Department of Physics and Materials Science

Dated: 30-09-2016

The meeting of the Board of Studies of the Department of Physics and Materials Science was held at 11:00 hrs on 30th September 2016 in Board Room JUIT.

The following members of the BOS, Physics and Materials Science were present in the meeting:

Prof. P.B. Barman (Chairman)
Prof. Sunil K. Khah
Dr. Vineet Sharma
Dr. Pankaj Sharma
Dr. Dheeraj Sharma
Dr. Rajesh Kumar (on sabbatical leave)
Dr. Surajit Kumar Hazra
Dr. Ragini R. Singh
Dr. Sanjiv Kumar Tiwari (Laboratory duty)

Member from Other Department of JUIT
Prof. Karanjeet Singh HOD, Mathematics

The following members were not present in the meeting:

Prof. R. S. Chauhan Dean, BI & BT
Prof. Sunil Bhoosan HOD, ECE
Prof. S.P. Ghrera HOD, CSE & IT
Prof. Ashok K.Gupta HOD, Civil

Members from Sister Institutes
Prof. D.K. Rai HOD, Physics, JIIT, Sec.62, Noida

Member from Other Institutes

Prof. Anil Vohra Dean, Academic Affairs,
Kurukshetra University, Kurukshetra, Haryana
(Professor, Dept. of Electronic Science,
Kurukshetra University, Kurukshetra, Haryana)

Minutes of the Board of Studies Meeting of the Department of Physics and Materials Science on 30th September 2016

Agenda I : Proposal to discuss the suitability of revision in different courses

1. Physics-I	B.Tech 1st semester (CSE, ECE,IT,CE)
2. Physics-II	B.Tech 2nd semester (CSE, ECE,IT)
3. Materials Science	B.Tech 6th semester (CSE, ECE,IT)

The members agreed to the suggestions for modifications in the syllabi of above mentioned courses to make them more relevant with the B.Tech programmes and to synchronize them with the laboratory courses, particularly for the first two courses.

The suggestions made in the meeting are as given under:

1. For revision of Physics-I course, it has been proposed to remove the contents related to statistical physics and radiation physics and include the contents related to the introduction to thermodynamics and Quantum Physics [to be shifted from Physics-II to Physics-I] (APPENDIX-I)
2. For revision of Physics-II course, it has been proposed to delete the contents related to thermodynamics and Quantum Physics and include Statistical Physics & Applications and Optical Fibre Communication. (APPENDIX-II)
3. For Materials Science, the members have proposed to delete the contents related to display devices & fluorescent materials and optical fibres. It has been proposed to include the topics based on New Engineering Materials and Introduction to Nanomaterials in the Materials Science course. (APPENDIX-III)

Agenda II: Proposal to introduce a new course 'Basic Engineering and Applied Physics' to B. Tech (Biotech/Bioinformatics), 1st Semester, **Credits: 4 (3 1 0)** in place of Physics-I.

The members agreed to the introduction course but unanimously suggested to rationalize and optimize the course which will suit the need of Biotechnology/Bioinformatics. It was suggested that the following topics in the course need to be deleted. The revised course is attached (APPENDIX-IV)

The contents suggested to be deleted are

1. **Removed Part : 5. Introduction to Lasers and Optical fibre:** Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients – derivation, Types of lasers – Nd:YAG, CO_2, Semiconductor lasers, Industrial and Medical Applications of lasers. **3 L**

   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. 3

Reason: The atomic physics is not included in this syllabus, the knowledge of which is fundamentally required for studying LASERs and secondly the optical fibers are of end term aids in the field of biotechnology and basics of optical fibres are not required.

2. **Removed Part : 6. Cryogenics:** Cryogenics: Methods of liquefaction of gases (cascade process, Linde's process, and adiabatic demagnetization process) – Measurement of cryogenic temperatures. **3 L**

Reason: The use of cryogenics in the field of biotechnology is such that the biotechnologist use cryosystems just in order to perform various experiments at low temperature and hence there is no requirement of studying and understanding the concepts of cryo-engineering .

