Ref No:

Sri Krishna Institute of Technology,
Bangalore

COURSE PLAN

Academic Year 2019-2020

Program:	B E
Semester :	2
Course Code:	18PHY22
Course Title:	Engineering Physics
Credit / L-T-P:	4 / 3-2-0
Total Contact Hours:	50
Course Plan Author:	Prof. Ravi S

Academic Evaluation and Monitoring Cell

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Table of Contents

A. COURSE INFORMATION....2
1. Course Overview....2
2. Course Content....3
3. Course Material....3
4. Course Prerequisites....3
5. Content for Placement, Profession, HE and GATE....4
B. OBE PARAMETERS....4
1. Course Outcomes....4
2. Course Applications....4
3. Articulation Matrix....4
4. Curricular Gap and Content....5
C. COURSE ASSESSMENT....5
1. Course Coverage....5
2. Continuous Internal Assessment (CIA)....5
D1. TEACHING PLAN - 1....5
Module - 1....5
Module – 2....6
E1. CIA EXAM – 1....7
a. Model Question Paper - 1....7
b. Assignment -1....7
D2. TEACHING PLAN - 2....7
Module – 3....7
Module – 4....8
E2. CIA EXAM – 2....9
a. Model Question Paper - 2....9
b. Assignment – 2....10
D3. TEACHING PLAN - 3....10
Module – 5....10
E3. CIA EXAM – 3....11
a. Model Question Paper - 3....11
b. Assignment – 3....11
F. EXAM PREPARATION....11
1. University Model Question Paper....11
2. SEE Important Questions....12

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	All
Year / Semester :	2020 / 2	Academic Year:	2019-2020
Course Title:	Engineering Physics	Course Code:	18PHY22
Credit / L-T-P:	3-2-0	SEE Duration:	180 Minutes
Total Contact Hours:	52	SEE Marks:	60 Marks
CIA Marks:	40	Assignment	1 / Module
Course Plan Author:	Prof. Ravi S	Sign	Dt:
Checked By:	Dr. Savita B. Hosur	Sign ..	Dt:
CO Targets	CIA Target : 75 %	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.

Module	Content	Teaching Hours	Blooms Learning Levels
1	Definition of SHM, Characteristics, Examples and Derivation of differential equation of motion for SHM starting from Hooke's 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 ($Ae^{i(\omega t + \varepsilon)}$), 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. 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	10	L2, L3, L4
2	Concept of elasticity, plasticity, stress, strain, tensile stress, shear stress, compressive stress, strain hardening and strain softening, failure. Hooke's 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. Single cantilever. Expression for couple per unit test of a solid cylinder (Derivation), Torsional Pendulum. Numerical problems.	10	L2, L3, L4
3	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, 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	10	L2, L3, L4

	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 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. 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	L2, L3, L4
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. 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	L2, L3, L4
-	**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.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	-	-
	A Text book of Engineering Physics – M. N. Avadhanulu and P. G. Kshirsagar, S Chand & Co., 10th Revised Ed	1,10,20,24	In Lib
1-5	Engineering Physics – Gaur and Gupta, Dhanpat Rai Publications - 2017 Engineering Physics – S. P. Basavaraju, Subash Publications - 2017	2, 4 1-10	In Lib/ In dept
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
1, 2	Introduction to Mechanics – M. K. Verma, 2nd Ed, University Press,		In Lib
3,4	Laser and Non Linear Optics – B B Laud, 3rd Ed., New age international publishers		In Lib
5	Solid State Physics – S. O. Pillai, 8th Ed., New age international publishers	5,6,10,11	In lib
C	**Concept Videos or Simulation for Understanding**	-	-
C1 - C10	• Baisc Physics: https://www.physicsclassroom.com • Elasticity:https://www.youtube.com/watchv=OAK7CZSu9DA		web

	• Quantum Mechanics: NPTEL: https://www.youtube.com/watch?v=pGerRhxNQJE		
D	**Software Tools for Design**	-	-
E	**Recent Developments for Research**	-	-
F	**Others (Web, Video, Simulation, Notes etc.)**	-	-
1	NPTEL		
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	-	-
1-5	A Text book of Engineering Physics – M. N. Avadhanulu and P. G. Kshirsagar, S Chand & Co., 10th Revised Ed	1,10,20, 24	In Lib
	Engineering Physics – Gaur and Gupta, Dhanpat Rai Publications - 2017	2, 4	In Lib/ In dept
	Engineering Physics – S. P. Basavaraju, Subash Publications - 2017	1-10	
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
1, 2	Introduction to Mechanics – M. K. Verma, 2nd Ed, University Press,		In Lib
3,4	Laser and Non Linear Optics – B B Laud, 3rd Ed., New age international publishers		In Lib

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.

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

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	18PHY12	Engineering Physics	Oscillations and Waves	Lower Standards	Knowledge of Motion, vibrations, conservation laws	L1, L2
2	18PHY12	Engineering Physics	Elastic Properties of Materials	Lower Standards	Size, Shape of materials, Application of forces	L1, L2
3	18PHY12	Engineering Physics	Maxwell's equations, EM waves and Optical Fibers	Lower Standards	Study of Vector, Scalar, Electromagnetic waves	L2
4	18PHY12	Engineering Physics	Quantum Mechanics and Lasers	Lower Standards	Understanding of Classical Physics, Emission and absorption processes	L2
5	18PHY12	Engineering Physics	Material Science	Lower Standards	Band theory of Solids, Conductivity in Semiconductors	L1, L2

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.

