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 :

<table>
<thead>
<tr>
<th>Name of the instructor</th>
<th>Class handling</th>
<th>Office location</th>
<th>Office phone</th>
<th>Email (domain:@bharathuniv.ac.in)</th>
<th>Consultation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Sree Latha</td>
<td>1st Year building</td>
<td>-</td>
<td>-</td>
<td>@bharathuniv.ac.in</td>
<td>12.45-1.15 pm</td>
</tr>
</tbody>
</table>

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


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


UNIT IV  DIELECTRIC MATERIALS  
9 HOURS


UNIT V  ADVANCED ENGINEERING MATERIALS  
9 HOURS


Total : 45 HOURS

Text book(s) and/or required materials


Reference Books:


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

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Test</th>
<th>Tentative Date</th>
<th>Portions</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cycle Test-1</td>
<td></td>
<td>Session 1 to 14</td>
<td>2 Periods</td>
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<tr>
<td>2</td>
<td>Cycle Test-2</td>
<td></td>
<td>Session 15 to 28</td>
<td>2 Periods</td>
</tr>
<tr>
<td>S.NO</td>
<td>Topics</td>
<td>Problem solving (Yes/No)</td>
<td>Text / Chapter</td>
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<tr>
<td>UNIT I</td>
<td>CONDUCTING MATERIALS</td>
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<tr>
<td>1.</td>
<td>Conductors – classical free electron theory of metals</td>
<td>Yes</td>
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<tr>
<td>2.</td>
<td>Electrical and thermal conductivity</td>
<td>Yes</td>
<td></td>
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<td>3.</td>
<td>Wiedemann – Franz law – Lorentz number</td>
<td>Yes</td>
<td></td>
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<tr>
<td>4.</td>
<td>Draw backs of classical theory</td>
<td>Yes</td>
<td></td>
<td></td>
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<tr>
<td>5.</td>
<td>Quantum theory</td>
<td>Yes</td>
<td>[T1] [R3]</td>
<td></td>
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<tr>
<td>6.</td>
<td>Fermi distribution function</td>
<td>Yes</td>
<td></td>
<td></td>
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<tr>
<td>7.</td>
<td>Effect of temperature on Fermi Function</td>
<td>Yes</td>
<td></td>
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<tr>
<td>8.</td>
<td>Density of energy states</td>
<td>Yes</td>
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</tbody>
</table>
9. Carrier concentration in metals | No |

**UNIT II  SEMICONDUCTING MATERIALS**

10. Intrinsic semiconductor | No |
11. Carrier concentration derivation Fermi level – Variation of Fermi level with temperature | Yes [T1] [R1] |
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 |
20. Comparison of Dia, Para and Ferro magnetism | No [T1] [R1] |
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  IVDELECTRIC 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. Clausius – Mosotti relation (derivation) | No |
34. Clausius – 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 |
40. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application | Yes [T1] [R1] |
41. Nanomaterials– Preparation -pulsed laser deposition | No |
42. Chemical vapour deposition – Applications | No |
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<tbody>
<tr>
<td>43.</td>
<td>NLO materials</td>
<td>No</td>
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<td>44.</td>
<td>Birefringence- optical Kerr effect</td>
<td>Yes</td>
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<td>45.</td>
<td>Classification of Biomaterials and its applications</td>
<td>No</td>
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**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**

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<tbody>
<tr>
<td>Cycle Test – I</td>
<td>-</td>
<td>5%</td>
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<tr>
<td>Cycle Test – II</td>
<td>-</td>
<td>5%</td>
</tr>
<tr>
<td>Model Test</td>
<td>-</td>
<td>10%</td>
</tr>
<tr>
<td>Assignments/Seminar/online test/quiz</td>
<td>-</td>
<td>5%</td>
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<tr>
<td>Attendance</td>
<td>-</td>
<td>5%</td>
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<tr>
<td>Final exam</td>
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<td>70%</td>
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**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.
<table>
<thead>
<tr>
<th>Course Teacher</th>
<th>Signature</th>
</tr>
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<tbody>
<tr>
<td>Dr Sree Latha</td>
<td></td>
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</tbody>
</table>

Course Coordinator  
HOD/ECE