FIRST YEAR B.TECH.
Course Title : APPLIED PHYSICS , Course No : AP-111
Course Category : Basic Sciences ( Theory ), Credits : 4
( Common to all branches of the B. Tech. Degree )
( Examination Time : 3 Hours )
( 3L+ 1T ) / Week : (Total 52 Periods Course )

UNIT I: (13 PERIODS)
**Semiconductors:** Elemental and compound semiconductors (S,1.1), Energy bands (S,3.1.2) Direct and indirect semiconductors (S, 3.1.4), Electrons and holes (S, 3.2.1), Effective mass (S, 3.2.2), Intrinsic material (S, 3.2.3), Extrinsic material (S, 3.2.4), Fermi level (S,3.3.1), Electron and hole concentration at equilibrium (S,3.3.2) Temperature dependence of carrier concentrations (S, 3.3.3), Compensation and space charge neutrality (S, 3.3.4), Conductivity and mobility (S, 3.4.1), Hall effect in semiconductors (S,3.4.5)

**Superconductivity:** Zero resistivity, Meissner effect, Type I and Type II Superconductors, High Temperature Superconductors (B,10.9), BCS theory (qualitative) (B,10.10), Josephson effect (W,9.19), SQUIDS (W,9.20 & B.10.10/ 24 to 26)

UNIT II: (13 PERIODS)
**Masers and Lasers:** Basic principle, Einstein coefficients for Induced absorption, Spontaneous Emission and induced emission, Ammonia maser and its applications(W,4.12), Ruby and He-Ne Lasers(B,4.9), Semiconductor laser(W,9.15), Spatial and temporal coherence (W4.12), Characteristics of lasers and its applications based on these characteristics (W4.13/4.42 to 4.45) (such as in Industry, Science, Medicine, Communications, Surveying, Holography, Fusion reactors, Isotope separation, etc.)

**Fibre Optics:** Basic principle (S, 7.2), Fibre construction (S, 7.2.2) and dimensions (S, 7.2.3), Light Propagation in fibres (S,7.2.4/1), Numerical aperture of the fibre (S, 7.2.4), Step index and graded index fibres (S,7.2.4), Signal distortion in optical fibres (S, 7.2.5), Transmission losses (S, 7.2.6), Light wave communication in optical fibres (S, 7.3), Fibre Optics in medicine and industry (S, 7.4).

UNIT III: (13 PERIODS)
**Particles and Waves:** Mechanism of X- ray production (continuous and characteristic X- rays, Duane- Hunt limit) (B, 2.5/20,21), Compton effect (B, 2.7/25 to 38 ), Pair production (B, 2.8/39 to 50), Phase and group velocities (B,3.4/ 13 to 22), Uncertainty principle (B, 3.7/30-40)

**Quantum Mechanics:** Introduction to quantum mechanics, Wave function, Conditions necessary for physically acceptable wavefunction, Probability density and probability (B, 5.1/ 1 to 5), Schrödinger equation (Time dependent form and steady state or time independent form), Eigen values and eigen functions (B 5.3 and 5.7/11), Expectation values (B, 5.5), Particle in a box (Infinite potential well) (B, 5.8/12 to 23), Tunnel effect (B, 5.10 / 37 & 38).

UNIT IV: (13 PERIODS)
**Statistical Mechanics:** Statistical distributions (B, 9.1), Maxwell–Boltzmann statistics (B, 9.2/1&6 ), Molecular energies in an ideal gas (B, 9.3/7 to 14 ), Quantum statistics (B, 9.4/15 &16 ), Specific heats of solids (B, 9.8), Free electron in a metal (B, 9.9), Electron- energy distribution (B, 9.10/36 to 51)

**Nuclear Physics:** Q value and threshold energy of nuclear reactions (W, 11.8), Cross section of a nuclear reaction and reaction rate (B, 12.7/35 to 42), Breeder reactors (B, 12.10/57 to 59 and W, 12.12), Fusion reactors (B, 12.12/63 & 64), Nuclear detectors (names and general working principle), Gas filled detectors (W, 10.7), Scintillation detectors (W, 10.6)

**TEXT BOOKS:**
Limited, Publishers
FIRST YEAR B.TECH.
Course Title: APPLIED PHYSICS, Course No: APS111/AP111
Course Category: Basic Sciences (Theory), Credits: 4
(Common to all branches of B. Tech.)
(3L+ 1T) / Week

Course Outcomes:

Upon completion of the course, the student will be able to:
CO1- recognize and present real life examples of the aforementioned concept and interrelate some of them.
CO2- describe the link between physics and the technology.
CO3 - identify technological applications of some of the aforementioned concepts.
CO4 - describe how he/she can harness the benefits of some of the aforementioned concepts to his /her area of specialization.

