Academic Course Description

BHARATH UNIVERSITY

Faculty of Engineering and Technology

Department of Electronics and Communication Engineering

BPH201 - ENGINEERING PHYSICS II

Second Semester, 2016-17 (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. Sree Latha

Instructors **:**

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Dr. Sree Latha	Ist Year building	-	-		12.45-1.15 pm

Relationship to other courses:

Pre –requisites **:** ENGINEERING PHYSICS I

Assumed knowledge : Basic knowledge in Engineering Materials

Following courses : -

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	-	100%
Engineering sciences & Technical arts	-	0%
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		Session 1 to 14	2 Periods
2	Cycle Test-2		Session 15 to 28	2 Periods

3	Model Test		Session 1 to 45	3 Hrs
4	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	[T1] [R1]
30.	Dielectric constant – electronic, ionic, orientational and space charge polarization	No	
31.	Frequency and temperature dependence of polarisation	No	
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%
Assignments/Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Dr Sree Latha, Professor , Department of Physics **Dated** :

Addendum

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

a) An ability to apply knowledge of mathematics, science, and engineering
b) An ability to design and conduct experiments, as well as to analyze and interpret data
c) An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d) An ability to function on multidisciplinary teams
e) An ability to identify, formulate, and solve engineering problems
f) An understanding of professional and ethical responsibility
g) An ability to communicate effectively
h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i) A recognition of the need for, and an ability to engage in life-long learning
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION
Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE
Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL
Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS
Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	Signature
Dr Sree Latha	

Course Coordinator **HOD/ECE**