3. **Removed Part :** Mass spectrometry basics: Concept of mass spectrometric analysis, Ionization, Elements of a spectrum, Isotopes. **2 L**

Reason: The topic is already included in II year syllabus of Biophysical Techniques taught to them in IV semester, also the information delivered superficially in advance will not aid the advantages in future course.

Prof. P.B. Barman (Chairman) 30/9/16

Prof. Karanjeet Singh HOD, Mathematics

Prof. Sunil K. Khah 30/9/2016

Dr. Vineet Sharma 30/09/2016.

Dr. Pankaj Sharma 30/09/2016

Dr. Dheeraj Sharma 30/9/2016

Dr. Surajit Kumar Hazra 30.09.2016

Dr. Ragini R. Singh 30.9.16

APPENDIX-I

PHYSICS – I

PHYSICS – I (10B11PH111)

Objective

Broadly, the study of Physics-I course will improve the ability of students to think logically about the problems of science and technology and obtain their solutions. The present course is aimed to offer a broad aspect of those areas of Physics which are specifically required as an essential background to all engineering students for their studies in higher semesters.

Learning outcomes

At the end of the course, the students will have sufficient scientific understanding of different phenomena associated with optics, relativity, radiation physics, statistical physics and thermodynamics, atomic physics.

Detailed Syllabus:

Optics: **[18 lectures]**

Interference: Introduction, Young's double slit experiment, Phase difference and Path Difference, Coherence, Analytical treatment of interference, Methods of interference (division of wave front & division of amplitude) Applications of interference in the field of engineering, Scientific applications of interference.

Diffraction: Introduction, Difference between interference and diffraction, Fresnel and Fraunhoffer class of diffraction, Diffraction grating, Applications of diffraction grating, Resolving and dispersive power of an optical instrument.

Polarization: Introduction, Difference between unpolarized and polarized light, Means of production of polarized light, Optical activity, specific rotation, Lorentz half shade and biquartz polarimeter.

Modern Physics: **[10 lectures]**

Atomic Physics: Introduction, Quantum numbers, spin and orbital angular momentum, Atoms in magnetic field, Zeeman effect, Atoms in electric field, Stark effect.

Quantum Physics: wave particle duality, uncertainty principle and its applications, wave function, Schrodinger equation and its solutions, Particle in a box, Harmonic Oscillator

Thermal Physics: **[8 lectures]**

Introduction, Zeroth law of Thermodynamics. First law of thermodynamics, Specific heat relation, Work done during an isothermal and adiabatic process. Second law of thermodynamics, concept of entropy, entropy for an ideal gas, Third law of thermodynamics, Principle of increase of entropy or degradation of energy, Reversible and irreversible processes. Carnot cycle and Carnot engine, Refrigerator, Clausius-Cleyperon equation, Thermodynamic Potentials, Maxwell's equations.

Lasers: **[02 Lectures]**

Principle and working of laser, Different types of lasers (Three level and four level lasers)

Relativistic Mechanics: **[04 Lectures]**

Inertial & non-inertial frames, Michelson- Morley experiment, Einsteins postulates. Lorentz transformation, equations. Length contraction & Time dilation, Addition of velocities; Variation of mass with velocity Mass energy equivalence.

Methodology:

Students will be encouraged for inductive learning during this course. The course will be covered through lectures supported by tutorials. In tutorials, apart from the discussion on the topics covered in lectures, assignments will also be given. Students will be required to be regular in the course and complete the assignments, if needed difficulties will be discussed in the tutorials. There will be at least two class tests/surprise tests conducted during the whole semester.

