		Surname		Type
Group Number		Name		A
List Number		e-mail		
Student ID		Signature		

ATTENTION:Each question has only one correct answer and is worth one point. Be sure to fill in completely the circle that corresponds to your answer on the answer sheet. Use a pencil (not a pen). Only the answers on your answer sheet will be taken into account.

1. Which of the following statements is always correct?
I. A force acting on a body is the negative value of the x derivative of the potential energy function of this force.
II. The magnitude of a force acting on a body is the negative value of the x derivative of the potential energy function of this force.
III. The undefined constant in the potential energy will allow defining this energy to be zero at any desired point.
IV. The derivative of the potential energy function is equal to the conservative force in both magnitude and direction.

(a) IV and III (b) only IV (c) only I (d) I and III (e) only III

2. The physical quantity 'impulse' has the same dimensions as that of:

(a) momentum (b) power (c) work (d) energy (e) force

3. There are two planets whose masses M and m and their centre-to-centre separation is r. What is the value of the gravitational field (kütle çekim alanı) produced by M at the location of mass m?

(a) $G.M.m/r^2$ (b) $G.m/r^2$ (c) $4\pi r^2$ (d) $G.M/r^2$ (e) $g.m.M/r^2$

4. Which of the following is correct? In uniform circular motion I. $\vec{v}$ is constant, II. v is constant, III. a is constant, IV. $\vec{a}$ is constant.

(a) I,III (b) I,IV (c) I,II,III,IV (d) II,III (e) II,IV

5. Which of the following statements is true?

(a) The change in kinetic energy is equal to the net work done. (b) The change in potential energy is equal to the work done. (c) If non-conservative forces are doing work, **total** energy is not conserved. (d) The change in potential energy is equal to the negative of the work done. (e) Mechanical energy is always conserved.

6. Which of the following is the unit of Power in MKS unit system?

(a) $\mathrm{kg\,m^2/s}$ (b) none of them (c) $\mathrm{kg\,m/s}$ (d) $\mathrm{kg\,m^2/s^3}$ (e) $\mathrm{kg\,m^2/s^2}$

7. Consider an object with acceleration function $a(t) = 3t\,(m/s^3) - 3\,(m/s^2)$ with initial conditions v(t=0)=1 m/s and x(t=0)=2 m. What is the magnitude of the position of the object at t=1 s?

(a) 2 m (b) 6 m (c) 4 m (d) 3 m (e) 5 m

8. The position of a point mass 2.0 kg is given as a function of time by $\vec{r} = 6\hat{i}\,(m) + 5t\hat{j}\,(m/s)$. What is the angular momentum of this mass about the origin in $kg\,m^2$/s at t=1 s?

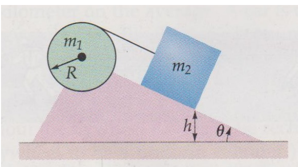
(a) $30\hat{k}$ (b) $30\hat{j}$ (c) $6\hat{j}$ (d) $6\hat{i} + 5\hat{j}$ (e) $25\hat{k}$

9. There are two blocks on top of one another. All surfaces are frictionless. The bottom block is pulled with force F. If the mass of the top block is doubled, the force necessary to pull the bottom block with the same acceleration as before, should be;

(a) 2F (b) F (c) None of them (d) F/2 (e) 0

Questions 10-13

A uniform cylinder of mass $m_1 = 0.5kg$ and radius $R = 10cm$ is pivoted on frictionless bearings. A string wrapped around the cylinder connects to a mass $m_2 = 1.0kg$, which is on a frictionless incline of angle θ as shown in Figure. The system is released from rest with m_2 at height $h = 1.0m$ above the bottom of the incline. Take $\theta = 30^0$ and $I = \frac{M.R^2}{2}$.



10. What is the acceleration of m$_2$? (a) 0.4 m/s^2 (b) 40 m/s^2 (c) 4 m/s^2 (d) 2 m/s^2 (e) 0.2 m/s^2

11. What is the angular acceleration of the disk? (a) 2 rad/s^2 (b) 4 rad/s^2 (c) 0.4 rad/s^2 (d) 0.2 rad/s^2 (e) 40 rad/s^2

12. What is the tension in the string? (a) 10 N (b) 0.5 N (c) 5 N (d) 0.1 N (e) 1 N

13. What is the speed of the m_2 at the bottom of the incline? (a) $\frac{\sqrt{10}}{3}$ (b) $\frac{\sqrt{40}}{3}$ (c) 4 (d) $\frac{\sqrt{4}}{3}$ (e) $\frac{\sqrt{20}}{3}$

