U7507

Reg. No.: ……..……..……..

Name:……..……..……...

University of Kerala

First Semester Degree Examination, November 2024

Four Year Under Graduate Programme

Discipline Specific Core Course

PHYSICS

UK1DSCPHY100- Foundation Course in Physics I

Academic Level: 100-199

Time: 1½ hours Max.Marks: 42

Part A.

Answer All Questions, Objective Type. 1 Mark Each.

(Cognitive Level: Remember/Understand) 6 Marks. Time: 6Minutes

Qn.No.	Question	Cognitive Level	Course Outcome (CO)
1.	State Gauss' divergence theorem.	Remember	1
2.	State SI unit of power.	Remember	2
3.	Explain how gravity affects the weight of an object, but not the mass.	Understand	2
4.	Explain why the kinetic energy will always be positive or zero	Understand	3
5.	Discuss the method to calculate work from a force vs. distance graph.	Understand	3
6.	Discuss the equation for total kinetic energy in rolling motion.	Understand	4

Part B.

Answer All Questions, Short Answer. 2 Marks Each.

(Cognitive Level: Understand/Apply) 8 Marks. Time: 24 Minutes

Qn.No.	Question	Cognitive Level	Course Outcome (CO)
7.	Describe how acceleration due to gravity varies with location.	Understand	2
8.	Sketch the divergence of flux lines on electric charge (both positive and negative).	Apply	1
9.	Estimate the work done in a closed loop by a conservative force.	Apply	3
10.	Write a note on elastic potential energy	Understand	4

Part C.
Answer all 4 questions, choosing among options within each question.
Long Answer. 7 Marks Each.
(Cognitive Level: Apply) 28 Marks. Time: 60 Minutes

Qn.No.	Question	Cognitive Level	Course Outcome (CO)
11.	A. A spacecraft of mass 1000 kg is traveling in space and fires its thrusters to exert a constant force of 4000 N for 5 seconds. i) Calculate the acceleration of the spacecraft. ii) Determine the change in velocity of the spacecraft after 5 seconds. iii) Find the total distance traveled by the spacecraft during this time. **OR** B. A 10 kg object is subjected to a force of 40 N at an angle of 30° above the horizontal. The object moves horizontally on a frictionless surface. i) Calculate the horizontal component of the force. ii) Determine the vertical component of the force. iii) Find the acceleration of the object in the horizontal direction.	Apply	5
12.	A. Derive the impulse-momentum theorem using the statement of Newton's second law and explain how it relates to the change in momentum of an object. **OR** B. A baseball of mass 0.15 kg is thrown with a velocity of 40 m/s. The bat strikes the ball and reverses its direction, sending it back with a velocity of 30 m/s. The time of contact between the bat and the ball is 0.02 seconds. i) Calculate the change in momentum of the baseball. ii) Determine the impulse delivered by the bat to the ball. iii) Calculate the average force exerted by the bat on the baseball.	Apply	2
13.	A. Describe how work and energy are calculated for an object moving along a curved path under the influence of a variable force. **OR** B. i) Discuss elastic potential energy and calculate the expression for total elastic potential energy stored in a spring when it gets compressed. ii) A person weighing 600 N steps on a bathroom scale that contains a stiff spring. In equilibrium, the spring is compressed 1.0 cm under her weight. Find the force constant of the spring and total elastic potential energy. stored in it.	Apply	3
14.	A. State and explain parallel axes theorem. Apply this theorem to determine the moment of inertia of a thin wire with respect to an axis passing through its edge and parallel to its principal axis. **OR** B. A uniform rod of mass 4 kg and length 1.5 meters is pivoted at a point 0.3 meters from one of its ends. The axis of rotation is perpendicular to the rod. i) Calculate the moment of inertia of the rod about this axis using the parallel axis theorem. ii) If the rod is rotating with an angular speed of 6 rad/s, determine its rotational kinetic energy.	Apply	4

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University of Kerala

First Semester Degree Examination, November 2024

Four Year Under Graduate Programme

Discipline Specific Core Course

PHYSICS

UK1DSCPHY101- Principles of Dynamics

Academic Level: 100-199

Time: 1½ hours Max.Marks: 42

Part A.
Answer All Questions, Objective Type. 1 Mark Each.
(Cognitive Level: Remember/Understand) 6 Marks. Time: 6Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
1.	Define divergence of two vectors	Remember	1
2.	Define Centre of Mass.	Remember	3
3.	Describe the conservation of linear momentum	Understand	3
4.	If the work done is zero, discuss the angle between force and displacement	Understand	4
5.	Explain work-energy theorem	Understand	4
6.	State an example for the action-reaction pair	Understand	2

