CMR Institute of Technology, Bangalore			
Department(s): Basic Science and Humanities (Physics)			
Semester: 01	Section(s): D	Lectures/week: 04	
Subject: Engineering Physics		Code: 18PHY12	
Course Instructor(s): Sudarshana R			
Course duration: 21st December 2020 to 25th March 2021			
Course Site: https://sites.google.com/a/cmrit.ac.in/sudarshana-2014/			
Google Classroom Link: https://classroom.google.com/c/MTI2ODEzMTUzNDIz Class Code: gl6rn53			

Link to detailed syllabus:	**https://drive.google.com/drive/folders/1aalh0KBe90j4kJhtJOXQz72pqOrS8t46?usp=sharing**
Course Objectives/ Expectations	1. Learn the basic concepts in Physics which are very much essential in understanding and solving engineering related challenges. 2. Gain the knowledge of newer concepts in modern physics for the better appreciation of modern technology.
Prerequisites	➢ Fundamentals of optics- basic laws of reflection and refraction, properties of light ➢ Basics of atomic physics, atomic structure, orbits, orbital, configuration ➢ Basics of differential and integral calculus and vector algebra ➢ Introduction to conductors, insulators, semiconductors, Ohm's law, band theory of solids ➢ Basics elastic properties of materials and theory of simple harmonic oscillations

NOTE: First one to two sessions should be marked for expectations setting about the course.

Lesson Plan				
Lecture #	**Book & Sections**	**Topics**	**Portions coverage**	
			Teaching Aids/Course Delivery Methods	% of Syllabus Covered
3-12	TB1: 20.1 to 20.22 TB3: 5.1 to 5.8 RB3: Page 333 to 398 RB4: 4.2,6.3, 2.7 - 2.9 RB5: 12.1 to 12.5 &	**MODULE- 04- Quantum Mechanics and Lasers** **Quantum mechanics:** 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 **Lasers**: Review of spontaneous and stimulated	Online lectures, Videos and Flip Class	20

	17.11 to 17.15	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		
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included ➢ https://www.youtube.com/watch?v=TcmGYe39XG0 ➢ https://www.youtube.com/watch?v=2ejyr-E7q2M ➢ https://www.youtube.com/watch?v=YvrwVK9ZqQY ➢ https://www.youtube.com/watch?v=CBrsWPCp_rs ➢ https://www.youtube.com/watch?v=1LmcUaWuYao ➢ https://drive.google.com/drive/folders/1aalh0KBe90j4kJhtJOXQz72pqOrS8t46?usp=sharing				
13-22	TB2: 33.1 to 33.22 RB14: Page 1 to 54	**MODULE-01-Oscillations and Waves** **Free Oscillations**: Definition of SHM, derivation of equation for SHM, Mechanical and electrical simple harmonic oscillators (mass suspended to spring oscillator), complex notation and phasor representation of simple harmonic motion. Equation of motion for free oscillations, Natural frequency of oscillations. **Damped and forced oscillations**: Theory of damped oscillations: over damping, critical & under damping, quality factor. Theory of forced oscillations and resonance, Sharpness of resonance. One example for mechanical resonance. **Shock waves**: Mach number, Properties of Shock waves, control volume. Laws of conservation of mass, energy and momentum. Construction and working of Reddy shock tube, applications of shock waves, Numerical problems .	Online lectures, Videos and Flip Class	40
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included ➢ https://www.youtube.com/watch?v=iubb3eFBQ9U ➢ https://www.youtube.com/watch?v=t8FIvBOdEtk ➢ https://www.youtube.com/watch?v=t8FIvBOdEtk ➢ https://www.youtube.com/watch?v=6V_JBGRCWV8 ➢ https://www.youtube.com/watch?v=85X8hjBlLYA ➢ https://www.youtube.com/watch?v=9rVJD4drsKo ➢ https://www.youtube.com/watch?v=9f2wBmFC3Rk ➢ **https://drive.google.com/drive/folders/1aalh0KBe90j4kJhtJOXQz72pqOrS8t46?usp=sharing**				
23-32	TB1: 33.1 to 33.22 RB3: Page 159 to 246 RB1: Page 521 to 575	**MODULE- 05-Material science** **Quantum Free electron theory of metals:** 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. **Physics of Semiconductor**: Fermi level in intrinsic	Online lectures, Videos and Flip Class	60