Modules	Topic / Description	Area	Remarks	Blooms Level

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Instr Method	Assessment Method	Blooms' Level
1,2,3, 4,5	CO1	Understand the basics concepts of Elastic properties, oscillations and waves and relate the knowledge of quantum physics to the properties of materials such as conductors, laser, optical fiber, dielectrics.		Lecture, PPT, Videos	Slip Test	L2
1,3	CO2	Illustrate the point to point communication system and production of Shockwaves and Laser.		Lecture, PPT, Videos	Slip Test	L4
3	CO3	Compute the Eigen values and eigen function by using the time independent 1D Schrodinger wave equation		Lecture, PPT, Videos	Slip Test	L3
1,2,3, 4,5	CO4	Apply the knowledge in problem solving and construct the applications of the materials		Lecture, PPT, Videos	Slip Test	L3
-	**-**	**Total**	**50**	**-**	**-**	**L2-L4**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO's	Level
1	Understand the car shock absorbers and musical instruments.	CO4	L3
1	Analyze the concrete structures.	CO4	L3
2	Analyze the materials in mechanical engineering.	CO4	L3
2	Analyze the civil engineering structural elements.	CO4	L3
3	Analyze the EM communication and wireless communication.	CO4	L3
3	Used in the medical field, communication system.	CO4	L3
4	Used in materials engineering, photonics, MRI.	CO4	L3
4	Used in medical field, communication, Industry applications.	CO4	L3
5	Used in electrical and electronics engineering.	CO4	L3
5	Design of active electronic components.	CO4	L3

3. Articulation Matrix

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

-	-	Course Outcomes	Program Outcomes															-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1 -5	CO1	Understand the basics concepts of Elastic properties, oscillations and waves and relate the knowledge of quantum physics to the properties of materials such as conductors, laser, optical	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-	

		fiber, dielectrics.																
1, 3, 4	CO2	Illustrate the point to point communication system and production of Shockwaves and Laser.	2	2	2	-	-	-	-	-	-	-	-	1	-	-	-	
4	CO3	Compute the Eigen values and eigen function by using the time independent 1D Schrodinger wave equation	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	
1 -5	CO4	Apply the knowledge in problem solving and construct the applications of the materials	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	**18PHY22**	Average																**-**
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																	

4. Curricular Gap and Content

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

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Oscillations and Waves	10	2	-	-	1		2	CO1, CO2, CO4	L2, L3,L4
2	Elastic Properties of Materials	10	2	-	-	1		2	CO1, CO2, CO4	L2, L3,L4
3	Maxwell's Equation, EM waves and Optical Fibers	10	-	2	-	1		2	CO1, CO2, CO4	L2, L3,L4
4	Quantum Mechanics and Lasers	10	-	2	-	1		2	CO1, CO2, CO3, CO4	L2, L3,L4
5	Quantum Free electron theory, Physics of semiconductors and Dielectric materials	10	-	-	4	1		2	CO9, CO10	L2, L3,L4
-	**Total**	**50**	**4**	**4**	**4**	**5**		**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

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

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	30	CO1, CO2, CO4	L2, L3,L4
3, 4	CIA Exam – 2	30	CO1, CO2, CO3, CO4	L2, L3,L4
5	CIA Exam – 3	30	CO1, CO2, CO4	L2, L3,L4
1, 2	Assignment - 1	10	CO1, CO2, CO4	L2, L3,L4

3, 4	Assignment - 2	10	CO1, CO2, CO3, CO4	L2, L3,L4
5	Assignment - 3	10	CO1, CO2, CO4	L2, L3,L4
	Final CIA Marks	**40**	**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:	Oscillations and Waves	Appr Time	10 Hrs
a	***Course Outcomes***	***CO***	**Blooms**
-	The student should be able to:	-	**Level**
1	Understand the basics concepts of Elastic properties, oscillations and waves and relate the knowledge of quantum physics to the properties of materials such as conductors, laser, optical fiber, dielectrics.	CO1	L2
2	Illustrate the point to point communication system and production of Shockwaves and Laser.	CO2	L3
3	Apply the knowledge in problem solving and construct the applications of the materials	CO3	L4
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Definition of SHM, Characteristics, Examples and Derivation of differential equation of motion for SHM.	CO1	L2,
2	Mechanical simple harmonic oscillator. (Mass suspended to spring oscillator) – Description.	CO1, CO4	L3
3	Complex notation of simple harmonic motion (Aei(ωt + ε)), Phasor representation of simple harmonic motion. Equation of motion for free oscillations	CO1	L2
4	Springs in Series and Parallel combination	CO1, CO4	L3
5	Natural frequency of oscillations. Theory of damped oscillations (over damping critical and under damping) forced oscillations	CO1, CO4	L2
6	Resonance, sharpness of resonance. Example for mechanical resonance,	CO1, CO4	L3
7	Mach number, Properties of Shock waves, control volume.	CO1, CO2, CO4	L2
8	Laws of conservation of mass, energy and momentum.	CO1	L3
9	Construction and working of Reddy shock tube	CO1, CO2, CO4	L4
10	Applications of shock waves.	CO1, CO4	L3
11	Numericals	CO4	L3
c	**Application Areas**		**Level**
1	Understand the car shock absorbers and musical instruments.	CO4	L3
2	Analyze the concrete structures.	CO4	L3
d	**Review Questions**		-
1	Define SHM	CO1	L2
2	Derivation of equation for SHM	CO1	L2
3	Define Mechanical Simple harmonic oscillator	CO1, CO4	L3
4	Explain complex notation and phasor representation of simple harmonic motion	CO1	L3
5	Derive Equation of motion for free oscillations, Natural frequency of oscillations	CO1, CO4	L3
6	Define over damping, critical & under damping, quality factor	CO1	L2
7	Explain Theory of forced oscillations and resonance, Sharpness of resonance.	CO1, CO4	L3
8	Explain One example for mechanical resonance	CO1, CO4	L3