Part B.
Answer All Questions, Short Answer. 2 Marks Each.
(Cognitive Level: Understand/Apply) 8 Marks. Time: 24 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
7.	Define coefficient of static friction	Understand	2
8.	List and explain the parameters that remain constant during an elastic collision.	Understand	3
9.	Restate the impulse-momentum theorem with an example of impulse	Understand	2
10.	Discuss the differences between tangential and radial acceleration	Understand	4

Part C.
Answer all 4 questions, choosing among options within each question.
Long Answer. 7 Marks Each.
(Cognitive Level: Apply/Analyse/Evaluate/Create) 28 Marks. Time: 60 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
11.	A. (i) Discuss the motion of a projectile launched at an angle with respect to the horizontal. (ii) Explain how the position, velocity, and acceleration vectors change throughout the motion. (iii) Use equations to illustrate the horizontal and vertical components of the motion, and describe how gravity affects the projectile. **OR** B. (i) Discuss Newton's Second Law of motion, explaining the relationship between force, mass, and acceleration. (ii) Describe applications in everyday life.	Understand	2
12.	A. Discuss the differences between elastic and inelastic collisions, highlighting conservation of momentum and energy. Provide examples. **OR** B. Describe and compare elastic and inelastic collisions, focusing on momentum and energy conservation, and provide practical applications.	Understand	3
13.	A. Explain the concepts of torque and its relationship with angular momentum by examining how torque influences the rotational motion of objects. **OR** B. (i) Explain the concept of work-energy theorem, highlighting its significance in physics. (ii) Describe how it relates to kinetic energy and potential energy	Understand	4
14.	A. Explain Newton’s second law for particles in uniform circular motion. **OR** B. (i) Explain the gyroscopic effect, focusing on the vector aspects of angular momentum. (ii) Demonstrate how the conservation of angular momentum causes gyroscopes and spinning objects to resist changes in their orientation	Understand	4

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University of Kerala

First Semester Degree Examination, November 2024

Four Year Under Graduate Programme

Discipline Specific Core Course

PHYSICS

UK1DSCPHY102- PROPERTIES OF SOLIDS

Academic Level: 100-199

Time: 1½ hours Max.Marks: 42

Part A.

Answer All Questions, Objective Type. 1 Mark Each.

(Cognitive Level: Remember/Understand) 6 Marks. Time: 6Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
1.	What type of bonding is found in diamond?	Understand	1
2.	Which law states that the ratio of thermal conductivity to electrical conductivity of a metal is proportional to its temperature?	Remember	4
3.	What is the full form of MOSFET?	Remember	1
4.	Describe exchange interaction in ferromagnetic materials.	Understand	2
5.	Give two examples of superconducting materials and mention their transition temperatures.	Understand	3
6.	Define thermal diffusivity.	Understand	4

Part B.

Answer All Questions, Short Answer. 2 Marks Each.

(Cognitive Level: Understand/Apply) 8 Marks. Time: 24 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
7.	Explain Meissner effect in Superconductors.	Understand	3
8.	What are donor and acceptor energy levels in semiconductors?	Understand	1
9.	Find the relative permeability of a ferromagnetic material if a field strength of 200 Am^{-1} produces a magnetisation of 3100 Am^{-1}.	Apply	2
10.	One of the faces of a Cu cube of side 7.7cm is maintained at 100^0C and the opposite face at 30^0C. if the thermal conductivity of Cu is 385$Wm^{-1}K^{-1}$.Calculate the rate of flow of heat through the cube.	Apply	4

Part C.

Answer all 4 questions, choosing among options within each question.

Long Answer. 7 Marks Each.

(Cognitive Level: Apply/Analyse/Evaluate/Create) 28 Marks. Time: 60 Minutes

Qn.No.	Question	Cognitive Level	Course Outcome (CO)
11.	A) Model a p-n junction by specifying the doping process and explain how the p-type and n-type regions influence the behaviour of the semiconductor in electronic devices. **OR** B) Demonstrate the working of LED and OLED with necessary theory.	Apply	1
12.	A)Illustrate how magnetic materials are classified as diamagnetic, paramagnetic and ferromagnetic. Mention any two uses of magnetic materials **OR** B) i) Demonstrate how magnetic materials are used for information storage. ii) Apply hysteresis curve to explain the behavior of a ferromagnet.	Apply	2
13.	A) Compare Type I and Type 2 Superconductors in detail. **OR** B) What are two key applications of superconductors in modern technology? Use BCS theory to explain Superconductivity	Apply	3
14.	A) Illustrate different thermoelectric effects in solids. Define thermoelectric power. **OR** B) Use appropriate theory to cylindrical flow of heat.	Apply	4

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University of Kerala

First Semester Degree Examination, November 2024

Four Year Under Graduate Programme

Discipline Specific Core Course

PHYSICS

UK1DSCPHY102- PROPERTIES OF SOLIDS

Academic Level: 100-199

Time: 1½ hours Max.Marks: 42

Part A.

