Academic Course Description

BHARATH UNIVERSITY

Faculty of Engineering & Technology

Department of Mechanical Engineering

FIRST Semester, 2015-16 (ODD Semester)

Course (catalog) description

This course is to understand the impact of Crystal Physics. Learn the Properties of Elasticity and Heat transfer. Acquire Knowledge on Quantum Physics. Understand the concepts of Acoustics & Ultrasonic's and its application understand the concepts on Laser & Fiber Optics and its application.

Compulsory/Elective course: Compulsory course

Credit & contact hours : 3 & 45

Course Coordinator : Dr.Srilatha

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Faculties of Physics Department	First year	First year Block		Hod.physics@bharathuniv.ac.in	9.00-9.50 AM

Relationship to other courses:

Pre –requisites **:** +2 level Physics

Assumed knowledge : The students will have a physics and mathematics background obtained at a high school (or equivalent) level.

Syllabus Contents

UNIT I: CRYSTAL PHYSICS: 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II: PROPERTIES OF MATTER AND THERMAL PHYSICS: 9

Elasticity-Hooke‟s law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson‟s ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young‟s modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton‟s law of cooling - Linear heat flow – Lee‟s disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III: QUANTUM PHYSICS: 9

Black body radiation – Planck‟s theory (derivation) – Deduction of Wien‟s displacement law and Rayleigh – Jeans‟ Law from Planck‟s theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger‟s wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV: ACOUSTICS AND ULTRASONICS: 9

Classification of Sound- decibel- Weber–Fechner law – Sabine‟s formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V: PHOTONICS AND FIBRE OPTICS: 9

Spontaneous and stimulated emission- Population inversion -Einstein‟s A and B coefficients - derivation. Types of lasers – Nd:YAG, CO_2 , Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TOTAL NO OF PERIODS: 45 HOURS

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House ,2014.
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009.

4. http://ocw.mit.edu/courses/find-by-topic
5.. http://nptel.ac.in/course.php?disciplineId=122
6.. https://en.wikipedia.org/wiki/Engineering_physics

Computer usage: Yes

Professional component

General	-	10%
Basic Sciences	-	80%
Engineering sciences & Technical arts	-	10%
Professional subject	-	0%

Broad area: photonics and fibre optics, Acoustics and ultrasonics and Properties of matter and thermal physics

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 3rd week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2nd week	Session 15 to 28	2 Periods
3	Model Test	October4th week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology. This course emphasizes:	Correlates to program outcome		
	H	M	L
To understand the impact of Crystal Physics.	O,j	g	
Learn the Properties of Elasticity and Heat transfer.	C,l	e,i	b,k
Acquire Knowledge on Quantum Physics.		C,f	a,g
Understand the concepts of Acoustics & Ultrasonic's and its application	a	C,l	j
Understand the concepts on Laser & Fibre Optics and its application.			b,c,k,l

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem Solving (Yes/No)	Text / Chapter
Unit -I : Crystal Physics			
1.	Introduction Lattice – Unit cell – Bravais lattice – Lattice planes	No	[T1] Chapter -1,
2.	Miller indices – d spacing in cubic lattice	Yes	
3.	Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC	Yes	
4.	Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for BCC	Yes	
5.	Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for FCC	Yes	
6.	Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for HCP	Yes	
7.	Crystal growth techniques –solution,	No	
8.	Crystal growth techniques – melt (Bridgman and Czochralski)	No	
9.	Crystal growth techniques vapour growth techniques (qualitative)	No	
Unit- II : Properties Of Matter And Thermal Physics			
10.	Introduction Elasticity-Hooke‟s law - Relationship between three modulii of elasticity	No	[T1] Chapter -2
11.	stress -strain diagram – Poisson‟s ratio	No	
12.	Factors affecting elasticity –Bending moment	No	
13.	Depression of a cantilever –Young‟s modulus by uniform bending ,I-shaped girders	Yes	
14.	Modes of heat transfer- thermal conductivity-	No	
15.	Newton‟s law of cooling	Yes	
16.	Linear heat flow – Lee‟s disc method	Yes	
17.	Radial heat flow – Rubber tube method	Yes	
18.	conduction through compound media (series and parallel)	No	
Unit -III Quantum Physics			

19.	Introduction -Black body radiation Compton effect	No	[T1]Chapter-3
20.	Planck‟s theory (derivation)	Yes	
21.	Deduction of Wien‟s displacement law and Rayleigh – Jeans‟ Law from Planck‟s theory	Yes	
22.	Theory and experimental verification– G.P Thomson experiment	No	
23.	Schrödinger‟s wave equation – Time independent equations	Yes	
24.	Schrödinger‟s wave equation –time dependent equations	Yes	
25.	Physical significance of wave function – Particle in a one dimensional box	Yes	
26.	- Electron microscope - Scanning electron microscope	No	
27.	Transmission electron microscope	No	
Unit –IV- Acoustics And Ultrasonics			
28.	Introduction Classification of Sound- decibel- Weber–Fechner law	No	[T1]Chapter-5,6
29.	Sabine‟s formula-	Yes	
30.	derivation using growth and decay method	Yes	
31.	Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies.	No	
32.	Production of ultrasonics by magnetostriction	No	
33.	Production of ultrasonics by piezoelectric methods	No	
34.	acoustic grating -Non Destructive Testing	No	
35.	pulse echo system through transmission and reflection modes - A,B and C – scan displays	No	
36.	Medical applications – Sonogram.	No	
Unit-V Photonics And Fibre Optics			
37.	Introduction-Spontaneous and stimulated emission-Population inversion	No	[T1] Chapter 7,8
38.	-Einstein‟s A and B coefficients - derivation.	Yes	
39.	Types of lasers – Nd:YAG, CO2	No	
40.	Semiconductor lasers (homojunction & heterojunction	No	
41.	Industrial and Medical Applications	No	

42.	Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle	Yes	
43.	Types of optical fibres (material, refractive index, mode) attenuation, dispersion, bending	No	
44.	Fibre Optical Communication system (Block diagram)	No	
45.	Active and passive fibre sensors- Endoscope	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and brainstorming skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Attendance	-	5%
Seminar / Assignments / online tests / Quiz	-	5%
Final exam	-	70%

Addendum

ABET Outcomes expected of graduates of B.Tech / MECH / program by the time that they graduate:

a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) The ability to identify, formulate and solve engineering problems.

c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) The ability to design and conduct experiments, as well as to analyze and interpret data

e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

f) The ability to apply reasoning informed by the knowledge of contemporary issues.

g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

h) The ability to understand professional and ethical responsibility and apply them in engineering practices.

i) The ability to function on multidisciplinary teams.

j) The ability to communicate effectively with the engineering community and with society at large.

k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) The ability to recognize the need for, and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION:

Mechanical Engineering graduatesare enthusiastic to provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Mechanical Engineering.

PEO2: CORE COMPETENCE:

Mechanical Engineering graduates have competence to enhance the skills and experience in defining problems in the field of Mechanical Engineering and Technology design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:

Mechanical Engineering graduates made competence to enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: PROFICIENCY:

Mechanical Engineering graduates became skilled to afford training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:

Mechanical Engineering graduates are morally merged to apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

Course Teacher	Signature
Dr.R.Velavan	

Course Coordinator **HOD/MECH**

Dr.Srilatha