		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) **Dielectric materials:** 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		
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included ➢ https://www.youtube.com/watch?v=G2zgAs5O7I8 ➢ https://www.youtube.com/watch?v=BQijtvYxgIM ➢ https://www.youtube.com/watch?v=etjZmdmrjSU ➢ https://www.youtube.com/watch?v=45EfsSPjia ➢ https://www.youtube.com/watch?v=ekRwjDzie4s ➢ https://www.youtube.com/watch?v=VEf0GTAsvVw ➢ https://drive.google.com/drive/folders/1aalh0KBe90j4kJhtJOXQz72pqOrS8t46?usp=sharing				
33-42	TB2: 33.1 to 33.22	**MODULE-02-Elastic properties of materials:** **Elasticity:** Concept of elasticity, plasticity, stress, strain, tensile stress, shear stress, compressive stress, strain hardening and strain softening, failure (fracture/fatigue), Hooke's law, different elastic moduli: Poisson's ratio, Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of α and ß. Relation between Y, n and K, Limits of Poisson's ratio. **Bending of beams**: Neutral surface and neutral plane, Derivation of expression for bending moment. Bending moment of a beam with circular and rectangular cross section. Single cantilever, derivation of expression for young's' modulus **Torsion of cylinder**: Expression for couple per unit twist of a solid cylinder (Derivation), Torsional pendulum-Expression for period of oscillation. Numerical problems	Online lectures, Videos and Flip Class	80
Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included ➢ https://www.youtube.com/watch?v=EzcWpOFJ6P4 ➢ https://www.youtube.com/watch?v=Z2Jj-cqDYh8 ➢ https://www.youtube.com/watch?v=PRYtw9EQhug ➢ https://drive.google.com/drive/folders/1aalh0KBe90j4kJhtJOXQz72pqOrS8t46?usp=sharing				
43-52	RB3: Page 401 to 436 RB8: Page 1 to 37 TB1: Page 38 to 93	**MODULE- 03- Maxwell's equations, EM waves and Optical fibers:** **Optical fibers:** Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation and Types of optical fibers. Attenuation: Causes of attenuation and Mention of expression for	Online lectures, Videos and Flip Class	100

		attenuation coefficient. Discussion of block diagram of point to point communication. Merits and demerits, Numerical problems **Maxwell's equations:** 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 **EM Waves**: 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)		

Links to some useful online lectures: Videos, assignments, quizzes, answers to old external question papers, notes and other e-material can be included

- https://www.youtube.com/watch?v=ibF0L6X53tg
- https://www.youtube.com/results?search_query=nptel+electromagnetic+waves+
- https://www.youtube.com/watch?v=o5t6evogJbg
- https://www.youtube.com/watch?v=j4qbhVQQdBQ
- https://drive.google.com/drive/folders/1aalh0KBe90j4kJhtJOXQz72pqOrS8t46?usp=sharing

Text Books	
1.	A Text book of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10 Revised Ed, S. Chand & Company Ltd, New Delhi
2.	Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017
3.	Concepts of Modern Physics-Arthur Beiser: 6th Ed;Tata McGraw Hill Edu Pvt Ltd- New Delhi,2006
Reference Books	
1.	S O Pillai,"Solid State Physics", 8th Ed- New Age International Publishers-2018
2.	MK Verma, "Introduction to Mechanics", 2 Ed, University Press(India) Pvt Ltd,Hyderabad 2009
3.	S.P.Basavaraju,"Engineering Physics", Subhas Stores
4.	K R Nambiar, " Lasers", New Age International, 81-224-1492-3
5.	B B Laud ," Lasrs & Non linear Optics", 2nd edition, New Age International, 81-224-0324-7
6.	Ajoy Ghatak & S.Lokanathan, "Quantum Mechanics Thory and applications", 5thedition,2004, Macmillan Publishers, 140-392-341-8
7.	C Kittel, "Introduction to Solid State Physics",8th Edition, 2013, John Wiley ,978-81-265-3518-7
8.	David Griffiths, "Introduction to Electrodynamics", 4 Ed, Cambridge University Press 2017
9.	Ajoy Ghatak, K thyagarajan," An Introduction to Fiber Optics", 5th Edition,2012, Tata McGraw-Hill, 1-25-900434-1
10.	A.J.Dekker," Solid State Physics", Revised Edition, 2014, Macmillan Publishers, 0333-91833-9

11.	R.K.Gaur,S.L.Gupta,"Engineering Physics", 7thEdition,Dhanpat Rai & Sons
12.	Fox,McDonald,Pritchard,"Fluid Mechanics", 8th Edition, John Wiley, 978-81-265-4128-7
13.	Munson,Young,"Fluid Mechanics", 6th Edition, John Wiley, 978-81-265-2392-4
14.	Chintoo S.Kumar , K.Takayana and K.P.J.Reddy,"Shock waves made simple", Willey India Pvt. Ltd. New Delhi,2014
15.	A. Marikani, "Engineering Physics", PHI Learning Private Limited, Delhi – 2013
16.	S.Mani Naidu,"Engineering Physics", Pearson India Limited – 2014

Syllabus for Internal Assessment Tests (IAT*)

IAT #	Syllabus
IAT-1	Class # 01 – 18
IAT-2	Class # 19–36
IAT-3	Class # 37–52

*See calendar of events for IAT schedule.

