LEAD CITY UNIVERSITY, IBADAN
Faculty of Basic Medical and Applied Sciences
Department of Computer and Physical Sciences

COURSE PARTICULARS

Course code: PHY 101
Course title: General Physics II
No. of Units: 3
Status: Compulsory

LECTURER DETAILS

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COURSE DESCRIPTION

Space and Time, Units and dimension, Kinematics; Fundamental Laws of Mechanics, statics and dynamics; work and energy; Conservation laws. Elasticity; Hooke's law, Young's shear and bulk moduli, Hydrostatics; Pressure; buoyance, Archimedes' Principles. Surface tension; adhesion, cohesion, capillarity, drops and bubbles. Temperature; heat; gas laws; laws of thermodynamics; kinetic theory of gases. Sound, Applications.

COURSE OBJECTIVES

- Highlight the importance of physics in science & technology as an applied discipline
- To introduce the students to the general concepts of motion and time
- To introduce simple calculus in solving motion , energy and power problems
- To examine and solve simple questions in thermodynamics
- To discuss the concept of heat transfer as well as solve problems on specific heat and latent heat

ASSESSMENT

Test(s) and Assignments 40marks
Final Examination 60marks

LECTURE PLAN

Week	Topic
Week 1	Space and Time, Units and dimension, Kinematics
Week 2	Newton laws of motion
Week 3	Work, Energy/Power/Friction/viscosity
Week 4	Gravitational field/ SHM
Week 5	Moment/Energy of rotation
Week 6	Kinetic theory of matter, Elasticity of Materials

Week 7	Surface tension/capillary Archimedes' Principles.
Week 8	Surface tension; adhesion, cohesion, Capillarity, drops and bubbles
Week 9	First law of thermodynamics, Applications, quantity of heat, Latent/hidden heat
Week 10	Expansion of materials, Linear, superficial and cubical expansivities
Week 11	Sound and applications
Week 12	Revision
Week 13	Second Test and Tutorials

READING LIST

1. Young and Freeman; Sears and Zemansky's University Physics with Modern Physics 11th edition, 2004
2. University Physics (with modern Physics) 11th edition by Hugh D.Young/Roger A. Freedma Personal Educate Inc (Publishing as Addison Wesley)
3. Advanced level Physics by Nelkon & Parker 7th edition (1995)

QUESTIONS

1a. The speed of ocean waves is proportional to the acceleration due to gravity g, wavelength λ, and density ϱ of the wave such that $c = kg^x\lambda^y\varrho^z$ where k is a dimensionless constant. What is the correct equation/dimension for the speed of the ocean wave? (b) What is simple harmonic motion? List any 3 examples of SHM. (c) Given a simple pendulum undergoing SHM. Show that its period does not depend on the mass of the pendulum bob.

2a. The specific heat capacity of a particular solid material at temperature close 0K is given by $c = aT^3$. What is the S.I unit of the constant where T = temperature? (b) A 50g mass vibrates in S.H.M at the end of a spring when the amplitude of the motion is 12.0 cm and the period T is 1.70 seconds. Find: the frequency, the spring constant, the maximum speed of the mass, the maximum acceleration of the mass, the speed when the displacement is 6.0 cm, the acceleration when the displacement is 6.0 cm.

3a. State the Newton Laws of motion. (b) Differentiate between Elastic and Inelastic collisions. (c)A bullet of mass 50g is fired into a wood of mass 1.5kg such that the bullet and the wood are raised through a height of 75cm. Determine: the final velocity of the bullet and wood, initial velocity of the bullet, initial momentum of the bullet. (d) A proton is accelerated at $3.6 \times 10^{15} ms^{-2}$ through a distance of 3.5cm. If the initial velocity is $2.4 \times 10^{7} ms^{-1}$, find the change in Kinetic Energy at the end of the distance. ($M_o = 1.67 \times 10^{-27}$ kg)

4. A kettle is rated as 2.3 kW. A mass of 750 g of water at 20^oC is poured into the kettle. When the kettle is switched on, it takes 2.0 minutes for the H_2O to start boiling. In a further 7.0 minutes, half of the mass of H_2O is boiled away. Estimate for this water: The specific heat capacity, the specific latent heat of vaporization.

