Department of Physics
School of Basic & Applied Sciences
H.B.T.U. Kanpur

Minutes of the BOS Meeting of Physics Department

A meeting of BOS was organised by the Physics department on 25.06.2021 at 04:00 P.M.to discuss the Course Structure and to revise the curriculum of Physics to make it suitable for new entrants of B.Tech. Programme (Engg. & Technology) of this University as per AICTE guidelines. The following members participated in the meeting **through online mode**:

1.	Dr. S.K.Sharma	Department of Physics, HBTU Kanpur	Convener & HOD Physics
2.	Prof.R.K.Shukla	Department of Physics, HBTU Kanpur	Member
3.	Prof.R.K.Shukla,	Department of Physics, University of Lucknow	Member
4.	Prof.S.K.Tripathi	Department of Physics, Panjab University, Chandigarh	Member
5.	Dr. Hari Om Yadav	Council of Scientific & Industrial Research, New Delhi	Member
6.	Prof.Balak Das	Department of Physics, University of Lucknow	Member
7.	Prof.D.K.Dwivedi	Department of Physics, MMMU, Gorakhpur	Member
8.	Prof.Kedar Singh	Department of Physics, JNU, New Delhi	Member

After welcoming the members in the second meeting of the BOS of the university, a thorough discussion on the course structure & curriculum of Physics took place on the basis of "Model Curriculum for Undergraduate Degree Courses in Engineering & Technology, January 2018 (Volume –I and Volume – II) of All India Council for Technical Education (AICTE).

The following decisions were taken:

1. All members were agreed to continue the presently running course (BPH 151/152) with minor suggestions.
2. All the suggestions have been thoroughly incorporated at the appropriate places.
3. All members agreed with the course content to be taught to new entrants of forthcoming academic session 2022-23 onwards during I& II semester of B.Tech. Programme.
4. The above modifications should be effective from July, 2022.

(Prof.R.K.Shukla)
Member

(Dr. S.K.Sharma)
Convener & HOD Physics

Course Objective, Structure, Credits & Assessment Scheme

Course Objective: To understand the fundamentals of Physics and to apply these in solving engineering problems.

<table>
<tr><td>Course Code</td><td colspan="5">BPH – 151 / 152</td></tr>
<tr><td>Category</td><td colspan="5">Basic Science Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Physics (Theory & Lab.)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester- I / II</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td>Assessment Scheme</td><td colspan="5">Sessional : 50 Marks
End Semester Exam : 50 Marks</td></tr>
<tr><td>Course Content</td><td colspan="5">Attached below</td></tr>
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Proposed Curriculum of Physics (Theory & Lab)
for forthcoming
Academic Session 2022-23 Onwards
(Course Code: BPH – 151/152)

MODULE- 1

Relativistic Mechanics:

Inertial and Non- Inertial Frames of references, Galilean transformation equations, Michelson Morley Experiment, Lorentz Transformation equations, Length contraction, Time dilation and its experimental evidence, Relativistic velocity addition formula, Relativistic variation of mass with velocity, Evidence of variation of mass with velocity, Einstein's Mass-Energy equivalence, examples from nuclear physics, Relativistic energy momentum relation.

MODULE -2

Quantum Mechanics:

Dual nature of matter &radiation, Heisenberg's uncertainty Principleand their applications, wave packet concept, Davisson-Germer experiment, Postulates of quantum mechanics, Significance of wave function, Derivation of Schrodinger equation for time independent and time dependent cases.

Applications of Schrodinger wave equation for a free particle, Particle in a box (one dimensional and three dimensional cases), Simple harmonic oscillator (one dimensional case).

MODULE – 3

Electromagnetic Theory:

Ampere's law and Faraday's law of electromagnetic induction, Derivation of Maxwell's equationsand their physical significance, Correction of Ampere's law by Maxwell, Concept of displacement current,Poynting theorem, Maxwell's equations in free space & velocity of electromagnetic waves, Transverse character of the wave and orthogonality of **E**, **H** and **k** vectors, Maxwell's equation in dielectric medium and velocity of e.m. wave, Comparison with free space, Maxwell's equations in conducting media& solution of differential equation in this case,penetration depth& its significance.

MODULE – 4

Statistical Mechanics & Lasers:

MacrostatesandMicrostates,Phase space, probability of distribution, most probable distribution, Maxwell-Boltzmann Statistics, Applicationsof Maxwell-Boltzmann Statistics, derivation of average velocity, RMS velocity and most probable velocity in the above cases, Bose-Einstein Statistics& its application in case of black body radiation, distribution law of energy, Planck's radiation formula, derivation of Wien's law, Rayleigh-Jeans law and Stefan's law from Planck's radiation formula. Fermi – Dirac statics, application in case of free electrons in metals, energy distribution, Fermi energy.

Lasers: Spontaneous and stimulated emission of radiations, Einstein's theory of matter-radiation interaction, Einstein's coefficients and relation between them, Population inversion, components of a laser, different kinds of lasers, Ruby laser, He-Ne laser, solid state lasers, properties of laser beams, mono-chromaticity, coherence, directionality and brightness, applications of lasers in various technological applications.