Questions 14-18

In a tape recorder, the magnetic tape moves at a constant linear speed of approximately 5 cm/s. To maintain this constant linear speed, the angular speed of the driving spool (the take-up spool) has to change accordingly. Mass of the rotating parts are negligable except the tape and the linear mass density of the tape is λ=1.0 gr/m and $I = \frac{1}{2}m(r_1^2 + r_2^2)$

14. What is the angular speed of the take-up spool when it is empty, with radius $r_1 = 1.00$ cm? (a) 0.05 rad/s (b) 50 rad/s (c) 500 rad/s (d) 0.5 rad/s (e) 5 rad/s

15. If the total length of the tape is 100.0 m, what is the average angular acceleration of the take-up spool while the tape is being played? (When the spool is full, $r_2 = 2$ cm.) (a) 0.125 10^{-6} (b) 12.5 10^{-6} (c) 0.0125 10^{-6} (d) 125 10^{-6} (e) 1.25 10^{-6}

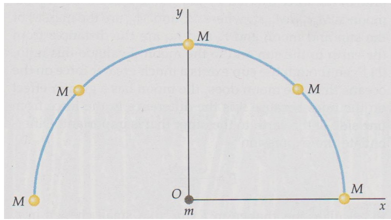
16. What is the moment of inertia of the tape when one spool is empty the other one is full? (a) 10 10^{-6} kgm^2 (b) 20 10^{-6} kgm^2 (c) 25 10^{-6} kgm^2 (d) 15 10^{-6} kgm^2 (e) 5 10^{-6} kgm^2

17. What is the total moment of inertia of the tape when it is equally distributed between the spools? (a) 10.0 10^{-6} kgm^2 (b) 12.5 10^{-6} kgm^2 (c) 7.50 10^{-6} kgm^2 (d) 17.5 10^{-6} kgm^2 (e) 15 10^{-6} kgm^2

18. In which case the rotational kinetic energy of the tape is highest? (a) When one spull have $1/4^{th}$ of the tape and the other one has $3/4^{th}$ of the tape. (b) When one spool is full, the other one is empty. (c) Not enough information is given. (d) When both spools shares the tape equally. (e) The rotational kinetic energy is the same in all cases.

Questions 19-21

Five equal masses M are equally spaced on the arc of a semicircle of radius R as shown in figure. A mass m is located at the center of the curvature of the arc. G is the gravitational constant.



19. What is the direction of the gravitational force on the mass m?

(a) both +x and +y (b) -y (c) +x (d) +y (e) -x

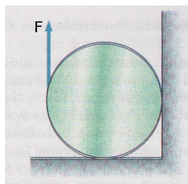
20. What is the magnitude of the gravitational force on the mass m?

(a) $\frac{G.M.m}{R}(1+\sqrt(2))$ (b) $\frac{G.M.m}{R^2}$ (c) $\frac{G.M.m}{R^2}(1-\sqrt(2))$ (d) 0 (e) $\frac{G.M.m}{R^2}(1+\sqrt(2))$

21. What is the magnitude of the gravitational potential energy of the mass m? (a) $5\frac{G.M.m}{R}(1+2\sqrt{2})$ (b) $5\frac{G.M.m}{R}(1-2\sqrt{2})$ (c) $5\frac{G.M.m}{R}$ (d) 0 (e) $5\frac{G.M.m}{R}(1+4\sqrt{2})$

Questions 22-25

A vertical F force is applied tangentially to a uniform solid cylinder with mass m=8 kg as shown in the figure. The static friction coefficient between the cylinder and all of the surfaces is given as μ=0.5. F force is applied with maximum possible magnitude that, the cylinder holds its position without rotating. Take $g = 10\,m/s^2$.



22. What should be the magnitude of the F force?

(a) 30 N (b) 0.3 N (c) 300 N (d) 3 N (e) 0.03 N

23. What is the magnitude of the normal force acting on the cylinder at the bottom position?

(a) 40 N (b) 400 N (c) 0.4 N (d) 4 N (e) 0.04 N

24. What is the magnitude of the normal force on the cylinder due to the side wall?

(a) 0.2 N (b) 200 N (c) 0.02 N (d) 2 N (e) 20 N

25. What is the magnitude and the direction of the friction force on the side wall?

(a) 100 N up (b) 1 N down (c) 10 N up (d) 100 N down (e) 1 N up