9	Define Mach number and Mach Regimes	CO1	L2
10	Explain Properties of Shock waves	CO1, CO4	L3
11	Explain Properties of control volume	CO1, CO4	L3
12	Explain Laws of conservation of mass, energy and momentum	CO1, CO4	L3
13	Explain Construction and working of Reddy shock tube	CO2	L4
14	Explain applications of shock waves.	CO4	L3
e	**Experiences**	-	-
1			
2			

Module – 2

Title:	Elastic Properties of Materials	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Understand the basics concepts of Elastic properties, oscillations and waves and relate the knowledge of quantum physics to the properties of materials such as conductors, laser, optical fiber, dielectrics.	CO1	L2
2	Apply the knowledge in problem solving and construct the applications of the materials	CO4	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
11	Concept of elasticity, plasticity, stress, strain, tensile stress, shear stress.	CO1	L2
12	Stress, strain hardening and strain softening, failure (fracture/fatigue).	CO1	L2
13	Hooke's law, different elastic moduli: Poisson's ratio.	CO1, CO4	L3
14	Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of α and β.	CO1, CO4	L3
15	Relation between Y, n and K. Limits of Poisson's ratio.	CO1, CO4	L3
16	Neutral surface and neutral plane, Derivation of expression for bending moment.	CO1, CO4	L3
17	Bending moment of a beam with circular and rectangular cross section. Single cantilever, derivation of expression for young's' modulus	CO1, CO4	L3
18	Torsion of cylinder: Expression for couple per unit twist of a solid cylinder (Derivation),	CO1, CO4	L3
19	Torsional pendulum-Expression for period of oscillation.	CO1, CO4	L3
20	Numerical problems	CO4	L3
c	**Application Areas**	**CO**	**Level**
1	Analyze the materials in mechanical engineering.	CO1, CO4	L3
2	Analyze the civil engineering structural elements.	CO1, CO4	L3
d	**Review Questions**	-	-
12	Define Elasticity.	CO1	L2
13	Define plasticity	CO1	L2
14	Define stress	CO1	L2
15	Define strain	CO1	L2
16	Define tensile stress	CO1	L2
17	Define shear stress	CO1	L2
18	Define compressive stress	CO1	L2
19	Define strain hardening	CO1	L2
20	Define strain softening	CO1	L2

21	Define fracture in Materials.	CO1	L2
22	Define Hooke's law.	CO1	L2
23	Explain Poisson's ratio.	CO1, CO4	L3
24	Derive Expression for Young's modulus (Y) in terms of ¬ʎ and β.	CO1, CO4	L3
25	Derive Bulk modulus (K) in terms of ¬ʎ and β.	CO1, CO4	L3
26	Derive Rigidity modulus (n) in terms of ¬ʎ and β.	CO1, CO4	L3
27	Derive Relation between Y, n and K.	CO1, CO4	L3
28	Explain Neutral surface and neutral plane.	CO1, CO4	L3
29	Derive expression for bending moment.	CO1, CO4	L3
30	Explain Bending moment of a beam with circular cross section.	CO1, CO4	L3
31	Explain Bending moment of a beam with rectangular cross section.	CO1, CO4	L3
32	Define Single cantilever.	CO1, CO4	L3
33	Derive expression for young's' modulus	CO1, CO4	L3
34	Derive Expression for couple per unit twist of a solid cylinder	CO1, CO4	L3
35	Explain Torsional pendulum.	CO1, CO4	L3
36	Derive an Expression for period of oscillation.	CO1, CO4	L3

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	18PHY22	Sem:	II	Marks:	50	Time:	90 minutes
Course:	Engineering Physics						

-	-	Note: Answer any 3 questions, each carry equal marks.	Marks	CO	Level
1	a	What are Damped vibrations? Deduce the theory of damped oscillations..	8	CO1, CO4	L3
	b	Define SHM and Derive the equation of motion for SHM and mention its solution.	7	CO1, CO4	L2
	c	What is a Mach number? Distinguish between acoustic, ultrasonic, subsonic and supersonic waves based on Mach number	6	CO1, CO4	L3
	d	For a particle Executing SHM, it's acceleration is found to be $15cm/s^2$ when it is at 3cm from it's mean position. Calculate time period.	4	CO4	L3
		or			
2	a	Describe the construction and working of Reddy tube with the help of a diagram.	8	CO2	L4
	b	Derive the Expression for equivalent force constant for 2 springs in series and parallel combination.	7	CO1, CO4	L3
	c	Define resonance, Explain the sharpness of resonance.	6	CO1, CO4	L3
	d	In a Reddy Tube experiment it was found that, the time taken to travel between the two sensors is 195 μs. If the distance between the two sensors is 100 mm. Find the Mach Number. (given-speed of sound in air=333 m/s)	4	CO4	L3
3	a	Derive the Relation between Y, η & σ.	8	CO1, CO4	L3
	b	S T for an elastic body shear Strain = Longitudinal strain + Compression strain.	7	CO1, CO4	L3
	c	Explain The Nature of Elasticity with the help of stress – strain diagram	6	CO1	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 2×10^{11} N/m^2.)	4	CO4	L3
		or			
4	a	Derive the expression for couple per unit twist of solid Cylinder.	8	CO1, CO4	L3
	b	Explain the different types of modulus of elasticity	7	CO1	L2
	c	Mention the various types of beams with diagram and their	6	CO1, CO4	L3

