

**INTRODUCTION TO BIOPHYSICS**  
**SCHEDULE**  
**15.09 – 06.10 2025**

|   | DATE   | group | Topic   |
|---|--------|-------|---|
| 1 | 15.09. | all   | INTRODUCTION  |
| 2 | 15.09  | all   | <p><b><i>Description of Motion: Kinematics in One and Two Dimensions</i></b></p> <ol style="list-style-type: none"> <li>1. To understand the concept of frames of reference and relative velocity</li> <li>2. To employ concepts of average velocity, instantaneous velocity and acceleration to solve problems</li> <li>3. To learn how to use graphs to find quested unknowns</li> <li>4. Motion at a constant acceleration. Falling Objects</li> <li>5. To distinguish vectors and scalars</li> <li>6. To learn how to add and subtract vectors-graphical methods</li> <li>7. To learn how to find the components of vectors and add vectors by components</li> <li>8. To introduce students to vectors and the use of sine and cosine for a triangle when resolving components</li> <li>9. Projectile motion</li> </ol> |
| 3 | 16.09. | all   | <p><b><i>Dynamics: Newton's Law of motion in Straight Line:</i></b></p> <ol style="list-style-type: none"> <li>1. To understand Newton's 1st law.</li> <li>2. To understand Newton's 2<sup>nd</sup> law.</li> <li>3. To understand the relationship between applied force, net force, acceleration, and mass for 1-dimensional motion.</li> <li>4. To understand Newton's 3rd law.</li> <li>5. The normal force.</li> <li>6. To gain practice drawing free-body diagrams.</li> <li>7. To introduce contact forces: the normal force and the force due to friction</li> </ol>  |

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| 4          | 16.09<br><br><b>17.09</b>  | <b>S5, S6,<br/>S7, S8, B</b><br><br><b>S1, S2,<br/>S3, S4, A</b> | <b><i>ELEMENTS OF KINEMATICS AND DYNAMICS OF CIRCULAR AND ROTATIONAL MOTION</i></b><br>1. To understand relations between linear and angular velocity, relations between period and frequency<br>2. Centripetal acceleration and the centripetal force<br>3. Torque – the definition and practice – some aspects of equilibrium   |
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| 5          | 16.09<br><br><b>18.09</b>  | <b>S5, S6,<br/>S7, S8, B</b><br><br><b>S1, S2,<br/>S3, S4, A</b> | <b><i>WORK, POWER AND ENERGY</i></b><br>1. To explore the definition of work and learn how to find the work done by a force on an object<br>2. Gravitational potential energy<br>3. Conservation and conversion of energy<br>4. Work-energy principle   |
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| 6          | 17.09<br><br><b>19.09</b>  | <b>S5, S6,<br/>S7, S8, B</b><br><br><b>S1, S2,<br/>S3, S4, A</b> | <b><i>WORK, POWER AND ENERGY-CONTINUED. ELEMENTS OF ELASTICITY AND FRACTURE</i></b><br>1. Power<br>2. Elastic potential energy<br>3. Elasticity - mechanical properties of solids: concepts of stress, strain, Hooke's law and Young's modulus<br>4. Energy Conservation with Dissipative Forces  |
| <b>!!!</b> | <b>18<sup>th</sup> Sep</b> |  | <b><i>10-15 min short quiz</i></b>  |
| 7          | 18.09<br><br><b>19.09</b>  | <b>S5, S6,<br/>S7, S8, B</b><br><br><b>S1, S2,<br/>S3, S4, A</b> | <b><i>OSCILLATIONS</i></b><br>1. To learn the basic terminology and relationships among the main characteristics of simple harmonic motion: period, frequency, displacement, velocity and acceleration<br>2. Energy in Simple Harmonic Motion<br>3. To learn to apply the law of conservation of energy to the analysis of harmonic oscillators.                                    |
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| 8          | 19.09<br><br><b>22.09</b>  | <b>S5, S6,<br/>S7, S8, B</b><br><br><b>S1, S2,<br/>S3, S4, A</b> | <b><i>WAVES AND SOUNDS</i></b><br>1. Propagation of waves in different substances<br>2. To understand the relationships among the parameters that characterize a wave: period, frequency, wavelength and intensity; the inverse square law<br>3. To learn the properties of logarithms and how to manipulate them when solving sound problems – the Sound Intensity Level, dB scale |

