F.E. Sem. I (Revised in 2007-08) