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| Course Number & Title: PH111xH: Introductory Classical Mechanics | |
| L-T-P-C: 2-1-0-3 | |
| Kind of Proposal (New Course / Revision of Existing Course(s)): | |
| Offered as (Compulsory / Elective): | |
| Offered to: BTech | |
| Offered in (Odd/ Even / Any): Odd | |
| Offered by (Name of Department/ Center): Physics | |
| Tentative Pre-Requisite: <i>(Not always required, if JAM syllabus is sufficient pre-requisite. You can give name of the topics of the courses that the student needs to know before the course starts)</i> | |
| Preamble / Objectives (Optional): | |
| <p>Course Content/ Syllabus:</p> <p>Kinematics: Position, velocity, acceleration vectors in rectilinear, plane polar, cylindrical and spherical polar coordinate systems.</p> <p>Laws of Mechanics: Newton's laws of motion, dynamics using polar coordinates; forces and equations of motion, simple harmonic motion.</p> <p>Momentum and Energy: System of particles, center of mass, center of mass coordinates, conservation of momentum; Work-energy theorem, conservation laws; non-conservative forces.</p> <p>Angular Momentum: Angular momentum about fixed axis of rotation, dynamics of fixed axis rotation, work-energy theorem and rotational motion.</p> <p>Motion in non-inertial frame: Galileo-Newton law of inertia, motion of an object in a linearly accelerated frame of reference; motion of an object in a rotating frame of reference.</p> <p>Oscillations: <i>Small oscillations in a bound system, stability, normal modes, damped oscillations, driven damped oscillations, resonance.</i></p> | |
| Books (In case of compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References" The books should be compatible to the syllabus. | |
| Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
| 1. | D. Kleppner and R. Kolenkow, <i>An Introduction to Mechanics</i> , 2 nd Ed. Cambridge University Press (2014). |
| 2. | Charles Kittel, Walter D. Knight, Malvin A. Ruderman, A. Carl Helmholz, Burton J. Moyer, <i>Mechanics (Berkeley Physics Course, Vol. 1)</i> , McGraw-Hill Book Company (1973) |
| 3. | John Taylor, <i>Classical mechanics</i> , (University Science Books, 2005). |
| References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
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NB: x is digit between (0-9)

Detailed Course Content
It will not be included in the Courses of Study Booklet

| Week No | Topics: Subtopics | Probable Book where the content is probably to be taught | Number of Lectures (in hours) | Included in GATE/NET (Yes-No) | Whether this subtopic was included/replaced with respect to the existing syllabus |
|---------|---|--|-------------------------------|-------------------------------|---|
| 1 | Kinematics: Position, velocity, acceleration vectors in rectilinear, plane polar, cylindrical and spherical polar coordinate systems. | | 3 | | |
| 2 | Laws of Mechanics: Newton's laws of motion, dynamics using polar coordinates; forces and equations of motion, simple harmonic motion. | | 2 | | |
| 3 | Momentum and Energy: System of particles, center of mass, center of mass coordinates, conservation of momentum; Work-energy theorem, conservation laws; non-conservative forces. | | 2 | | |
| 4 | Angular Momentum: Angular momentum about fixed axis of rotation, dynamics of fixed axis rotation, work-energy theorem and rotational motion. | | 3 | | |
| 5 | Motion in non-inertial frame: Galileo-Newton law of inertia, motion of an object in a linearly accelerated frame of reference; motion of an object in a rotating frame of reference. | | 2 | | |
| 6 | Oscillations: Small oscillations in a bound system, stability, normal modes, damped oscillations, driven damped oscillations, resonance | | 2 | | |

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| Total Number of Lectures = | | 14 | | |
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| Course Number & Title: PH113xH: Modern Physics | |
| L-T-P-C: 2-1-0-3 | |
| Kind of Proposal (New Course / Revision of Existing Course(s)): | |
| Offered as (Compulsory / Elective): | |
| Offered to: BTech | |
| Offered in (Odd/ Even / Any): Odd | |
| Offered by (Name of Department/ Center): Physics | |
| Tentative Pre-Requisite: (Not always required, if JAM syllabus is sufficient pre-requisite. You can give name of the topics of the courses that the student needs to know before the course starts) | |
| Preamble / Objectives (Optional): | |
| <p>Course Content/ Syllabus:</p> <p>Theory of Relativity: Postulates of special theory of relativity; The Michelson-Morley experiment; Time dilation; Doppler effect; Length contraction; Velocity addition; Mass and energy; Energy and Momentum;.</p> <p>Particle properties of waves: Electromagnetic waves; Blackbody radiation; Photoelectric effect; X-rays; X-ray diffraction; Compton effect; Pair production;.</p> <p>Wave properties of particles: De Broglie waves; Describing a matter wave; Phase and Group velocities; Particle diffraction; Particle in a box; Uncertainty principle; Concept of wave function.</p> <p>Structure of Atom: Rutherford scattering; Bohr's Atomic model; Energy levels and spectra; Correspondence principle; Nuclear mass effect on spectral lines; Sommerfeld's model, Atomic excitation; Basic mechanism of Laser.</p> | |
| Books (In case of compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References" The books should be compatible to the syllabus. | |
| Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
| 1. | Arthur Beiser, <i>Concepts of Modern Physics</i> , McGraw Hill, Eighth Ed. (2024). |
| 2. | |
| 3. | |
| References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
| 1 | Robert Eisberg and Robert Resnick, <i>Quantum Physics</i> , Wiley India Private Ltd. (2006). |
| 2 | J.R. Taylor, C.D. Zafiratos and M.A. Dubson, <i>Modern Physics: For</i> |

