1st Semester Back Examination 2017-18
MECHANICS
BRANCH : AEIE, AUTO, CHEM, CIVIL,
CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, IEE, IT, MECH, MME, PE, TEXTILE
Time : 3 Hours
Max Marks : 100
Q.CODE : B926
Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions: multiple type or dash fill up type** **(2 x 10)**
a) If the sum of all the forces acting on a body is zero, then the body may be in equilibrium
provided the forces are
(a) Concurrent (b) Parallel
(c) Like parallel (d) Unlike parallel

b) The centre of gravity of hemisphere lies at a distance of ......form its base measured along the vertical radius.

c) The moment of inertia of a circular section of diameter (d) is given by the relation……………

d) The moment of inertia of a triangular section of base (b) and height (h) about an axis through its c.g. and parallel to the base is given by the relation……………..

e) The centre of gravity of an equilateral triangle with each side (a) is ...... from any of the three sides.

f) The Lami's Theorem is applicable only for
(a) Coplanar forces (b) Concurrent forces
(c) Coplanar and concurrent forces (d) Any type of forces

g) The torque acting on a body of moment of inertia (I) and angular acceleration (α) is…………….

h) One watt is equal to
(a) 0.1 J/s (b) 1 J/s
(c) 10 J/s (d) 100 J/s

i) The potential energy of a mass (m) kg raised through a height (h) metres is
(a) mh newtons (b) gh newtons
(c) mgh newtons (d) none of these

j) If the moment of inertia (I) of a pulley is doubled, then the acceleration of a body tied to a string and passing over it is
(a) Halved (b) Remains the same
(c) Doubled (d) None of these

Q2 **Answer the following questions: Short answer type** **(2 x 10)**
a) Differentiate between 'Resultant' and 'Equilibrant'
b) State Varignon's theorem.
c) Define principle of transmissibility
d) Define free Body Diagram (FBD) and draw FBD of Hinged, Fixed & Roller support.
e) State Lami's theorem with a sketch.
f) Write the equations of equilibrium of a coplanar system of forces
g) Differentiate truss and frame.

h) Explain D-Alembert principle.
i) Explain why a man feels weightless while coming down in a elevator?
j) What are impulse and momentum?

Q3 a) Two identical rollers each of weight 50N are supported by an inclined plane and a vertical wall as shown in figure-1. Find the reactions at the points of supports A, B, and C. **(10)**
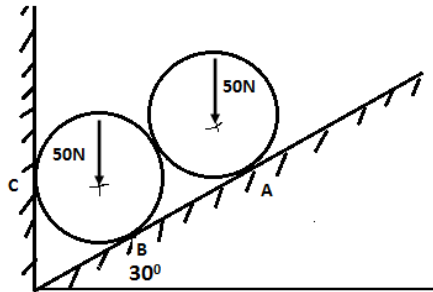

Figure-1

b) A weight of 40 kN is suspended by two cables as shown in the figure-2. Find the tensions T_1 & T_2 in the cables. **(5)**
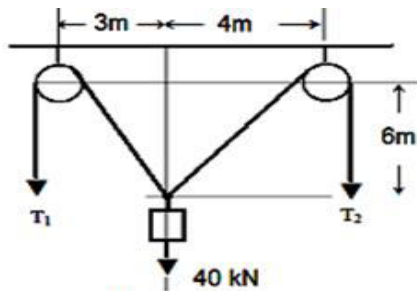

Figure-2

Q4 a) A ball of weight Q= 53.4 N rest in a right-angle trough, as shown in figure- 3. Determine reactions at D & E if all surface are perfectly smooth. **(10)**
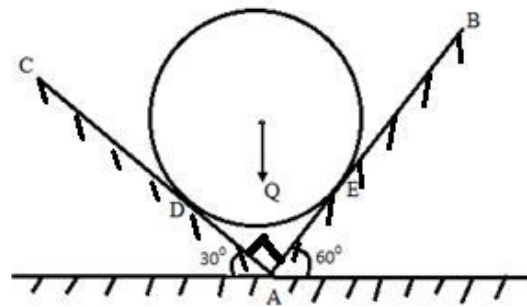

Figure-3

b) A roller of weight 500 N has a radius of 120 mm and is pulled over a step of height 60 mm by a horizontal force P. Find magnitudes of P to just start the roller over the step. **(5)**
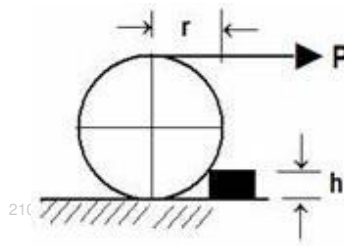
Fig.4

Q5 **a)** A uniform ladder of 4 m. length rests against a vertical wall which it makes an angle 45^0. If a man, whose weight is half of the ladder, ascends it, how high will it be when the ladder slips?
(Take μ=0.4 (between ladder and wall) and μ=0.5 (between ladder and floor)) **(10)**

b) Find the moment of inertia of a T-section with flange as 150 mm × 50 mm and web as 150 mm × 50 mm about X-X and Y-Y axes through the centre of gravity of the section. **(5)**

Q6 **a)** Find the centroid of one quarter of ellipse whose major diameter is 2a and minor diameter is 2b. **(10)**

b) Two beams AC (= 5 m.) and CD (7 m.) are hinged internally at C and simply supported at A & D. When it is subjected to transverse loading at point P (3.5 m. from A) and Q (2 m. from D) 5 kN and 6 kN respectively. Using principle of virtual work, find the reaction at the third support B (i.e. 4.5 m. from D). **(5)**

Q7 **a)** A flywheel of mass 8 tonnes starts from rest, and gets up a speed of 180 rpm in 3 minutes. Find the average torque exerted on it. Take radius of gyration is 60 cm.) **(10)**

b) A car starts moving (without slipping) from rest along a 14^0 inclined plane. After 9 m. it hits the block B (of same weight of car). After impact, car and block will move at single body. If μ=0.39 at contact surfaces, determine the distance where it will come to rest. **(5)**

Q8 **a)** Train A passes a certain station at velocity 72 kmph and moves 20 km at this speed and then comes to rest at next station 24 km away from the first one. Train B, starts from the first station, in accelerate and then decelerate and finally reaches the second station. Time taken by B is twice of the time taken by A. Determine the maximum speed attained by B. **(10)**

b) Explain the laws of friction. **(5)**

Q9 **a)** A projectile fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance find : **(10)**
1. The greatest elevation above the ground reached by the projectile ; and
2. Horizontal distance from the gun to the point, where the projectile strikes the ground.

b) A bullet of mass 30 g is fired into a body of mass 10 kg, which is suspended by a string 0.8 m long. Due to this impact, the body swings through an angle 30°. Find the velocity of the bullet. **(5)**