		Engineering Applications.			
	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 x 10^{11} N/m^2.	4	CO4	L3

b. Assignment -1

Model Assignment Questions								
Crs Code:	18PHY22	Sem:	2	Marks:	10	Time:	30 minutes	
Course:	Engineering Physics							

SNo	Assignment Description	Marks	CO	Level
1	Define SHM. Derivation of equation for SHM.	5	CO1	L3
2	Explain Mechanical simple harmonic oscillator.	5	CO1	L3
3	Explain complex notation and phasor representation of simple harmonic motion.	5	CO1	L2
4	Derive Equation of motion for free oscillations,	5	CO1	L2
5	Explain Natural frequency of oscillations.	5	CO1	L2
6	Define over damping, critical & under damping, quality factor	5	CO1	L2
7	Explain theory of forced oscillations and resonance, Sharpness of resonance.	5	CO1	L2
8	Explain one example for mechanical resonance	5	CO1	L2
9	Define Mach number and Mach Regimes	5	CO1	L2
10	Explain Properties of Shock waves	5	CO1	L2
11	Explain Properties of control volume	5	CO1	L2
12	Explain Laws of conservation of mass, energy and momentum	5	CO1	L2
13	Explain Construction and working of Reddy shock tube	5	CO2	L4
14	Explain applications of shock waves.	5	CO1, CO4	L3
15	Explain Elasticity and plasticity	5	CO1	L2
16	Define stress and strain	5	CO1	L2
17	Define tensile stress and shear stress	5	CO1	L2
18	Define compressive stress	5	CO1	L2
19	Define strain hardening and strain softening	5	CO1	L2
20	Define fracture in Materials.	5	CO1	L2
21	Define Hooke's law.	5	CO1	L2
22	Explain Poisson's ratio.	5	CO1	L2
23	Derive Expression for Young's modulus (Y).	5	CO1	L2
24	Derive Bulk modulus (K).	5	CO1	L2
25	Derive Rigidity modulus (n) .	5	CO1	L2
26	Derive Relation between Y, n and K.	5	CO1	L2
27	Explain Neutral surface and neutral plane.	5	CO1	L2
28	Derive expression for bending moment.	5	CO1	L2
29	Explain Bending moment of a beam with circular cross section.	5	CO1	L2
30	Explain Bending moment of a beam with rectangular cross section.	5	CO1	L2
31	Define Single cantilever.	5	CO1, CO4	L3
32	Derive expression for Young's modulus	5	CO1	L2
33	Derive Expression for couple per unit twist of a solid cylinder	5	CO1	L2
34	Explain Torsional pendulum.	5	CO1, CO4	L3

35	Derive an Expression for period of oscillation.	**5**	CO1	L2
36				

D2. TEACHING PLAN - 2

Module – 3

Title:	Maxwell's Equation, EM waves and Optical fibers	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Understand the basics concepts of Elastic properties, oscillations and waves and relate the knowledge of quantum physics to the properties of materials such as conductors, laser, optical fiber, dielectrics.	CO1	L2
2	Illustrate the point to point communication system and production of Shockwaves and Laser.	CO2	L4
3	Apply the knowledge in problem solving and construct the applications of the materials	CO4	L3
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**Level**
21	Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static)	CO1, CO4	L3
22	Gauss' divergence theorem and Stokes' theorem.	CO1	L2
23	Description of laws of electrostatics, magnetism and Faraday's laws of EMI.	CO1	L2
24	Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum	CO1	L2
25	The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations),	CO1	L2
26	Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves(Qualitative)	CO1	L3
27	Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation.	CO1,CO4	L3
28	Types of optical fibers. Attenuation: Causes of attenuation and Mention expression for attenuation coefficient.	CO1,CO4	L3
29	Discussion of block diagram of point to point communication. Merits and demerits	CO2	L3
30	Numerical problems	CO4	L3
c	**Application Areas**		**Level**
-	Students should be able employ / apply the Module learnings to . . .		
1	Analyze the EM communication and wireless communication.	CO4	L4
2	Optical fibers are used in the medical field, communication system.	CO2,CO4	L4
			-
d	**Review Questions**		
-	The attainment of the module learning assessed through following questions		
1	Define Fundamentals of vector calculus.	CO1	L2
2	Define Divergence	CO1	L2
3	Define curl of electric field	CO1	L2
4	Define magnetic field (static)	CO1	L2
5	Derive Gauss' divergence theorem.	CO1, CO4	L3
6	Derive Stokes' theorem.	CO1, CO4	L3

7	Describe laws of electrostatics	CO1, CO4	L2
8	Describe laws of magnetism	CO1, CO4	L3
9	Describe laws of Faraday's laws of EMI.	CO1, CO4	L4
10	Define Current density.	CO1	L2
11	Explain equation of Continuity.	CO1, CO4	L3
12	Derive displacement current Maxwell's equations in vacuum	CO1, CO4	L3
13	Derive wave equation in differential form in free space using Maxwell's equations.	CO1, CO4	L3
14	Explain Plane electromagnetic waves in vacuum.	CO1, CO4	L2
15	Define transverse nature.	CO1, CO4	L2
16	Define polarization of EM waves.	CO1, CO4	L2
17	Explain Propagation mechanism in an optical fiber.	CO1, CO4	L2
18	Define angle of acceptance.	CO1, CO4	L2
19	Define Numerical aperture.	CO1, CO4	L2
20	Based on Modes of propagation Explain Types of optical fibers	CO1, CO4	L2
21	Mention the Causes of attenuation in an optical fiber.	CO1, CO4	L2
22	Mention the expression for attenuation coefficient.	CO1, CO4	L2
23	Discuss point to point communication system of an optical fiber.	CO2	L4
24	Explain Merits and demerits of an Optical Fibers.	CO1, CO2, CO4	L3