Text Books:

1. Subrahmanayam and Brij Lal, *A Text Book of Optics*, S. Chand and Co.
2. Brij Lal,N. Subrahmanyam,P.S. Hemne, Heat Thermodynamics and Statistical Physics, S. Chand and Co.
3. A. Beiser, *Concepts of Modern Physics*, Mc Graw Hill International.
4. Engineering Physics, B.K. Pandey, S. Chaturvedi, Cengage publisher
5. Engineering Physics, H.K. Malik and A.K. Singh, Mc Graw Hill International.

Reference Books

1. J.B. Rajam, Atomic Physics, S. Chand and Co.
2. A. Ghatak, *Optics*, Tata McGraw Hill.
3. Zemansky, Thermodyanamics, McGraw-Hill

APPENDIX-II

Physics-II (10B11PH211)

Objective

Broadly, the study of Physics-II course will improve the ability of students to think logically about the problems of science and technology and obtain their solutions. The present course is aimed to offer a broad aspect of those areas of Physics which are specifically required as an essential background to all engineering students for their studies in higher semesters.

Learning outcomes

At the end of the course, the students will have sufficient scientific understanding of different phenomena associated with electrodynamics, statistical physics, solid state physics and optical fibre Communication.

Solid State Physics:

Basic ideas of bonding, ionic bonding, covalent bonding (hybridization), metallic bonding, dispersion bonds, dipole bonds, hydrogen bonds,

Lattice points and space lattice, basis and crystal structure, unit cell and primitive cell, seven crystal systems and fourteen Bravais space lattice, coordination number, nearest neighbour distance, atomic radius, atomic packing factor in crystal structure, calculation of lattice constant, lattice planes and Miller indices, separation between lattice planes.

X-ray diffraction, Bragg's law of X-ray diffraction, Bragg's x-ray spectrometer, powder crystal method, rotating crystal method.

Electronic conduction in metals, classical free electron theory, quantum theory of free electrons, band theory of solids, distinction between metals, semiconductors and insulators, intrinsic and extrinsic semiconductors, carrier concentration in thermal equilibrium in intrinsic semiconductor, Fermi level and energy band diagram in intrinsic semiconductor, energy band diagram and Fermi level in extrinsic semiconductors, effect of temperature on extrinsic semiconductor, electrical conductivity of intrinsic semiconductor and extrinsic semiconductor, Hall effect, allied parameters and its applications.

(16 Lectures)

Electromagnetism:

Basic knowledge of fields, gradient, divergence and curl, Coulomb's law and related numerical, electric flux, Gauss's law for the charge inside and outside the Gaussian surface, applications of Gauss law: spherical and cylindrical symmetries, electric field due to charged conductor, force per unit area on the surface of the charged conductor, treatment of electrostatic problems by solution of Laplace and Poisson's equations.

Biot Savart law, Ampere's law, Maxwell's equations in free space and dielectric media, energy in electromagnetic waves (Poynting vector and Poynting theorem), plane electromagnetic waves

in free space, transverse nature, wave impedance and energy flow, energy density and energy flux (Poynting vector) in an electromagnetic field, radiation pressure. **(12 Lectures)**

Statistical Physics & Applications:

Introduction, macrostates, microstates, thermodynamic probability, distribution of n-particles in k-cells, phase space, minimum volume, classical and quantum statistics: common approach to three statistics, Maxwell-Boltzmann (ideal gas), Bose-Einstein (photon gas), Fermi-Dirac distributions (electron gas), Compton effect.

(10 Lectures)

Optical Fibers Communication: Light propagation in fibers, Step index and Graded Index fibers, Numerical Aperture and Attenuation, Single and Multimode fibers and their propagation characteristics, Fiber losses and optical fiber applications. **(4 Lectures)**

Methodology: The course will be covered through lectures supported by tutorials. In tutorials, apart from the discussion on the topics covered in lectures, assignments in the form of questions will be given.