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MODULE: 5

Materials of Technological Importance:

Dielectric Materials: Electric field in presence of dielectric medium, concept of electric polarization, different types of polarizations, behaviour of dielectric in a.c. field, concept of dielectric loss and loss energy and their importance.

Semiconducting Materials: Concept of energy bands in solids, carrier concentration and conductivity in intrinsic semiconductors and their temperature dependence, carrier concentration and conductivity in extrinsic semiconductors and their temperature dependence, Hall effect in semiconductors, compound semiconductors, amorphous semiconductors.

Nano Materials: Basic principles of nanoscience and technology, preparation, structure and properties of fullerene and carbon nanotubes, applications of nanotechnology.

Superconducting Materials: Resistivity and susceptibility of Superconductors, Type – I and Type – II superconductors, Meissner effect, Low temperature Superconductors, Organic Superconductors, Oxide Superconductors, High temperature Superconductors, BCS theory (Qualitative).

References:

1. Physics, Marcelo Alonso, J. Finn Edwards, Addison Wesley
2. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill
3. Engineering Physics, R. K.Shukla, Pearson Education
4. Electrical Engineering Materials, R.K.Shukla, McGraw Hill
5. Introduction to Electrodynamics, David Griffiths, Cambridge University Press
6. Principles of Engineering Physics, R.K.Shukla, Ira Books
7. Introduction to Solid State Physics, Charles Kittel, Willey
8. Introduction to Nanotechnology, Charles P. Poole Jr., Frank J. Owens, Wiley-Interscience
9. Nanotechnology: Principles and Practices, Sulabha K. Kulkarni, Springer
10. Mechanics, R.K. Shukla and Anchal Srivastava, New Age International (P) Limited Publishers (Formerly Wiley Eastern Limited)
11. Quantum Mechanics, Atomic and Molecular Spectra, R.K. Shukla and Anchal Srivastava, New Age International (P) Limited Publishers (Formerly Wiley Eastern Limited)
12. Introduction to Electricity and Magnetism, Rajesh Kumar Shukla, HP Hamilton Limited, United Kingdom
13. Practical Physics (Electricity, Magnetism and Electronics), Anchal Srivastava and R.K. Shukla, New Age International (P) Limited Publishers (Formerly Wiley Eastern Limited)
14. Practical Physics, R.K. Shukla and Anchal Srivastava, New Age International (P) Limited Publishers (Formerly Wiley Eastern Limited)

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List of Experiments:

1. To determine the energy of band gap of a N-type Ge-semiconductor using four probe method
2. Verification of Stefan's fourth power law for black body radiation, determination of the exponent of the temperature
3. Study of thermoelectricity: Determination of thermo-power of Copper-constantan thermo-couple
4. To study the variation of magnetic field with distance along the axis of current carrying coil and then to estimate the radius of the coil
5. Study of Carrey Foster's bridge: determination of resistance per unit length of the bridge wire and of a given unknown resistance
6. Determination of specific charge (charge to mass ratio; e/m) for electron
7. Study of tangent galvanometer: determination of reduction factor and horizontal component of earth's magnetic field
8. Determination of the wavelength of sodium light using Newton Rings' method
9. Determination of wavelength of laser using laser diode
10. Determination of wavelength of spectral lines of mercury (for violet, green, yellow-1 and yellow-2) using plane transmission grating
11. Determination of charge sensitivity and ballistic constant of a ballistic galvanometer
12. To determine the wavelength of spectral lines of hydrogen & hence to determine the value of Rydberg Constant
13. Draw the V-I characteristic of Light Emitting Diode (LED) and determine the value of Planck's constant

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Course Outcome

Module -1 To understand and to apply principle of conservation of momentum. e.g. in rocket propulsion and in many other space applications.
To understand the theory of relativity and to analyse how the physical quantities undergo drastic changes in their original value at very high velocities and also to see how its principles are applicable in particle accelerators, nuclear devices as an alternative sources of energy and for defence purpose.

Module-2 To understand the basics of quantum mechanics, and to apply its principles to learn the phenomena that occur at subatomic dimensions.

Module–3 To understand and to apply Maxwell's equations which forms the basis of electromagnetic theory. This has a wide application in communication systems. All the information propagating in the universe utilises the principle of electromagnetic theory.

Module–4 To study the fundamentals of material science especially dielectric materials, semiconducting materials and nanomaterial and to apply the knowledge to use how dielectrics are used for the storage of charge. infrared detectors, crystal oscillators, manufacture of microphones, headsets loudspeakers, transducers, ultrasound applications, gas ignitors, accelerometers etc.

Semiconductor material technology which has completely changed the scenario by replacing the older vacuum tube technology, are another technologically important materials which are widely used in LEDs, miniaturisation of electronic devices and to develop materials with improved efficiency and economy.

Nanotechnology is the most emerging field at present and is extremely important. It has got various applications in many areas including information technology, biomedical, energy-storage, automotive industry, electronics industry, textiles and chemical industries.

Model – 5 To understand the statistical behaviour of the constituent particles which give rise to form a material, and to apply the principles of statistical mechanics and to understand the basics of Laser.

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