Roll No.			

Code No.-1/1/1

Candidate must write the Code No. on the title page of the answer book.

- Please check that this question paper contains 4 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 26 questions.
- Please write down the Serial Number of the question before attempting it.

FIRST TERM EXAMINATION 2016 -17

SUBJECT CODE - 1103

Time allowed: **3 Hours** Maximum Marks: 70

General Instruction:

(a) All questions are compulsory.
(b) There are 26 questions in total. Questions 1 to 5 carry one mark each, questions 6 to 10 carry two marks each, questions 11 to 23 carry three marks each and questions 24 to 36 carry five marks each.
(c) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and one question of five marks each.
(d) Use of calculators is not permitted.
(e) You may use the following physical constants wherever necessary:

$c = 3X\ 10^{8}$ m/s — Mass of electron $= 9.1X\ 10^{-31}$ kg
$h = 6.6 \times 10^{-34}$ Js — Mass of neutron $= 1.67 \times 10^{-27}$ kg
$e = 1.6 \times 10^{-19}$ C — Boltzmann's constant $= 1.38 \times 10^{-23}$ J/K
$\mu_0 = 4\Pi \times 10^{-7}$ TmA^{-1} — Avogadro Number $= 6.023 \times 10^{23}$ /mol

1. If $x=a+bt+ct^2$, where x is in metres and t in seconds, what is the dimensional formula of c?
2. Write the number of significant figures in each of the following measurement:

(i) $1.67X10^{-27}$Kg (ii) 0.270cm.

3. When a ball hits a wall with a velocity of 50m/s and bounces back with the same velocity. What is the change in velocity of the ball?

4. Give the magnitude and direction of the net force acting on a drop of rain falling down with a constant speed.

5. A light body and a heavy body have the same momentum. Which one will have greater kinetic energy?

6. If two resistances of values $R_1 = (100 \pm 3)\ \Omega$ and $R_2 = (200 \pm 4)\ \Omega$ are put in parallel. Find the error in the equivalent resistance.

OR

A physical quantity P is related to four observables, a, b, c, and d as follows:

$P = a^3 b^2 / c^{1/2} d$

The percentage errors of measurement in a,b,c and d are 1%, 3%, 4%, and 2% respectively. What is the percentage error in the quantity P? If the value of P calculated using the given relation turns out to be 3.763, to what value should the result be rounded off?

7. Derive by method of dimensions, an expression for the time period (T) of oscillation of the simple pendulum, assuming that this time period depends upon (i)length of pendulum and (ii) acceleration due to gravity.

8. Draw the position –time graphs for two objects initially occupying different positions but having zero relative velocity.

9. A horizontal force of 10N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2.Calculate the weight of the block.

10. Show that the mechanical energy of a freely falling body is conserved.

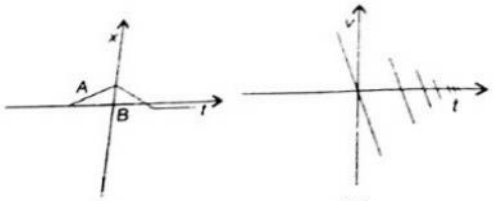
11. Write three uses of dimensional analysis. Convert 10 joule to erg using the dimensional analysis.

12. What do you mean by parallax? How can you measure the distance of a nearby star by parallax method?

13. Resultant of two equal forces acting at right angle to each other is 14.14N.Find the magnitude of each force.

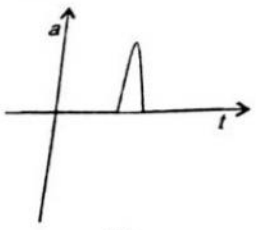
14. A passenger arriving in a new town wishes to go from the station to a hotel located 10km away on a straight road from the station. A dishonest cabman takes him along a circuitous path 23km long and reaches the hotel in 28min.What is (i)the average speed of the taxi, (ii)the magnitude of average velocity? Are they equal?

15. Suggest a suitable physical situation for each of the following graphs



(a)

(b)



(c)

16. An aircraft executes a horizontal loop of radius 1.00km with a steady speed of 900km/h.Compare its centripetal acceleration with the acceleration due to gravity.

17. Show that Newton's second law of motion is a real law of motion.

OR

A helicopter of mass 1000kg rises with a vertical acceleration of 15m/s^2.The crew and the passengers weigh 300kg.Give the magnitude and direction of the

(i) Force on the floor by the crew and passengers.

(ii) Action of the rotor of the helicopter on the surrounding air, and

(iii) Force on the helicopter due to the surrounding air.

18. Show that it is easier to pull than to push a body.

19. Show that in elastic one dimensional collision, velocity of approach before collision is equal to velocity of separation after collision for two bodies of equal masses.

20.What is a conservative force? Prove that gravitational force is conservative, while frictional force is non-conservative.

21. If the momentum of the body increases by 20%.What will be the increase in the K.E. of the body?

22.A person trying to lose weight (dieter) lifts a 10kg mass 1000 times to a height of 0.5m each time. Assume that the potential energy lost each time she lowers the mass is dissipated.

(i) How much work does she do against the gravitational force?

(ii) Fat supplied 3.8 x10^7J of energy per kilogram which is converted to mechanical energy with 20% efficiency rate. How much fat will the dieter use up?

23. Rohit and Suresh were going to the market when they spotted a man who left a black bag in the corner of the stall and ran away. They went near it and heard some ticking sound coming from it. They immediately called the police and alerted the people nearby. By their alertness a major tragedy was averted.

(i) What values were shown by Rohit and Suresh ?

(ii) A bomb at rest explodes into 2 fragments of mass 3.0 Kg and 1.0 Kg. The total K.E of fragments is 6x10^4J. Calculate the K.E of the bigger fragment.

(iii) In which type of collision, elastic or inelastic, momentum is conserved?

24. Derive the three equations of motion by calculus method. Express conditions under which they can be used.

OR

Prove that the path of a projectile is a parabola. If the time of flight of a projectile projected with a velocity u at an angle θ is $2u\sin\theta/g$, find the condition for maximum range and its value.

25. Derive an expression for velocity of a car on a banked circular road having coefficient of friction (u).Hence write the expression for optimum velocity.

OR

Explain:

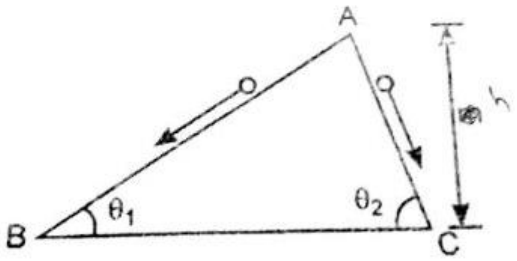
(i) Why are ball bearings used in machinery?

(ii) Why does a horse have to apply more force to start a cart than to keep it moving?

(iii) State two advantages and two disadvantages of friction.

(iv) What is the need for banking the tracks?

26. Two inclined frictionless tracks, one gradual and the other steep, meet at A from where two stones are allowed to slide down from rest, one on each track. Will the stones reach the bottom at the same time? Will they reach there with the same speed? Explain.Given $\theta_1 = 30°, \theta_2 = 60°$ and h =10m. What are the speeds and times taken by the two stones?



OR

A 1kg block situated on a rough inclined is connected to a spring of spring constant 100N/m as shown in figure. The block is released from rest with the spring in the outstretched position. The block moves 10cm down the incline before coming to rest. Find the coefficient of friction between the block and the incline. Assume that the spring has a negligible mass and the pulley is frictionless.