Module – 4

Title:		Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Understand the basics concepts of Elastic properties, oscillations and waves and relate the knowledge of quantum physics to the properties of materials such as conductors, laser, optical fiber, dielectrics.	CO1	L2
2	Compute the Eigen values and eigen function by using the time independent 1D Schrodinger wave equation	CO3	L3
3	Apply the knowledge in problem solving and construct the applications of the materials	CO4	L3
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
1	Introduction to Quantum mechanics, Wave nature of particles.	CO1, CO4	L3
2	Heisenberg's uncertainty principle and applications (non confinement of electron in the nucleus).	CO1, CO4	L3
3	Schrodinger time independent wave equation.	CO1, CO3, CO4	L3
4	Significance of Wave function,Normalization.	CO1, CO3, CO4	L3
5	Particle in a box, Energy eigen values of a particle in a box and probability densities	CO1, CO3, CO4	L3
6	Review of spontaneous and stimulated processes, Einstein's coefficients (derivation of expression for energy density). Requisites of a Laser system. Conditions for laser action.	CO1, CO2, CO4	L3
7	Principle, Construction and working of CO_2.	CO1, CO2, CO4	L3
8	Principle, Construction and working of semiconductor Lasers.	CO1, CO2, CO4	L3
9	Application of Lasers in Defense (Laser range finder) and Engineering (Data storage)	CO1, CO2, CO4	L3
10	Numerical problems	CO4	L3

c	Application Areas		Level
1	Used in materials engineering, photonics, MRI.	CO4	L3
2	Used in medical field, communication, Industry applications.	CO4	L3
d	**Review Questions**		-
1	Define Quantum mechanics	CO1	L2
2	Explain Wave nature of particles	CO1	L3
3	State Heisenberg's uncertainty principle.	CO1	L2
4	Show that non confinement of electron in the atomic nucleus.	CO1	L2
5	Derive Schrodinger time independent wave equation.	CO1, CO3, CO4	L3
6	Define Significance of Wave function.	CO1, CO3, CO4	L3
7	Define Significance of Normalization.	CO1, CO3, CO4	L3
8	Define Particle in a box.	CO1, CO3, CO4	L3
9	Derive Energy eigen values of a particle in a box.	CO1, CO3, CO4	L3
10	Explain probability densities.	CO1, CO3, CO4	L3
11	Define spontaneous Emission processes.	CO1, CO2, CO4	L3
12	Define stimulated Emission processes.	CO1, CO2, CO4	L3
13	Derive expression for energy density of radiation interms of Einstein's coefficients.	CO1, CO2, CO4	L3
14	Explain Requisites of a Laser system.	CO1, CO2, CO4	L3
15	Define Conditions for laser action	CO1, CO2, CO4	L3
16	Explain Principle, Construction and working of CO2 Lasers.	CO1, CO2, CO4	L3
17	Explain Principle, Construction and working of semiconductor Lasers.	CO1, CO2, CO4	L3
18	Explain Laser range finder.	CO1, CO2, CO4	L3
19	Explain Data storage.	CO1, CO2, CO4	L3
e	**Experiences**	-	-
1			
2			
1			
2			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	18PHY22	Sem:	II	Marks:	30	Time:	75 minutes
Course:	Engineering Physics						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	With neat diagram, derive an expression for numerical aperture and Acceptance angle.	8	CO1	L2
	b	With neat diagram explain the different types of optical fiber	8	CO1	L2
	c	Explain point to point communication system using optical fibers. & write any four advantages of optical communication system.	5	CO2	L4
	d	An optical fiber has a core material with refractive index 1.50 and 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.	4	CO4	L3
		Or			
2	a	Describe the concept of divergence. Derive Gauss divergence theorem.	8	CO1, CO4	L3

	b	Mention Maxwell's equations for electromagnetic field. Starting from Maxwell's equation deduce the wave equation for a plane wave in free space.	8	CO1, CO4	L3
	c	What is displacement current? Obtain the expression for displacement current.	5	CO1, CO4	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	CO4	L4
3	a	Derive expression for energy density of radiation in terms of Einstein's coefficients.	8	CO1, CO4	L2
	b	Explain Construction and working of Semiconductor Diode Laser With Diagram.	8	CO1, CO2, CO4	L4
	c	Explain Range Finder and Compact Disc.	5	CO1, CO4	L3
	d	The average output power of laser source emitting a laser beam of wavelength 6328 A° is 5mW. Find the number of emitted photons emitted per second by the laser source.	4	CO4	L3
		Or			
4	a	Obtain the solution of Schrodinger's time independent wave equation, When applied to a potential well of infinite height.	8	CO1, CO3, CO4	L4
	b	Derive Time independent Schrödinger wave equation.	8	CO3, CO4	L3
	c	Explain Heisenberg's uncertainty principle and give its physical significance.	5	CO1, CO4	L3
	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= 6.63×10^{-34}JS, m = 9.11×10^{-31}Kg)	4	CO4	L3

b. Assignment – 2

Model Assignment Questions							
Crs Code:	18PHY22	Sem:	II	Marks:	10	Time:	
Course:	Engineering Physics						

