Free electron theory	Analyze the electrical and thermal properties	-Analyze -Electrical and Thermal properties -lecture	Analyze electrical thermal prop of conductor Quantum the	the and erties using ory.
5	- classificatio n of solids -	- band theory of solids -	Material Physics	Analyze conductivity of semiconductors.	- Analyze - Semiconductors and Dielectrics -lecture	Analyze electrical conductivity semiconducto using band t of solids.	the of ors heory