Text Books:

1. Introduction to Solid State Physics, C. Kittel, Wiley International.
2. M. A. Wahab, *Solid State Physics*, Narosa Publishers.
3. D. J. Griffiths, *Introduction to electrodynamics*, Prentice Hall of India Ltd.
4. D.J. Cheng, Field and Wave Electromagnetics, Addison-Wesley Publishing Company.
5. Engineering Physics, B.K. Pandey, S. Chaturvedi, Cengage publisher
6. Statistical Physics and Thermodynamics, BrijLal and Subramayam, S Chand Publishers.
7. Optical Fibre Communication by Keiser, McGraw Hill Publishers.

Reference Books:

1. Solid State Physics, Ashcroft, Cengage Publishers.
2. Electrodynamics, J.D. Jackson, Wiley International.
3. Introduction to Statistical Physics, Kerson Huang, Taylor and Francis.
4. Introduction to Modern Physics, Arthur Beiser, TMH.

APPENDIX-III

Materials Science (10B11PH611)

Title: Materials Science

Course Code: 10B11PH611 (3 1 0)

Objective

Information Technology is collectively the technology associated with communication, processing and storing of information. Materials are the building blocks for these technologies. Therefore, search for new materials and study of their properties, useful for information technology field, has become an area of current interest to the scientists and technologists. The present course aims at giving the students a basic knowledge necessary for understanding of electric, magnetic and optical properties of materials used in Information Technology.

Learning outcome:

The course will make the basic understanding of properties of different Information Technology materials and hence build up a suitable foundation for the understanding of design and working of communication, processing and storage devices fabricated with these materials.

Course outline:

Dielectric Materials: Polarization mechanism & Dielectric Constant, Behavior of polarization under impulse and frequency switching, Dielectric loss, Spontaneous polarization, Piezoelectric effect; Applications of Dielectric Materials. **(10 Lectures)**

Magnetic Materials: Concept of magnetism, Classification, dia-, para-, ferro-, antiferro- and ferri-magnetic materials, Their properties and Applications; Hysteresis; Applications. **(10 Lectures)**

Superconducting Materials: Meissner effect, Critical field, type-I and type-II superconductors; Field penetration and London equation; High temperature Superconductors and their Applications. **(5 Lectures)**

New Engineering Materials: Metallic Glasses, Shape Memory Alloys, Memory Effect, Nano-materials- singificance of nanoscale, 0-Dimensional, 1- Dimensional, 2- Dimensional, 3-Dimensional nanostructures, Applications. **(10 Lectures)**

Other materials: Optical materials, semiconducting materials, Polymers (Conjugated and Doped Semiconductors) and Ceramics (Oxide and Sulphide Semiconductors): Introduction, classification, characteristics and applications. **(7 Lectures)**

Methodology: The course will be covered through lectures supported by tutorials. In tutorials, apart from the discussion on the topics covered in lectures, assignments in the form of questions will be given.

Text Books:

1. S.O. Pillai, Material Science, New Age International Publishers.
2. M.A. Wahab, Solid State Physics, Narosa Publications
3. C. Kittel, Intoduction to Solid State Physics
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Publishers
5. Optical Materials, Joseph Habib Simmons, Kelly S. Potter, Elsevier

Reference Books:

1. Van Vleck, Elements of Material Science and Engineering, Pearson Education.
2. Srivastava and Srinivasan, Material Science and Engineering,
3. W.D. Callister Jr., Material Science and Engineering: An Introduction, John Wiley.

APPENDIX-IV

Basic Engineering and Applied Physics

B. Tech (Biotech/Bioinformatics), 1st Semester

JUIT, Waknaghat **Credits: 4 (L 3 T 1)**

PURPOSE:

The purpose of this course is to develop scientific temper and analytical capability through learning physical concepts and their applications in engineering and technology. Comprehension of some basic physical concepts will enable the students to logically solve problems. To give students a basic exposure to Physics that will better prepare them for more rigorous courses that will be taken later on.

COURSE OBJECTIVES:

CO1. Understand the general scientific concepts required for technology.

CO2. Apply the concepts in solving BT/BI engineering problems.