SNo	Assignment Description	Marks	CO	Level
1	Define Fundamentals of vector calculus.	5	CO1	L1
2	Define Divergence and curl of electric field.	5	CO1	L1
3	Define magnetic field (static) and Derive Gauss' divergence theorem.	5	CO1	L1
4	Derive Stokes' theorem.	5	CO1	L3
5	Describe laws of electrostatics and laws of magnetism.	5	CO1	L2
6	Describe laws of Faraday's laws of EMI and Current density.	5	CO1	L2
7	Explain equation of Continuity.	5	CO1	L3
8	Derive displacement current Maxwell's equations in vacuum	5	CO1	L3
9	Derive displacement current Maxwell's equations in vacuum	5	CO1	L3
10	Derive wave equation in differential form in free space using Maxwell's equations.	5	CO1	L3
11	Explain Plane electromagnetic waves in vacuum.	5	CO1	L2
12	Define transverse nature and polarization of EM waves.	5	CO1	L1
13	Explain Propagation mechanism in an optical fiber.	5	CO1	L2
14	Define angle of acceptance and Numerical aperture.	5	CO1	L1
15	Based on Modes of propagation Explain Types of optical fibers	5	CO4	L3
16	Explain the Causes of attenuation in an optical fiber and Mention the expression for attenuation coefficient.	5	CO2, CO4	L3
17	Discuss point to point communication system of an optical fiber.	5	CO2	L4

18	Explain Merits and demerits of an Optical Fibers.	5	CO1, CO2, CO4	L2
19	Explain the necessity of Quantum mechanics and Wave nature of particles	5	CO1, CO2, CO4	L2
20	State and Explain Heisenberg's uncertainty principle.	5	CO1, CO4	L2
21	Show that non confinement of electron in the atomic nucleus.	5	CO1, CO4	L3
22	Derive the Schrodinger time independent wave equation.	5	CO1, CO4	L4
23	Define Significance of Wave function and Normalization.	5	CO3, CO4	L3
24	Define Particle in a box and Derive Energy eigen values of a particle in a box and Probability density.	5	CO1, CO3, CO4	L1
25	Define spontaneous Emission processes and stimulated Emission processes.	5	CO1, CO3, CO4	L1
26	Derive expression for energy density of radiation in terms of Einstein's coefficients.	5	CO1, CO3, CO4	L3
27	Explain the Requisites and Conditions for laser action.	5	CO1, CO2, CO4	L2
28	Explain Principle, Construction and working of CO2 Lasers.	5	CO2	L4
29	Explain Principle, Construction and working of semiconductor Lasers.	5	CO2	L4
30	Explain Laser range finder and Data storage.	5	CO4	L4
31	Explain Laser Cutting, laser welding and Laser Drilling.	5	CO4	L3
32				

D3. TEACHING PLAN - 3

Module – 5

Title:	Material Science	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
	Understand the basics concepts of Elastic properties, oscillations and waves and relate the knowledge of quantum physics to the properties of materials such as conductors, laser, optical fiber, dielectrics.	CO1	L2
	Apply the knowledge in problem solving and construct the applications of the materials	CO4	L3
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.	CO1, CO4	L3
42	Assumptions of Quantum Free electron theory, Mention of expression for density of states.	CO1, CO4	L3
43	Fermi-Dirac statistics (qualitative), Fermi factor, Fermi level,	CO1, CO4	L4
44	Derivation of the expression for Fermi energy, Success of QFET.	CO1, CO4	L4
45	Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band, Hole concentration in valance band (only mention the expression),	CO1, CO4	L4
46	Conductivity of semiconductors(derivation),	CO1, CO4	L3
47	Hall effect, Expression for Hall coefficient(derivation)	CO1, CO4	L3
48	Polar and non-polar dielectrics, Internal fields in a solid, Clausius-Mossotti equation(Derivation),	CO1, CO4	L3
49	Mention of solid, liquid and gaseous dielectrics with one example each. Application of dielectrics in transformers.	CO1, CO4	L3
50	Numerical problems	CO4	L4

c	Application Areas	CO	Level
1	Used in electrical and electronics engineering.	CO4	L4
2	Design of active electronic components.	CO4	L4
d	**Review Questions**		-
1	Define classical free electron theory.	CO1, CO4	L1
2	Define Failures of classical free electron theory.	CO1, CO4	L3
3	Explain Assumptions of Quantum Free electron theory.	CO1, CO4	L2
4	Mention of expression for density of states.	CO1, CO4	L4
5	Mention of expression for Fermi-Dirac statistics	CO1, CO4	L2
6	Mention of expression for Fermi factor	CO1, CO4	L2
7	Mention of expression for Fermi level	CO1, CO4	L2
8	Derive the expression for Fermi energy, Success of QFET	CO1, CO4	L3
9	Explain Fermi levels in intrinsic semiconductors.	CO1, CO4	L4
10	Expression for concentration of electrons in conduction band.	CO1, CO4	L1
11	Mention the expression for Hole concentration in valance band.	CO1, CO4	L4
12	Derive the expression for Conductivity of semiconductors.	CO1, CO4	L3
13	Explain Hall effect.	CO1, CO4	L2
14	Derive the expression for Hall coefficient.	CO1, CO4	L3
15	Explain polar dielectrics.	CO1, CO4	L3
16	Explain non-polar dielectrics.	CO1, CO4	L2
17	Explain internal fields in a solid.	CO1, CO4	L2
18	Derive the Expression for Clausius-Mossotti equation.	CO1, CO4	L3
19	Mention Solid dielectrics with one example.	CO1, CO4	L2
20	Mention liquid dielectrics with one example.	CO1, CO4	L2
22	Mention gaseous dielectrics with one example.	CO1, CO4	L2
23	Explain Application of dielectrics in transformers.	CO1, CO4	L3
e	**Experiences**	-	-
1			
2			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	18PHY22	Sem:	II	Marks:	30	Time:	75 minutes
Course:	Engineering Physics						