UNIT-I:
Semiconductors: Elemental and compound semiconductors (S,1.1), Energy bands (S,3.1.2) Direct and indirect semiconductors (S, 3.1.4), Electrons and holes (S, 3.2.1), Effective mass (S, 3.2.2), Intrinsic materials (S, 3.2.3), Extrinsic materials (S, 3.2.4), Fermi level (S,3.3.1), Electron and hole concentration at equilibrium (S,3.3.2), Temperature dependence of carrier concentrations (S, 3.3.3.), Compensation and space charge neutrality (S, 3.3.4), Conductivity and mobility (S, 3.4.1), Hall effect in semiconductors (S,3.4.5)

UNIT-II:
Lasers & its Applications: Basic principle, Induced absorption, Spontaneous and induced emissions, Ruby and He-Ne lasers (B, 4.9), Semiconductor laser (W, 9.15), Characteristics of laser light and its applications based on these characteristics (W, 4.13/4.42to4.45) (e.g., in industry, science, medicine, communications, surveying, holography, fusion reactors, isotope separation, etc.)
Fibre Optics: Basic principle (S,7.2), Fibre construction (S,7.2.2) and dimensions (S,7.2.3), Light propagation in fibres (S,7.2.4/1), Numerical aperture of fibres ( S, 7.2.4), Step index and graded index fibres (S,7.2.4), Signal distortion in optical fibres (S, 7.2.5), Transmission losses (S, 7.2.6), Light wave communication in optical fibres (S,7.3). Advantages of optical fibres over conventional system of communication.

UNIT-III:
Particles and Waves: Mechanism of x- ray production (continuous and characteristic x- rays, Duane-Hunt limit) (B, 2.5/20, 21), Compton effect (B, 2.7/25 to 38), Pair production (B, 2.8/39 to 50), Phase and group velocities (B, 3.4/ 13 to 22), Uncertainty principle ( B, 3.7/30-40)
Quantum Mechanics: Introduction to quantum mechanics, Wave function, Conditions necessary for physically acceptable wave function, Probability density and probability (B,5.1/1to5), Schrödinger equation (time dependent and steady state or time independent forms), Eigen values and Eigen functions (B,5.3 and 5.7/11), Expectation values (B,5.5), Particle in a box (infinite potential well) (B,5.8/12 to 23), Tunnel effect (qualitative discussion only) (B,5.10/37& 38).

UNIT-IV:
Statistical Mechanics: Statistical distributions (B, 9.1), Maxwell–Boltzmann statistics (B, 9.2/1&6), Molecular energies in an ideal gas (B, 9.3/7 to 14), Quantum statistics (B, 9.4/15 &16), Specific heats of solids (B, 9.8), Free electron in a metal (B, 9.9) and Electron- energy distribution (B, 9.10/36 to 51)

B.O.S. Date: 31-12-2016
TEXT BOOKS:


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DEPARTMENT OF APPLIED PHYSICS, Z. H. COLLEGE OF ENGG. & TECH.
A.M.U. ALIGARH

Minutes of an ordinary meeting of the Board of Studies of the Department of Applied Physics,
Z.H. College of Engg. & Tech., A.M.U., Aligarh held on 31.12.2016 at 3:00 p.m. in the Staff Room
of the Department.

Following members were present:

1. Prof. Shakeel Khan
2. Dr. M. Mohisin Khan
3. Dr. Pushpendra Tripathi
4. Dr. Azra Parveen
5. Dr. Zafarul Hasan
6. Dr. S. Asad Ali
7. Prof. Ameer Azam (In the Chair)

Before taking up the agenda, Chairperson welcomed the members of BOS present in the meeting.

Following decisions were taken:

1. Confirmed the minutes of the last BOS held on 27.10.2016.
2. Recommended the teaching load of B.Tech. and Ph.D. Course work for the Winter Semester
   2016-17. (Appendix-I)
3. In view of Office Memo D. No.621/Gen dated 20.12.2016, the teaching load and
   Supervisors of Project Dissertation of M.Tech. (Nanotechnology), Advanced P.G. Diploma
   in Nanotechnology students was not considered. (Appendix-II)
4. Recommended the changes in the syllabus of Course No. AP-111 (Applied Physics) for
   B.Tech. I Year (All branches). (Appendix-III)
5. Considered the request of Mr. Tahir Hussain for change of topic of his Ph.D. thesis. In view
   of the explanation submitted by Mr. Tahir Hussain and his Supervisor, Dr. M. Mohisin
   Khan, the BOS recommended that the change of topic of Ph.D. thesis of Mr. Tahir Hussain
   be consider as a minor change.

Any other item(s):

(i) Recommended the changes in the syllabus of Course No. EAP-111 (Applied Physics) for
   B.E (Evening) I Year (All branches). (Appendix-IV)
(ii) Office Memo D. No.621/Gen dated 20.12.2016 from the Joint Registrar (General) was
    discussed and the BOS unanimously resolved that the Hon’ble Vice-Chancellor may kindly
    be requested to review the Office Memo in the larger interest of teaching and research work
    of the Department of Applied Physics.
(iii) Recommended the change in the Ph.D. topic of Mr. Ateeq Ahmed (Faculty No. 13-PHD
    APD-11 and En. No. GC-2405) as follows:

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<thead>
<tr>
<th>Old Topic</th>
<th>New Topic</th>
<th>Remark</th>
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<tbody>
<tr>
<td>Studies on Emerging Metal Oxide</td>
<td>Studies on Pure and Doped Tin Oxide</td>
<td>Major</td>
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<tr>
<td>Nanomaterials</td>
<td>Nanomaterials and their Applications</td>
<td>Change</td>
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