Institute for Language
and Preparatory Studies
Charles University

PHYSICS

(*Attached are typical problems from each topic that you should be able to count.*)

1. **Terminological Introduction**
- Basic Quantities and Units
- SI System
- Unit Conversions

2. **Kinematics**
- Uniform Motion and Motion with Acceleration
- Free Fall
- Projectile Problems
- Angular Motion in a Plane

3. **Dynamics**
- Newton's Laws
- Force and Impulse
- Momentum, Work, Power, Energy, Efficiency
- Conservation of Linear Momentum and Energy

4. **Rigid-Body Mechanics**
- Torque
- Equilibrium, Centre of Gravity
- Moment of Inertia and Energy of Rigid-Body

5. **Fluids at Rest and in Motion**
- Fluids
- Pressure, Hydrostatic Pressure, Archimedes' Principle
- Fluid Flow – Equation of Continuity, Bernoulli's Equation

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6. Molecular Physics and Thermodynamics

- Kinetic Theory
- Molar Quantities
- Temperature, Heat, Internal Energy Changes
- The First Law of Thermodynamics
- Calorimetry Equation
- Ideal Gas, Thermal Processes in Gases, Work Done by a System
- Thermal Expansion, Elasticity
- Changes in State

7. Simple Harmonic Motion

- Quantities
- Harmonic Vibration Motion
- Restoring Force
- Springs and Simple Pendulum

8. Wave Motion

- Wave Terminology
- Interference and Standing Waves
- Huygens' Principle
- Reflection and Refraction of Wave
- Sound Waves

9. Gravitational Field

- Gravitational Force and Weight
- Description of Gravitational Field – Intensity and Potential
- Work
- Motion in a Radial Field
- Kepler's Laws

10. Electric Field

- Electric Charge
- Intensity and Potential, Capacitance
- Capacitors

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11. Electric Current
- Ohm's Law for Simple and Compound Circuits
- Kirchhoff's Laws and their Use
- Electric Current in Semiconductors, Electrolytes, Gas and Vacuum

12. Magnetic Fields
- Stationary Magnetic Field
- Magnetic Induction
- Forces in Magnetic Fields
- Faraday's Law for Induced EMF

13. Alternating Current
- Origin and Description
- RLC Circuits
- Work and Power
- Oscillating Circuit – Electromagnetic Waves

14. Optics: Fundamental Characteristics of Light
- Geometric Optics (Mirrors and Lenses, Object and Image Relation, Mirror and Lens Equation)
- Quantum Physics (Photons, Photoelectric Effect)

15. Atom and Nuclear Physics
- Neutral Atoms, Nucleus, Models, Excitation and Ionization
- Radioactivity (Radiations, Wien's Displacement Law)
- Fission and Fusion Reactions

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