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|    |       |                      | 4.To understand standing waves, including calculation of wavelength and frequency in strings and tubes  |
| 9  | 22.09 | S5, S6,<br>S7, S8, B | <b>FLUIDS</b><br>1. Density, mass and weight<br>2. Pressure and related force<br>3. Pascal's principle – hydraulic lift<br>4. To understand the applications of Archimedes' principle and the buoyant force |
|    | 22.09 | S1, S2,<br>S3, S4, A | 5. Fluids in motion: flow rate and the law of continuity<br>6. Viscosity<br>7. Flow in tubes: Poiseuille's equation   |
| 10 | 22.09 | S5, S6,<br>S7, S8, B | <b>TEMPERATURE AND KINETIC THEORY OF GASES</b><br>1. Temperature and Thermometers<br>2. Thermal Equilibrium and the Zero-th Law of Thermodynamics.<br>3. To understand The Ideal Gas Law                    |
|    | 23.09 | S1, S2,<br>S3, S4, A | 4. To solve problems with the Ideal Gas Law<br>5. Molecular Interpretation of Temperature   |
| 11 | 23.09 | S5, S6,<br>S7, S8, B | <b>KINETIC THEORY OF GASES CONTINUED. THERMAL ENERGY</b><br>1. To distinguish temperature, heat and internal energy<br>2. To understand the First Law of thermodynamics                                     |
|    | 23.09 | S1, S2,<br>S3, S4, A | 3. To understand concepts of specific heat and latent heat<br>4. Heat exchange – the calorimetry solving problems   |
| 12 | 23.09 | S5, S6,<br>S7, S8, B | <b>ELECTRIC CHARGE AND FIELD</b><br>1. Electric charge and its conservation<br>2. Induced charge  |
|    | 24.09 | S1, S2,<br>S3, S4, A | 3. Electric force - Coulomb's Law<br>4. Electric field and the electric field lines   |

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|     |                      |                      | 5. Electric Potential  |
| !!! | 24 <sup>th</sup> Sep |                      | <i>10-15 min short quiz</i>  |
| 13  | 24.09                | S5, S6,<br>S7, S8, B | <b><i>ELECTRIC CURRENTS AND DC CIRCUITS</i></b><br>1. To understand the concept of electric current<br>2. The electrical resistance, resistors and resistance<br>2. To use the Ohm's law to solve problems<br>3. To understand electric power  |
|     | 26.09                | S1, S2,<br>S3, S4, A | 5. Electromotive force (EMF) and terminal voltage<br>6. Resistors in series and parallel, Kirchhoff's rules  |
| 14  | 29.09                | S5, S6,<br>S7, S8, B | <b><i>MAGNETISM AND ELECTROMAGNETIC INDUCTION</i></b><br>1. Magnets and magnetic fields<br>2. Sources of magnetic fields: field due to a straight wire and field inside a solenoid<br>3. Force on an electric current in a magnetic field  |
|     | 26.09                | S1, S2,<br>S3, S4, A | 4. Force on electric charge moving in a magnetic field<br>5. Faraday's law of induction; Lenz's law. Practice with Lenz's law  |
| 15  | 30.09                | S5, S6,<br>S7, S8, B | <b><i>ELECTROMAGNETIC WAVES AND GEOMETRIC OPTICS</i></b><br>1. Electromagnetic waves and the electromagnetic spectrum: wavelength, frequency and speed of propagation<br>2. Polarised vs unpolarised light: the Malus law<br>3. Refraction of light: index of refraction, Snell's law; total internal reflection; fibre optics |
|     | <u>29.09</u>         | S1, S2,<br>S3, S4, A |  |
|     | 30 <sup>th</sup> Sep |                      | <i>10-15 min short quiz</i>  |
| 16  | 30.09                | S5, S6,<br>S7, S8, B | <b><i>GEOMETRIC OPTICS - CONTINUED</i></b><br>1. Thin lenses, focal point, focal length, optical power<br>2. Ray tracing: converging and diverging lenses<br>3. The thin lenses equation; magnification  |
|     | 30.09                | S1, S2,<br>S3, S4, A | 4. Combination of lenses<br>5. Lensmaker's equation  |

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| 17 | 01.10 | <i>all</i> | <p><b><i>NUCLEAR PHYSICS AND RADIOACTIVITY</i></b></p> <ol style="list-style-type: none"> <li>1. Structure and properties on the nucleus, nuclear size</li> <li>2. Binding energy and Nuclear Forces</li> <li>3. Radioactivity: alpha, beta and gamma decay; Conservation of nucleon number and charge</li> <li>4. The law of radioactive decay; the half-life time</li> </ol> <p><b><i>ELEMENTS OF MODERN PHYSICS: EARLY QUANTUM THEORY AND MODELS OF THE ATOM</i></b></p> <ol style="list-style-type: none"> <li>1. Photon theory of light, photon energy, Planck's constant</li> <li>2. Photoelectric effect</li> <li>3. Compton effect</li> <li>4. Early models of the atoms, atomic spectra, the Bohr model: energy levels, transitions, absorption and emission</li> </ol> <p>Wave-particle duality: the de'Broglie hypothesis</p> |
| 18 | 06.10 |            | <b>TEST EXAMINATION 2:15 – 3:00 pm CITK</b>  |
| 19 | 13.10 |            | <b>RETAKE 1:30 – 3:00 pm CITK</b>  |