SUBJECT : PHYSICS (SET-II)

Time : 3 Hrs.   M.M.: 70

General Instructions :

(i) *All questions are compulsory.*

(ii) *Question numbers 1 to 5 are very short answer type questions carrying 1 marks each.*

(iii) *Question numbers 6 to 10 are very short answer type questions carrying 2 marks each.*

(iv) *Question numbers 11 to 22 are short answer type questions carrying 3 marks each.*

(v) *Question numbers 23 is also a short answer type question carrying 4 marks.*

(vi) *Question numbers 24 to 26 are long answer type questions carrying 5 marks each.*

(vii) *There are no overall choice, but choice is given in one question of 2 marks, one question of 3 marks and in all questions of 5 marks*

Q1. If $|\vec{A}| = 1$, $|\vec{B}| = 1$ and $4.\vec{A}.\vec{B} = |\vec{A} + \vec{B}|^2$, then find the angle between $\vec{A}$ and $\vec{B}$

Q2. Write the dimensional formula for torque.

Q3. A lift is accelerated upwards, will the apparent weight of the person increase, decrease or remain same relative to its real weight.

Q4. What should be the angle between force and displacement for maximum and minimum work.

Q 5. Find the relative error in Z if
$$Z = A^4 B^{1/3} C D^{3/2}$$

Q6. When a fast moving car takes a sudden turn, the passengers experience an outward push. Explain why?

(1)

Q7. Check the accuracy of the equation $\eta = \dfrac{k}{l}\sqrt{\dfrac{T}{m}}$ where k is a dimensionless constant. η is the frequency of transverse waves in a string of length l and m is the mass per unit length of a string of length l under the tension T.

Q8. A labourer lifts 100 bricks to a height of 6m in 2 minutes. If the mass of each brick is 2.5 kg. Calculate his average power.

Q9. Derive the following relation by graphical method:

$$S = ut + 1/2at^2$$

OR

$$v^2 - u^2 = 2as$$

Q10. Prove the vectors $\left(\hat{i} + 2\hat{j} + 3\hat{k}\right)$ and $\left(2\hat{i} - \hat{j}\right)$ are perpendicular to each other.

Q11. Frequency (v) of an oscillating drop may depend on radius (r) of the drop. density (ç) of the liquid and surface tension (s) of the liquid. Deduce the formula dimensionally.

Q12. What do you understand by a resultant vector briefly explain addition of two vectors.

Q13. Blocks of masses m_1 and m_2 are connected via a string and pulley arrangement as shown in figure below. Assuming no frictions. Calculate the direction and magnitude of acceleration of the system.
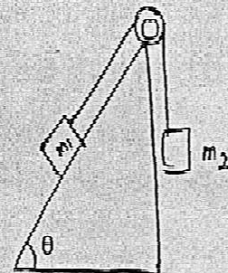
OR

A Brass block of mass 1 kg is placed on an inclined plane inclined at an angle of 30° to the horizontal, if the coefficient of friction between the block and plane be 0.2, what force should be applied.

(2)

(a)   to keep the body sliding down the plane

(b)   to just move it up the plane

Q14. State work-kinetic energy theorem and prove it analytically.

Q15. A bullet of mass 20g is moving with a speed of 150 ms^{-1}. It strikes a target and is brought to rest after piercing 10 cm into it. Calculate the average force of resistance offered by the target.

Q16. Explain

(i)   It is easier to pull a lawn mower than to push it.

(ii) Walking as a resolution of vectors.

Q17. On a certain day, rain was falling vertically with a speed of 35ms-1. A wind started blowing after some time with a speed of 12ms-1 in east to west direction in which direction should a boy waiting at a bus stop hold his umbrella.

Q18. A man can swim with a speed of 4.0 kmph in still water. How long does it take to cross a river 1.0 Km wide if river flows steadily at 3.0 kmph and he makes strokes normal to the river current. How far down the river does he go when he reaches the other bank?

Q19. Give the number of significant figures in the following :

(a)   143000   (b) 2.1×10^{-2}

(c)   100.007

Q20. Prove that in an elastic collision in one dimension the relative velocity of approach before impact is equal to the relative velocity of separation after impact.

Q21. State the laws of limiting friction. Hence define coefficient of friction.

Q22. Draw the position-time graphs for

(i)   Uniform motion

(ii)   Accelerated motion with positive acceleration

(iii) Accelerated motion with negative acceleration.

Q23. Having seen a big stone falling from the top of a tower. Ravi pulled his friend Kiran away. The stone hit Ravi slightly

(3)

and he got hurt, but he was saved from a major accident.

(a) What made Ravi act in such a way?

(b) From the top of the tower 100m in height a b is dropped and at the same time another ball is projected vertically upwards from the ground with a velocity of 25 m/s. When and where the two balls meet.

Q24. State and explain Newton's second law of motion. Hence deduce the relation F = ma. While catching a fast moving ball, why player lowers his hands.

OR

Derive an expression of acceleration and tension when 2 masses m_1 and m_1 (m1>m2) connected to the two ends of an inextensible string passing over a smooth frictionless pulley.

Q25. State parallelogram law of vector addition. Find analytically the magnitude and direction of the resultant of 2 vectors inclined at an angle θ.

OR

A projectile is fired at angle θ with the horizontal with initial velocity u. Find expressions for -

(i) Maximum height reached

(ii) time of flight

(iii) Horizontal range of the projectile

Q26. Define centripetal acceleration. Find an expression for centripetal acceleration acting on a particle in uniform circular motion. What is its direction?

OR

Derive an expression for speed of a car on banked circular track when angle of banking is θ and coefficient of friction is μ.

[4]