CHAPTER
Laws of motion

One mark questions (PART – A):

1. What is inertia? (K)
2. What is the measure of inertia? (K)
3. Give an example for inertia of rest. (U)
4. State Newton's first law of motion. (K)
5. Passengers standing in a stationary bus fall backward, when the bus suddenly starts moving forward. Give reason. (A)
6. Give an example for inertia of motion. (U)
7. Define linear momentum of a body. (K)
8. Write the S.I. unit of linear momentum. (K)
9. State Newton's second law of motion. (K)
10. Why athletes run a few steps before taking a jump? (A)
11. Bullet fired from a gun makes more damages than the bullet of same mass if thrown .Why? (A)
12. Why a cricketer draws his hands while catching a ball? (A)
13. Write the S.I. unit of force. (K)
14. Define S.I .unit of force. (U)
15. What is the force acting on a body of mass 1 g producing an acceleration of 1 cms^{-2}? (U)
16. What is the force acting on a body, where rate of change of momentum is 3kgms^{-1}? (A)
17. Write the dimensional formula of force. (U)
18. Define impulse of a force. (K)
19. What is the net force acting on a body moving with uniform velocity? (U)
20. What happens to the acceleration of the body if net force acting on the body is doubled? (U)
21. Give one example for impulsive force. (U)
22. Mention the expression for impulse. (U)
23. Write the S.I. unit of impulse. (U)
24. Write the dimensional formula of impulse. (U)
25. State Newton's third law of motion. (K)
26. Give one example for Newton's third law of motion. (U)
27. State the law of conservation of linear momentum. (K)
28. Give one example that illustrates the law of conservation of linear momentum. (U)
29. What are concurrent forces? (K)
30. What is the condition for equilibrium of two forces acting on a body? (U)
31. Name one contact force in mechanics. (K)
32. Name one non contact force in mechanics. (K)
33. What is frictional force? (K)
34. What is meant by normal reaction force? (K)
35. Define static friction. (K)
36. What is meant by the limiting friction? (U)
37. Define kinetic friction. (K)

38. Define rolling friction. (K)
39. Why ball bearings are placed between moving parts of a machine? (A)
40. Which is greater, μ_k or μ_s? (U)
41. What is the angle between frictional force and instantaneous velocity of motion over a rough surface? (A)
42. Give one example to show that friction is critically needed. (U)

Two mark questions (PART – B):

1. Write the mathematical form of Newton's second law of motion. Explain the terms. (U)
2. Why a force is necessary to whirl the stone tied to a string with uniform speed in a horizontal plane? Explain. (A)
3. No force is needed to move a body with constant velocity. Explain. (U)
4. Explain any one illustration that uses Newton's third law of motion in our daily life. (A)
5. Explain why forces of action and reaction cannot cancel even though they are equal and opposite? (A)
6. Force of 9N acting on a body for 0.03s. Calculate the impulse. (A)
7. Explain any one example that uses law of conservation of linear momentum (U)
8. Write the expression for coefficient of static friction. Explain the terms used. (U)
9. Write the expression for coefficient of kinetic friction. Explain the terms used. (U)
10. Mention two methods of reducing the friction. (U)
11. Mention two disadvantages of friction. (U)
12. Mention two advantages of friction. (U)
13. An object of mass 15 kg is moved on a horizontal surface by a force of 75N .Calculate the coefficient of friction. g=10ms^{-2}. (S)
14. Write the expression for maximum speed of circular motion of the car on a rough level road. Explain the terms used. (U)
15. Write the expression for maximum speed of circular motion of the car on a rough banked road .Explain the terms used. (U)
16. What is the need for banking the circular road? Explain. (U)
17. On the banked circular road, name the forces which provide the necessary centripetal force? (U)

Three mark questions (PART – C):

1. State Newton's laws of motion. (K)
2. State Newton's first law of motion and hence define force and inertia of a body. (U)
3. Mention the three types of friction. (K)
4. State the laws of friction (U).
5. What is the condition for equilibrium of three concurrent forces acting on a body. Explain with vector diagram. (S)
6. A force of 2N is acting on a body of mass 1kg.Starting from rest how much distance the body moves in 5s? (S) (12.5N)
7. A body of mass 5kg is moving with a velocity of 10ms^{-1}.How long does the body take to come to rest when a force of 8N acts on body? (S)(6.25s)

8. A block of 30N weight rests on a rough surface. A horizontal force of 10N required to start the motion of the block on the surface and a force of 7N will keep the block in uniform motion on the surface. Find μ_k and μ_s. (S) (0.233, 0.333)

Five mark questions (PART – D):

1. State Newton's second law of motion and hence derive F=ma. (U)
2. State and prove the law of conservation of linear momentum from Newton's third law of motion. (U)
3. Derive an expression for maximum speed of circular motion of the car on a rough banked road. (U)

Problems

1. Two perpendicular forces of 3N and 4N are acting on a body of mass 2kg. Calculate the magnitude and direction of acceleration of the body. (S)($2.5ms^{-2}$, $53^0 07^1$ with3N)
2. Stone of mass 3kg is dropped from the top of a building 25m high on a heap of sand. Stone penetrates 0.5m deep in sand. Calculate the retarding force exerted by the sand on stone. $g=10ms^{-2}$(S)   (-1500N)
3. Bus of mass 4000kg is moving with a speed of 54km/h on a level road. Calculate the force required to stop the bus in a distance of 40m. (S)(-11,250N)
4. A body of mass 0.5kg moving with a velocity $10ms^{-1}$ is stopped by a force of 2N. Calculate the impulse of the force. (S)(5Ns)
5. A body of mass 1kg moving with a velocity $15ms^{-1}$ is stopped in 2s.Calculate the impulse and opposing force. (S)(15Ns,-7.5N)
6. A bullet of mass 100g is moving with a speed of $50ms^{-1}$ enters a heavy wooden block and is stopped after a distance of 50m.What is the resistive force exerted by the block on the bullet? (S)(-0.225N)
7. Two balls each of mass 45g moving in opposite direction with a speed of $15ms^{-1}$ are collide and rebounds with same velocity. Calculate the impulse imparted to each other. (S)
   ($1.35kgms^{-1}$,$-1.35kgms^{-1}$)
8. Bullet of mass 30g is fired from a gun of mass 10kg with a velocity $300ms^{-1}$.What is the recoil velocity of the gun?(S) ($-0.9ms^{-1}$)
9. A body of mass 14kg moving with a velocity $4ms^{-1}$ along the X axis explodes into two parts of masses 8kg and 6kg. The heavier mass part moves along X axis with $10ms^{-1}$.Find the velocity of the smaller part. What is the direction of velocity of smaller part? (S) ($-4ms^{-1}$,-Xaxis)
10. A man of mass70kg stands on a weighing machine lift which is moving,
    What should be the reading on the scale if (a) Lift moves upwards with a uniform speed $10ms^{-1}$.
    (b) Downwards with a uniform acceleration of $5ms^{-2.}$ (c) Upward s with a uniform acceleration of $5ms^{-2.}$ Given $g=10ms^{-2}$. (S)   (0,350N, 1050N)
11. Two bodies of masses 10kg and 20kg respectively kept on a smooth horizontal surface are tied to the ends of a light string. A horizontal force600N is applied to (1) 10kg mass (2) 20kg mass along direction of the string. What is the tension in the string in each case? (S) (400N, 200N)