-	-	**Note: Answer any 2 questions, each carry equal marks.Derive the wave equation in differential form in free space using maxwell's equation.**	Marks	CO	Level
1	a	Discuss the failures of classical free electron theory.	6	CO1, CO4	L3
	b	Give the assumptions of QFET.	5	CO1, CO4	L3
	c	Calculate the probabilities of an electron occupying an energy level 0.02 eV above the fermi level and that in an energy level 0.02 eV below the Fermi level at 200K.	4	CO4	L4
		Or			
2	a	What is Hall effect? Obtain the expression for Hall voltage in terms of Hall Coefficient.	6	CO1, CO4	L3
	b	Define the Fermi factor. Explain the variation of fermi factor with	5	CO1, CO4	L3

		example.			
	c	The Hall coefficient is 3.68 x 10^{-6} m^{-3}/C. What is the type of charge carriers? Also calculate the carrier concentration.	4	CO4	L4
3	a	Obtain the relation between fermi energy and energy gap for an Intrinsic semiconductor.	6	CO1, CO4	L4
	b	Discuss the various types of polarization.	5	CO1, CO4	L4
	c	The following data given for intrinsic germanium at 300 K, ni = 2.4 X 10 19/m3, μo = 0.39 m2v-1s-1, μh=0.19 m2v-1s-1. Calculate the resistivity of sample.	4	CO4	L4
		Or			
	a	Derive the Expression for Clausius-Mossotti equation.	6	CO1, CO4	L4
	b	Explain Application of dielectrics in transformers.	4	CO1, CO4	L3
	c	If a NaCl crystal is subjected to an electric field of 1000 V/m and the resulting polarization is 4.3 X 10-8 C/m2, Calculate the dielectric constant of NaCl.	5	CO4	L4

b. Assignment – 3

Model Assignment Questions							
Crs Code:	18PHY22	Sem:	II	Marks:	10	Time:	30 minutes
Course:	Engineering Physics						

SNo	Assignment Description	Marks	CO	Level
1	Define classical free electron theory.	5	CO1, CO4	L2
2	Define Failures of classical free electron theory.	5	CO1, CO4	L3
3	Explain Assumptions of Quantum Free electron theory.		CO1, CO4	L4
4	Mention of expression for density of states and Fermi-Dirac statistics.	5	CO1, CO4	L3
5	Mention of expression for Fermi factor and Fermi level.	5	CO1, CO4	L2
6	Derive the expression for Fermi energy, Success of QFET	5	CO1, CO4	L3
7	Explain Fermi levels in intrinsic semiconductors.	5	CO1, CO4	L3
8	Mention the expression for concentration of electrons in conduction band and Hole concentration in valance band.	5	CO1, CO4	L3
9	Derive the expression for Conductivity of semiconductors.	5	CO1, CO4	L4
10	Exlain Hall effect. And Derive the expression for Hall coefficient.	5	CO1, CO4	L4
11	Explain polar dielectrics and non-polar dielectrics.	5	CO1, CO4	L3
12	Explain internal fields in a solid.	5	CO1, CO4	L2
13	Derive the Expression for Clausius-Mossotti equation.	5	CO1, CO4	L2
14	Mention Solid, liquid and gaseous dielectrics with one example.	5	CO1, CO4	L3
15	Explain Application of dielectrics in transformers.	5	CO1, CO4	L4

F. EXAM PREPARATION

1. University Model Question Paper

Course:	Engineering Physics					Month / Year	Jan/2020
Crs Code:	18PHY22	Sem:	II	Marks:	100	Time:	180 minutes
-	Note	Answer all FIVE full questions. All questions carry equal marks.			Mark	CO	Level