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| | Scientists and Engineers, PHI Learning Pvt. Ltd, 2 nd Ed. (2009). |
| 3 | R. Resnick, <i>Introduction to Special Relativity</i> , John Wiley, Singapore (2000). |

| Detailed Course Content It will not be included in the Courses of Study Booklet | | | | | |
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| Sl. No.(or week No. or Module no.) | Topics: Subtopics | Probable Book where the content is probably to be taught | Number of Lectures (in hours) | Include d in GATE/ NET (Yes-No) | Whether this subtopic was included/replaced with respect to the existing syllabus |
| 1 | Theory of Relativity: Postulates of special theory of relativity; The Michelson-Morley experiment; Time dilation; Doppler effect; Length contraction; Velocity addition; Mass and energy; Energy and Momentum | | 6 | | |
| 2 | Particle properties of waves: Electromagnetic waves; Blackbody radiation; Photoelectric effect; X-rays; X-ray diffraction; Compton effect; Pair production | | 2 | | |
| 3 | Wave properties of particles: De Broglie waves; Describing a matter wave; Phase and Group velocities; Particle diffraction; Particle in a box; Uncertainty principle; Concept of wave function. | | 3 | | |
| 4 | Structure of Atom: Rutherford scattering; Bohr's Atomic model; Energy levels and spectra; Correspondence principle; Nuclear mass effect on spectral lines; Sommerfeld's model, Atomic excitation; Basic mechanism of Laser. | | 3 | | |

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| Total Number of Lectures = | | | 14 | | |

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| Course Number & Title: PH121xH Introductory electromagnetics | |
| L-T-P-C: 2-1-0-3 | |
| Kind of Proposal (New Course / Revision of Existing Course(s)): | |
| Offered as (Compulsory / Elective): | |
| Offered to: BTech | |
| Offered in (Odd/ Even / Any): Even | |
| Offered by (Name of Department/ Center): Physics | |
| Tentative Pre-Requisite: <i>(Not always required, if JAM syllabus is sufficient pre-requisite. You can give name of the topics of the courses that the student needs to know before the course starts)</i> | |
| Preamble / Objectives (Optional): | |
| <p>Course Content/ Syllabus:</p> <p>Electrostatics: Gradient, divergence, and curl in curvilinear coordinates; Gauss law in integral form (review) and differential form, calculation of Divergence of E; Curl of E, Scalar potential, potential due to charges and Laplace/Poisson equation; Statements of Uniqueness theorems, boundary value problems and method of images; Dielectrics, Polarization, bound charges (review) and boundary conditions.</p> <p>Magnetism: Review of Biot-Savart's law, Lorentz Force. Divergence and curl of magnetic field, vector potential, and forces on magnetic dipoles; Magnetic materials and magnetic fields in the matter (magnetostatic case), bound currents</p> <p>Steady currents and electromagnetic fields: Review of Ohm's law, Faraday's law, Lenz's law and Electromotive force; Ampere's law and Displacement current.; Maxwell's equations.</p> | |
| Books (In case of compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References" The books should be compatible to the syllabus. | |
| Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
| 1. | <i>Purcell, Edward M. Electricity and magnetism. Cambridge university press, 2013</i> |
| 2. | Griffiths, David J. <i>Introduction to electrodynamics</i> . Cambridge University Press, 2023. |
| 3. | |
| References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
| 1 | Verma, H.C. <i>Classical Electromagnetism</i> , Bharati Bhawan, 2022. |

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| 2 | Feynman, Richard P. <i>The Feynman Lectures on Physics</i> , Volume 2, Pearson, 2013. |
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| Detailed Course Content It will not be included in the Courses of Study Booklet | | | | | |
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| Sl. No.(or week No. or Module no.) | Topics: Subtopics | Probabl e Book where the content is probably to be taught | Numb er of Lectur es (in hours) | Included in GATE/N ET (Yes-No) | Whether this subtopic was included/replaced with respect to the existing syllabus |
| 1 | Electrostatics: , Gradient, divergence, and curl in curvilinear coordinates; Gauss law in integral form (review) and differential form, calculation of Divergence of E; Curl of E, Scalar potential, potential due to charges and Laplace/Poisson equation; Statements of Uniqueness theorems, boundary value problems and method of images; Dielectrics, Polarization, bound charges (review) and boundary conditions. | | 7 | | |
| 2 | Magnetism: Review of Biot-Savart's law, Lorentz Force. Divergence and curl of magnetic field, vector potential, and forces on magnetic dipoles; Magnetic materials and magnetic fields in the matter (magnetostatic case), bound currents | | 4 | | |
| 3 | Steady currents and electromagnetic fields: Review of Ohm's law, Faraday's law, Lenz's law and Electromotive force; Ampere's law and Displacement current.; Maxwell's equations | | 3 | | |
| Total Number of Lectures = | | | 14 | | |