Evaluation :Quiz/Assignment/Seminar/Mini Project/Viva

- ***Evaluation of course delivery is based on any one of the above***
- ***Evaluation guidelines to be provided to help students understand how the evaluation would be done for assignments, quiz, and so on.***
- ***Evaluation tools/method to be mentioned e.g.: Easy polls, Survey Monkey, Typeform or inbuilt poll option in video conferencing tool.***
- ***'Work-book' section includes additional activities to support self-learning e.g. exercises, game-based learning, case-study, and so on.***

Evaluation Method	Remarks
No of Assignments/Quiz or any of the mentioned above given	
Assignment1: Issue date: 23/12/2020/ Submission date: 04/01/2020 **Assignment2:** Issue date: 05/01/2021 Submission date: 20/01/2021 **Assignment3:** Issue date: 21/01/2021 Submission date: 08/02/2021 **Assignment4:** Issue date: 09/02/2021 Submission date: 25/02/2021 **Assignment5:** Issue date: 26/02/2021 Submission date: 15/03/2021 **Quiz1:** 11/01/2021 **Quiz2:** 12/02/2020 **Quiz3:** 13/03/2021	In addition to assignments, quizzes will be conducted at regular intervals.

MOOC: 21st March 2021	

Evaluation guidelines (please provide the link)	https://drive.google.com/drive/folders/1aalh0KBe90j4kJhtJOXQz72pqOrS8t46?usp=sharing
Evaluation tools/method	Assignments, Quiz, MOOCs, Mini Projects
Flipped Classroom process for students to understand	Video sessions on Laser, Shock waves and Optical fibers

Workbook (*Additional activities to support self-learning e.g. exercises, game-based learning, case-study etc.)*	
Objective Type questions and Numerical exercises are planned.	
please provide the link to access the work book information	***https://drive.google.com/drive/folders/1aalh0KBe90j4kJhtJOXQz72pqOrS8t46?usp=sharing***

Peer Learning (*teacher should list out the opportunities provided to interact with peers,(through discussions & group work).*
Group discussion on Applications of SHM Presentations on Electromagnetics

Discussion Board (*teacher should set up problem-solving forums or discussion boards, and assign students or student teams to monitor and support or direct questions).*
Applications of LASERs and Shock waves

Mention the best practices identified as part of teaching this subject
1. Flipped classroom **2.** Reinforce important materials, concepts, and skills **3.** Preparation of evaluation contents: assignments, quizzes, viva etc.

Mention the Importance of this subject along with Real Time Applications
1. Physics forms the foundation of Engineering. Applications such as Optical fibers, Wireless communication, Nuclear Energy are a testimony to it. 2. In Quantum mechanics the concept of de-Broglie's wavelength is used in Electron microscopy 3. Lasers have industrial applications like cutting, welding, drilling and are used in storage devices like CDs, DVDs etc. 4. The concept of Quantum free electron theory from Materials Science is important in semiconductor research and device fabrication. 5. Elastic properties of materials play a major role in civil engineering designs and fabrication of machine parts etc.

Course Outcomes (COs)

By the end of this course, students will be able to :

1. Acquire Engineering knowledge on Quantum theory, material science, Maxwell's equations essential for applications in Laser, Semiconductor electronics, optical fiber communication.
2. Conduct analysis of engineering problems in the areas of oscillations, Elasticity, Semiconductors.
3. Develop solutions to complex problems on Quantum Mechanics, Electromagnetics, Oscillations and Shock waves.

Course Outcomes		Blooms Level	Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Acquire Engineering knowledge on Quantum theory, material science, Maxwell's equations essential for applications in Laser, Semiconductor electronics, optical fiber communication.	**L1**	**3,4,5**	3	1	1		-	-	-	-	-	-	-	-
CO2	Conduct analysis of engineering problems in the areas of oscillations, Elasticity, Semiconductors.	**L3**	**1,2,5**	2	2	2	1	-	-	-	-	-	-	-	-
CO3	Develop solutions to complex problems on Quantum Mechanics, Electromagnetics, Oscillations and Shock waves.	**L3**	**1,3,4**	2	2	1	1	-	-	-	-	-	-	-	1

Identified curriculum gap if any and Justification:

Identified Gap	Justification
1. More applications of LASERs 2. Applications of Modern Physics 3. Important role of optical fibers in Industry and Medicine	Constrained by the syllabus prescribed by VTU

Proposed Actions to fill the identified gaps:

1. Arranging guest lectures by experts
2. Flip class session
3. Article presentation by students
4. Student Seminar, MOOCs and Projects

Course Instructor Signature/s **CCI Signature** **HOD**