Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Mechanical Engineering

BPH201 - ENGINEERING PHYSICS II

Second Semester, 2015-16 (Even Semester)

Course (catalog) description

To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

Compulsory/Elective course **:** Compulsory for I year B.Tech students

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
Dr Velavan	Ist Year	First Year Block			9.00 - 9.50 AM
Dr. Sreelatha	Ist Year	First Year Block			12.45 - 1.15 PM
Mrs. Radhika	Ist Year	First Year Block			9.00 - 9.50 AM
Ms. Myvizhi	Ist Year	First Year Block			12.45 - 1.15 PM
Ms. Sheeba	Ist Year	First Year Block			9.00 - 9.50 AM
Ms. Suganya	Ist Year	First Year Block			12.45 - 1.15 PM
Dr. Selvi	Ist Year	First Year Block			9.00 - 9.50 AM
Dr. Sugumar	Ist Year	First Year Block			12.45 - 1.15 PM
Mrs. Antony Lyla	Ist Year	First Year Block			9.00 - 9.50 AM
Mr. Seevagan	Ist Year	First Year Block			12.45 - 1.15 PM

Relationship to other courses:

Pre –requisites : ENGINEERING PHYSICS I

Assumed knowledge : Basic knowledge in Engineering Materials

Following courses : Fluid Mechanics

Syllabus Contents

UNIT I CONDUCTING MATERIALS **9 HOURS**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS **9 HOURS**

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration –– Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS **9 HOURS**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS **9 HOURS**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS **9 HOURS**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials – Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

Total : 45 HOURS

Text book(s) and/or required materials

T1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.

T2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.

T3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

Reference Books:

R1. Arumugam M., Materials Science. Anuradha publishers, 2010

R2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

R3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

R4. http://ocw.mit.edu/courses/find-by-topic

R5. http://nptel.ac.in/course.php?disciplineId=122

R6. https://en.wikipedia.org/wiki/Engineering_physics

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	100%
Professional subject	-	0%

Broad area: Conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties

Test Schedule

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

Mapping of Instructional Objectives with Program Outcome

This course is to develop a strong foundation in analysis and design of digital electronics. This course introduces combinational and sequential circuit design. It also discussed concepts of memory, programmable logic and digital integrated circuits.	Correlates to program outcome		
	H	**M**	**L**
1. Recall the different number systems and demonstrate the simplification of Boolean expressions using Boolean algebra & K-Map method.	a		
2. Analyze the Combinational building blocks	c	e	b
3. Analyze the sequential building blocks	d	b	
4. Develop a state diagram and simplify the given sequential logic.	a	c	d
5. To illustrate the concept of synchronous sequential circuits			b,c
6. To illustrate the concept of asynchronous sequential circuits	a		

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

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I	**CONDUCTING MATERIALS**		
1.	Conductors – classical free electron theory of metals	Yes	[T1] [R3]
2.	Electrical and thermal conductivity	Yes	
3.	Wiedemann – Franz law – Lorentz number	Yes	
4.	Draw backs of classical theory	Yes	
5.	Quantum theory	Yes	
6.	Fermi distribution function	Yes	
7.	Effect of temperature on Fermi Function	Yes	
8.	Density of energy states	Yes	
9.	Carrier concentration in metals	No	
UNIT II	**SEMICONDUCTING MATERIALS**		
10.	Intrinsic semiconductor	No	[T1] [R1]
11.	Carrier concentration derivation Fermi level – Variation of Fermi level with temperature	Yes	
12.	Electrical conductivity – band gap determination	Yes	
13.	Compound semiconductors	No	
14.	Direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor	No	
15.	Variation of Fermi level with temperature and impurity concentration	Yes	
16.	Hall effect	Yes	
17.	Determination of Hall coefficient	Yes	
18.	Applications.	No	
UNIT III	**MAGNETIC AND SUPERCONDUCTING MATERIALS**		
19.	Origin of magnetic moment – Bohr magneton	Yes	[T1] [R1]
20.	Comparison of Dia, Para and Ferro magnetism	No	
21.	Domain theory	Yes	
22.	Hysteresis – soft and hard magnetic materials	Yes	
23.	Antiferromagnetic materials	Yes	
24.	Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors	No	
25.	BCS theory of superconductivity(Qualitative)	Yes	
26.	High Tc superconductors	Yes	
27.	Applications of superconductors	No	
28.	SQUID, cryotron, magnetic levitation.	Yes	
UNIT IV	**IVDIELECTRIC MATERIALS**		
29.	Electrical susceptibility	No	
30.	Dielectric constant – electronic, ionic, orientational and space charge polarization	No	

31.	Frequency and temperature dependence of polarisation	No	[T1] [R1]
32.	Internal field	No	
33.	Claussius – Mosotti relation (derivation)	No	
34.	Claussius – Mosotti relation (derivation)	No	
35.	Dielectric loss	Yes	
36.	Dielectric breakdown	No	
37.	Uses of dielectric materials (capacitor and transformer)	No	
38.	Ferroelectricity and applications	Yes	
UNIT V	**ADVANCED ENGINEERING MATERIALS**		
39.	Metallic glasses: preparation, properties and applications	Yes	[T1] [R1]
40.	Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application	Yes	
41.	Nanomaterials– Preparation -pulsed laser deposition	No	
42.	Chemical vapour deposition – Applications	No	
43.	NLO materials	No	
44.	Birefringence- optical Kerr effect	Yes	
45.	Classification of Biomaterials and its applications	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 debugging 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%
Assignment / Seminar / Online Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Dr P. Sugumar Assistant Professor , Department of Physics

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 Velavan Dr. Sreelatha	
Mrs. Radhika Ms. Myvizhi	
Ms. Sheeba	
Ms. Suganya	
Dr. Selvi	
Dr. Sugumar	
Mrs. Antony Lyla	
Mr. Seevagan	

Course Coordinator **HOD/MECH**

Dr .Srilatha