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| Course Number & Title: PH141xH: Introductory Quantum Mechanics | |
| L-T-P-C: 2-1-0-3 | |
| Kind of Proposal (New Course / Revision of Existing Course(s)): | |
| Offered as (Compulsory / Elective): | |
| Offered to: BTech | |
| Offered in (Odd/ Even / Any): Even | |
| Offered by (Name of Department/ Center): Physics | |
| Tentative Pre-Requisite: <i>(Not always required, if JAM syllabus is sufficient pre-requisite. You can give name of the topics of the courses that the student needs to know before the course starts)</i> | |
| Preamble / Objectives (Optional): | |
| <p>Course Content/ Syllabus:</p> <p>Experimental Basis of Quantum Mechanics: Double slit experiment and Stern-Gerlach experiment (basic ideas); De Broglie's hypothesis (matter wave dual nature); Wave-particle duality</p> <p>Postulates of Quantum Mechanics: Wave function and wave packets; Position and momentum operators, Uncertainty principle, Commutators; Schrödinger equation, Probabilities, probability current densities, wave function normalization; Expectation values, eigenvalues and eigenfunctions.</p> <p>Applications of Schrödinger Equation: Infinite potential well, energy quantization; Finite square well, potential step and potential barrier, quantum tunnelling; Harmonic Oscillator, energy eigenvalues and eigenfunctions.</p> | |
| Books (In case of compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References" The books should be compatible to the syllabus. | |
| Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
| 1. | R. Eisberg and R. Resnick, <i>Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles</i> , 2 nd Ed. Wiley, 2006. |
| 2. | David J. Griffiths, <i>Introduction to Quantum Mechanics</i> , 3 rd Edition, 2018. |
| 3. | |
| References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
| | Ajit Kumar, <i>Fundamentals of Quantum Mechanics</i> , Cambridge university press, 2018. |
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Detailed Course Content
It will not be included in the Courses of Study Booklet

| Sl. No.(or week No. or Module no.) | Topics: Subtopics | Probable Book where the content is probably to be taught | Number of Lectures (in hours) | Included in GATE/NET (Yes-No) | Whether this subtopic was included/replaced with respect to the existing syllabus |
|------------------------------------|---|--|-------------------------------|-------------------------------|---|
| 1 | Experimental Basis of Quantum Mechanics: Double slit experiment and Stern-Gerlach experiment (basic ideas); De Broglie's hypothesis (matter wave dual nature); Wave-particle duality | | 2 | | |
| 2 | Postulates of Quantum Mechanics: Wave function and wave packets; Position and momentum operators, Uncertainty principle, Commutators; Schrödinger equation, Probabilities, probability current densities, wave function normalization; Expectation values, eigenvalues and eigenfunctions. | | 7 | | |
| 3 | Applications of Schrödinger Equation: Infinite potential well, energy quantization; Finite square well, potential step and potential barrier, quantum tunnelling; Harmonic Oscillator, energy eigenvalues and eigenfunctions | | 5 | | |
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| Total Number of Lectures = | | | 14 | | |

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|---|--|
| Course Number & Title: PH110xL/PH120xL: Physics Lab | |
| L-T-P-C: 0-0-3-3 | |
| Kind of Proposal (New Course / Revision of Existing Course(s)): | |
| Offered as (Compulsory / Elective): | |
| Offered to: BTech | |
| Offered in (Odd/ Even / Any): Odd/Even | |
| Offered by (Name of Department/ Center): Physics | |
| Tentative Pre-Requisite: (<i>Not always required, if JAM syllabus is sufficient pre-requisite. You can give name of the topics of the courses that the student needs to know before the course starts</i>) | |
| Preamble / Objectives (Optional): | |
| Course Content/ Syllabus: List of Experiments: Determination of g by Compound pendulum, Surface tension of a liquid by Jaeger's Method, Magnetic field along the axis of a coil, Resonance and Q factor of a LCR circuit, Hall Effect in an extrinsic semiconductor, Newton's ring, Plane Transmission Grating, Linear Air track, Error analysis. | |
| Books (In case of compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References" The books should be compatible to the syllabus. | |
| Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.) | |
| 1. | Taylor, John R. " <i>Error analysis.</i> " Univ. Science Books, Sausalito, California 20 (1997). |
| 2. | Ghatak, Ajoy. <i>Contemporary Optics</i> . Springer Science & Business Media, 2012 |
| 3. | Mahajan, A. and Rangawala, A. <i>Electricity and Magnetism</i> . Mc. Gras Hill (2017). |
| 4 | Mathur D.S. <i>Elements of Properties of Matter</i> . S. Chand (2010). |