Answer All Questions, Objective Type. 1 Mark Each.

(Cognitive Level: Remember/Understand) 6 Marks. Time: 6Minutes

Qn.No.	Question	Cognitive Level	Course Outcome (CO)
1.	Recollect the relation connecting critical temperature and isotopic mass of superconductors.	Remember	3
2.	Name the impurity added to silicon to make an N-type semiconductor.	Remember	1
3.	What does MOSFET stand for?	Understand	1
4.	Define Meissner effect.	Understand	3
5.	What is the term for the heat required to convert one gram of solid into a liquid at its melting point?	Understand	4
6.	What is the relationship between permeability and magnetic susceptibility?	Understand	2

Part B.

Answer All Questions, Short Answer. 2 Marks Each.

(Cognitive Level: Understand/Apply) 8 Marks. Time: 24 Minutes

Qn.No.	Question	Cognitive Level	Course Outcome (CO)
7.	What effect do impurities have on the freezing point of ice?	Apply	4
8.	Briefly describe any two applications of superconductivity.	Understand	3
9.	Interpret how energy loss of ferromagnetic materials depends on shape of hysteresis loop. Classify the materials based on size of loop.	Understand	2
10.	A semiconductor is struck by light of slowly increasing frequency and begins to conduct when the wavelength of the light is 620 nm. Estimate the energy gap E_g.	Apply	1

Part C.

Answer all 4 questions, choosing among options within each question.

Long Answer. 7 Marks Each.

(Cognitive Level: Apply/Analyse/Evaluate/Create) 28 Marks. Time: 60 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
11.	A. Differentiate various types of bonding in solids. **OR** B. i) Identify the differences between p-type & n-type semiconductors. ii)Develop an idea on OLED.	Apply	1
12.	A. Differentiate between Antiferromagnetism and Ferrimagnetism. Give examples. **OR** B. i) Differentiate curie and Neel temperature. ii)With a neat diagram explain hysteresis loop.	Apply	2
13.	A. Compare and contrast Type I and Type II superconductors based on their physical properties and behavior in a magnetic field. **OR** B i) Explain Cooper pairs. ii) Calculate the London penetration depth for lead at 5.2 K if the penetration depth at 0 K is 37 nm. The critical temperature of lead is 7.193 K.	Apply	3
14.	A. i) Explain the term thermal conductivity ii) The thermal conductivity of copper is 390 W m^{-1} K^{-1}. Calculate the rate of heat transfer through a copper wire with area 4.0 cm^2 and length 0.50 m. The temperature difference between both of the ends of the wire is 30^0C **OR** B. Describe the important thermoelectric effects -Seebeck, Peltier and Thomson effects.	Apply	4

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University of Kerala

First Semester Degree Examination, November 2024

Four Year Under Graduate Programme

Discipline Specific Core Course

PHYSICS

UK1DSCPHY103- INTRODUCTION TO MECHANICS AND ENERGY RESOURCES

Academic Level: 100-199

Time: 1½ hours Max.Marks: 42

Part A.
Answer All Questions, Objective Type. 1 Mark Each.
(Cognitive Level: Remember/Understand) 6 Marks. Time: 6Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
1.	Define Torque.	Remember	4
2.	Outline the primary energy sources.	Remember	3
3.	Differentiate conventional and non-conventional energy resources.	Understand	3
4.	Summarize the number significant figures in each measurement (a) 0.006606 s (b) 36.7 m	Understand	1
5.	Explain the dot and cross product of two vectors A and B.	Understand	1
6.	Restate Newton's law of gravitation	Understand	2

Part B.
Answer All Questions, Short Answer. 2 Marks Each.
(Cognitive Level: Understand/Apply) 8 Marks. Time: 24 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
7.	Describe the relation connecting linear velocity and angular velocity	Understand	4
8.	Distinguish between Nuclear fission and nuclear fusion in terms of energy production.	Understand	3
9.	Determine the magnitude of the given vector 5i-4j+2k	Apply	1
10.	Explain why moon has no atmosphere	Understand	2

Part C.

Answer all 4 questions, choosing among options within each question.

Long Answer. 7 Marks Each.