CO3. Explain scientifically the new developments in engineering and technology and

CO4. Get familiarized with the concepts, theories, and models behind many technological applications.

TOPICS COVERED AND NUMBER OF LECTURES:

1. Nature of light and matter: The electromagnetic spectrum: Sources of light, emission and absorption spectra, Basics of Fluorescence, Brief introduction to spectroscopy, Particle nature of radiation- The Photoelectric effect, Compton Effect. **4**

X-rays (continuous and characteristic), X-ray diffraction- Bragg's law. **2**

The origin of quantum theory- Planck's hypothesis, the wave nature of matter- wave-particle duality, matter waves (de Broglie hypothesis). Basic postulates of quantum mechanics - the wave function - its physical interpretation, the Schrodinger equation. **4**

2. Interference: Coherence and coherent sources, Interference by division of wavefront (Young's double slit experiment, Fresnels' biprism), Interference by division of amplitude (Newton's rings, Michelson's Interferrometer). **6**

3. Diffraction: Fresnel and Fraunhoffer types of diffraction, Fraunhofer diffraction: Single slit, double slit, circular aperture and N-slit. Diffraction grating - wavelength determination, resolving power and dispersive power. Resolving power of optical instruments – Rayleigh criterion. **6**

4. Polarization: Types of polarization, Brewster's law, Malu's law, e-ray and O-ray, dichroism, Nicol prism, double refraction, quarter-wave and half-wave plates, elliptically and circularly polarized light, optical activity, specific rotation, Laurent half-shade polarimeter.

6

5. Viscosity: Streamline flow, Turbulent motion, Critical velocity, Viscosity, Coefficient of viscosity, Poiseulle's equation, Stoke's method, Ostwald viscometer. Centrifugation.

6

6. Surface tension, Excess pressure inside a liquid drop and soap bubble, Angle of contact, Searl's Torsion balance method, Jaeger's method, Quincke's method, Interfacial surface tension.

4

7. Introduction to Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Fabrication: Bottom-up and Top-down, Characterization, Nanobiotechnology. **4**

COURSE OUTCOME:

The students will have knowledge on the basics of physics related to properties of matter, optics, etc. and they will apply these fundamental principles to solve practical problems related to materials used for BIOTECH/BI engineering applications.

EVALUATION SCHEMES:

The assessment and evaluation of Learning objectives and course outcomes will be done throughout the course, periodically. It will be implemented as follows:

- Surprise quizzes to rehearse the previous week's lessons and topics.
- Regular assignments with supplementary reading materials to assess if the student is able to understand the subject and as to why they have to study a particular topic.
- One on one counseling and assessment will be performed periodically to familiarize the student's strength and weaknesses.

Examinations	Marks (%)	Duration (hrs)
First Term (T-I)	15	1:00
Mid Term Test (T-II)	25	1:30
End Term Test (T-III)	35	2:00
Internal Assessment (Based on assignments, quizzes etc.)	25	Entire Semester

Attendance: 5 Participation in discussions in lectures/tutorials: 6 Quizzes : 6 Assignment: 8		
Total	100	

Text Books

1. **Applied Physics for Engineers** by Neeraj Mehta PHI Pvt. Ltd.
2. **Optics** by BrijLal and Subramanyam S. Chand & Company Ltd
3. **Surface Tension and the Spreading of Liquids by** R S Burden Cambridge University Press

Reference Books

1.**Optics by** Ajoy Ghatak Tata McGrawHill

2.**Introduction to Quantum Mechanics by David Griffiths Prentice Hall**

3.**Introduction to Nanoscience and Nanotechnology** by Chattopadhyay K.K Prentice Hall India Learning Private Limited

4.**Viscosity of Liquids: Theory, Estimation, Experiment, and Data by** Dabir S. Viswanath, Tushar Ghosh, Dasika H.L. Prasad, Nidamarty V.K. Dutt, Kalipatnapu Y. Rani Springer