			s		
1	a	Define SHM. Derivation of equation for SHM.	5	CO1, CO4	L3
	b	Explain complex notation and phasor representation of simple harmonic motion.	6	CO1, CO4	L3
	c	Derive Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of ¬ʎ alpha and Beta.	5	CO1, CO4	L3
	d	Calculate the period of oscillation of a mass 40kg on a spring with constant k=10 N/m.	4	CO4	L3
		OR			
2	a	Explain Construction and working of Reddy shock tube and Applications of Shock Waves.	5	CO2, CO4	L4
	b	Define Resonance. Explain Sharpness of Resonance and give an example for Mechanical Resonance.	6	CO1, CO4	L3
	c	Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.	5	CO1	L2
	d	In a Reddy Tube experiment, it was found that, the time taken to travel between the two sensors is 195μs. If the distance between the two sensors is 100nm, find the Mach number.	4	CO4	L3
3	a	Explain strain hardening and strain softening.	5	CO1	L2
	b	Derive Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of ¬ʎ and β.	6	CO1, CO4	L3
	c	Explain Bending moment of a beam with circular cross section.	5	CO1, CO4	L3
	d	A particle executes a SHM of period of 10s and amplitude of 1.5m. Calculate its maximum acceleration and velocity.	4	CO4	L4
		OR			
4	a	Derive the expression for bending moment.	5	CO1	L2
	b	Derive the Expression for couple per unit twist of a solid cylinder.	6	CO1, CO4	L3
	c	Explain Neutral surface and neutral plane.	5	CO1	L2
	d	Calculate the percentage change in the frequency of oscillations of a spring if the mass attached to the spring is increased by 50%.	4	CO4	L4
5	a	Explain Attenuation mechanism and mention the equation of attenuation coefficient.	5	CO1	L2
	b	Derive the wave equation in differential form in free space using maxwell's equation	6	CO1	L2
	c	Define Divergence and curl of electric and magnetic field.	5	CO1	L2
	d	Find the ratio of population of two energy levels in a medium at thermal equilibrium, if the wavelength of light emitted at 291K is 6928A˚.	4	CO4	L4
		OR			
6	a	Discuss point to point communication system with Block Diagram.	5	CO2	L4
	b	Derive angle of acceptance and Numerical aperture in an optical fiber.	6	CO1	L2
	c	Explain Applications of dielectrics in transformers.	5	CO1, CO4	L3
	d	Find the ratio of population of two energy levels in a medium at thermal equilibrium, if the wavelength of light emitted at 291K is 6928A˚.	4	CO4	L3
7	a	Explain Heisenberg uncertainty principle with an example.	5	CO1	L2
	b	Explain Principle, Construction and working of CO2 Lasers.	6	CO2	L3
	c	Find Energy eigen values of a particle in a box.	5	CO3	L3
	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.	4	CO4	L3
		OR			
8	a	Derive time independent Schrodinger wave equation.	5	CO1	L2
	b	Explain Principle, Construction and working of semiconductor Lasers.	6	CO2, CO4	L4
	c	Explain the Requisites and Conditions for laser action.	5	CO2, CO2	L3
	d	A He-Ne laser is emitting a laser beam with an average power of	4	CO4	L3

		4.5mW. Find the number of photons emitted per second by t6he laser. The wavelength of emitted radiation is 632.8A°			
9	a	Explain the failures of classical free electron theory.	5	CO1, CO4	L2
	b	Derive the conductivity of semiconductor.	6	CO1, CO4	L3
	c	Explain the success of free electron theory.	5	CO1, CO4	L2
	d	A 5.00 µF parallel plate capacitor has air between the plates. When an insulating material is placed between the plates, the capacitances increases to 13.5 µF. Find the dielectric constant of the insulator.	4	CO4	L3
		OR			
10	a	Define Hall effect and Derive the Expression for Hall coefficient.	5	CO1, CO4	L3
	b	What are Dielectrics. Derive Clausius-Mossotti equation.	6	CO1, CO4	L3
	c	Explain Application of dielectrics in transformers.	5	CO1, CO4	L3
	d	The Hall coefficient is 3.68 x 10^{-6} m^{-3}/C. What is the type of charge carriers ? Also calculate the carrier concentration.	4	CO4	L3

2. SEE Important Questions

Course:	Engineering Physics					Month / Year	Jan /2020
Crs Code:	18PHY22	Sem:	II	Marks:	100	Time:	180 minutes

	Note	Answer all FIVE full questions. All questions carry equal marks.	-	-	
Module	Qno.	Important Questions	**Marks**	**CO**	**Year**
1	1	Define SHM. Derivation of equation for SHM.	5	CO1, CO4	
	2	Explain complex notation and phasor representation of simple harmonic motion.	5	CO1, CO4	
	3	Define over damping, critical & under damping, quality factor	4	CO1, CO4	
	4	Define Resonance. Explain Sharpness of Resonance and give an example for Mechanical Resonance.	5	CO1, CO4	
	5	Explain Construction and working of Reddy shock tube and Applications of Shock Waves.	6	CO1, CO4	
2	1	Define Elasticity, plasticity, stress, strain, tensile stress and shear stress.	6	CO1, CO4	
	2	Derive Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of ¬ʌ and β.	6	CO1, CO4	
	3	Derive the expression for bending moment.	5	CO1, CO4	
	4	Explain Torsional pendulum and give its theory.	5	CO1, CO4	
	5	Explain Bending moment of a beam with circular and rectangular cross section.	6	CO1, CO4	
3	1	Define Divergence and curl of electric and magnetic field.	6	CO1, CO4	
	2	Derive angle of acceptance and Numerical aperture in an optical fiber.	6	CO1, CO4	
	3	Derive the wave equation in differential form in free space using maxwell's equation.	5	CO1, CO4	
	4	Explain Attenuation mechanism and mention the equation of attenuation coefficient.	6	CO1, CO4	
	5	Discuss point to point communication system with Block Diagram.	5	CO2, CO4	
4	1	Explain Heisenberg uncertainty principle with an example.	5	CO1, CO4	
	2	Derive time independent schrodinger wave equation.	6	CO1, CO4	
	3	Find Energy eigen values of a particle in a box.	6	CO1,CO3, CO4	
	4	Explain Principle, Construction and working of CO2 Lasers.	6	CO2, CO4	
	5	Explain Principle, Construction and working of semiconductor Lasers.	6	CO2,CO4	

5	1	Explain the failures of classical free electron theory	5	CO1, CO4	
	2	Explain the success of free electron theory	5	CO1, CO4	
	3	Derive the conductivity of semiconductor.	5	CO1, CO4	
	4	Define Hall effect and Derive the Expression for Hall coefficient.	6	CO1, CO4	
	5	What are Dielectrics. Derive Clausius-Mossotti equation.	6	CO1, CO4	