(Cognitive Level: Apply/Analyse/Evaluate/Create) 28 Marks. Time: 60 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
11.	A. Explain Solar Constant. Describe the merits and demerits of using solar energy as an energy resource **OR** B. Explain the components of a nuclear reactor with a labelled diagram.	Understand	3
12.	A. Summarize that Kepler's second law is equivalent to law of conservation of angular momentum **OR** B. Interpret using Kepler's second law to convince yourself that the Earth must move faster in its orbit during December, when it is closest to the Sun, than during June, when it is farthest from the Sun.	Understand	2
13.	A. Illustrate the procedure for adding two vectors geometrically. Then demonstrate the properties of vector addition geometrically **OR** B. Explain scalar and vector product of two vectors. Calculate the angle between a = 3i - 4j and b = -2i + 3k.and show that A=2i -3j - k and B = -6i + 9j +3k are parallel	Apply	1
14.	A. Contrast the kinematic equations for linear with rotational motion arriving at the relation connecting Torque, Moment of Inertia and Angular Acceleration **OR** B. (a) State parallel axis theorem. (b) A rod of uniform cross section is rotated about (i) an axis along its central axis and (ii) an axis perpendicular to the central axis. Differentiate the moment of inertia in both cases.	Understand	4

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University of Kerala

First Semester Degree Examination, November 2024

Four Year Under Graduate Programme

Discipline Specific Core Course

PHYSICS

UK1DSCPHY103- INTRODUCTION TO MECHANICS AND ENERGY RESOURCES

Academic Level: 100-199

Time: 1½ hours Max.Marks: 42

Part A.

Answer All Questions, Objective Type. 1 Mark Each.

(Cognitive Level: Remember/Understand) 6 Marks. Time: 6Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
1.	Name any three renewable energy resources.	Remember	3
2.	Name the process by which energy is generated in a nuclear reactor.	Remember	3
3.	Discuss any law on vector addition.	Understand	1
4.	Explain the representation a two-dimensional vector into its component forms.	Understand	1
5.	Restate Newton's second law of rotation.	Understand	4
6.	Explain rotational inertia of an object.	Understand	4

Part B.

Answer All Questions, Short Answer. 2 Marks Each.

(Cognitive Level: Understand/Apply) 8 Marks. Time: 24 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
7.	A vector of 10 Newton is 30° north of east. Determine its components along east and north directions.	Apply	1
8.	A horizontally mounted wheel of radius r is initially at rest, and then begins to accelerate constantly until it has reached an angular velocity ω after 5 complete revolutions. Explain about the angular acceleration of the wheel.	Understand	4
9.	Explain Kepler's law of orbits.	Understand	4
10.	Distinguish between nuclear fission and nuclear fusion.	Understand	3

Part C.

Answer all 4 questions, choosing among options within each question.

Long Answer. 7 Marks Each.

(Cognitive Level: Apply/Analyse/Evaluate/Create) 28 Marks. Time: 60 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
11.	A. Describe solar energy in brief and explain its applications. **OR** B. Describe biomass and explain how biomass conversion takes place	Understand	3
12.	A. Discuss rotational inertia of continuous body and explain the parallel axis theorem. **OR** B. Discuss Newton's second law for rotation to relate the net torque on a body to the bodies rotational Inertia and rotational acceleration	Understand	4
13.	A. a) Illustrate Significant Figures. Give the rules to determine significant figures. b) Calculate the number of significant figures is there in each of the following numbers? i. 123 g ii. 0.123 m iii. 0.0456 g iv. 1.26×10^3 W v. 2.2315 vi. 50 **OR** B. a)Illustrate cross product and dot product of two vectors $\vec{A} \wedge \vec{B}$. b) Determine the angle between the vectors $3\hat{i}+\hat{j}+2\hat{k} \wedge 5\hat{i}+7\hat{j}+3\hat{k}$. c)If $\vec{A}=4\hat{i}-3\hat{j}+\hat{k} \wedge \vec{B}=5\hat{i}-2\hat{j}-2\hat{k}$, *find* $\vec{C}=\vec{A}\times\vec{B}$. *Determine* whether $\vec{C}$ is perpendicular to $\vec{A} \wedge \vec{B}$.find unit vectors along $\vec{A},\vec{B} \wedge \vec{C}$.	Apply	1
14.	A. A satellite is placed in a circular orbit 300 km above the Earth's surface. Given that the radius of the Earth is 6370 km and the mass of the Earth is 5.98×10^{24} kg and Gravitational constant ($G=6.674 \times 10^{-11} \mathrm{Nm}^2/\mathrm{kg}^2$). Discuss by calculation orbital velocity of the satellite. **OR** B. The mass of the Moon is 7.36×10^{22} *kg* and the escape velocity from the Moon's surface is 2.38 km/s. Interpret by calculation the radius of the Moon.	Understand	2