5. (a)Define the following concepts: Heat capacity of given substance, Specific latent heat of vaporization.(b) State the 1st law of thermodynamics and explain in detail each of the terms: Adiabatic process, Isochoric process, Isobaric process and Isothermal process. (c) A body of mass 2kg has an initial velocity of $8ms^{-1}$ in the positive x – direction as it passes the origin if the coordinates. It is subjected to a retarding force such that $F_x = -0.5$. What will be its x – coordinates when it stops.

6a. A 10g bullet moving at $70ms^{-1}$ penetrates a block of wood 5cm before stopping. Determine: (i) the kinetic energy of the bullet (ii) average stopping force. (b) A boy whose mass is 40kg finds that he can run up a flight of 50 steps, each 15cm high, in 5s. How much power is required? (Assume g = $10ms^{-2}$). (c) A tractor can exert a force of 5 x 10^5N while moving at constant speed of $10ms^{-1}$. Determine its power in horsepower.

7. (a) Explain briefly: work, energy and power. (b) A car of mass 300kg starts from rest and travels upwards along a straight road of 450m inclined at an angle of 5^oC to the horizontal and the speed of the car is $28.0\ ms^{-1}$ at the top of the slope. Determine: its acceleration, the time taken to travel the length of the slope, gain in kinetic energy and gain in gravitational potential energy. (c) The position of a particle is given $x = 3 - 2t + 3t^2m$. (i) what is its instantaneous velocity and acceleration at $t = 3s$? (ii) at what time is the particle at rest.

8. (a) A glass tube 0.15mm in diameter is dropped in glycerin which surface tension is $0.0632Nm^{-1}$. Calculate the contact angle if the glycerin rises to a height of 14cm. (the density of glycerin is $1250kgm^{-3}$ and g = $9.8ms^{-2}$). (b) A system absorbs 1500J of heat energy from its surroundings. Determine the change in the internal energy of the system when: (i) system performs 2200J of work on the surroundings (ii) the surroundings perform 2200J of work on the system. (c) Two moles of an ideal gas are compressed slowly and isothermally from a volume $0.4m^3$ to $0.1m^3$ at a temperature of 27^0C. How much work is done?

9. (a). State the law of gravitation. The mass m_1 of one small spheres of a Cavendish balance is 0.01kg, the mass m_2 of one of the large spheres is 0.50kg, and the center – center distance between each large sphere and the nearer small one is 0.05m. Find the gravitational force F_g on each sphere due to the nearest other sphere. (b) Suppose one large sphere and one small sphere are detached from the system in (a) above and placed 0.05m (between centers) from each other at a point in space far removed from all other bodies. What is the magnitude of the acceleration of each relative to an inertial system?

10. (a) If the hot air in a balloon have a density equal to ¾ of the density of air, what minimum balloon volume is required to lift a total load of 500kg. The density of air at 0^0C and atmospheric pressure is $1.29kgm^{-3}$. (b) A glass fiber of diameter 12µm is found to break under a load of 12g. Determine the breaking stress of the fiber. (c) A small oil drop falls with a terminal velocity of 4 x $10^{-4}ms^{-1}$ thorough air, calculate the radius of the drop. Viscosity of air = $1.8x10^{-5}Nsm^{-2}$. Density of oil = $900kgm^{-3}$, g = $10ms^{-2}$, neglect density of air.

11. How many beats are heard assuming two vibrating strings have fundamental frequencies of 160Hz and 322Hz respectively? (b) Two observers A and B are provided with sources of sound of frequency 500Hz. A remain stationery and B moves away from him at a velocity of $1.8ms^{-1}$, how many beats per second are observed by A and B, the velocity of sound beats $330ms^{-1}$. (c) The intensity level of the sound produced at a rock concert often reach 120dB. The intensity level of a quiet flute is about 67dB. What is the ratio of the sound intensity of a rock concert to the sound constantly produced by a quiet flute?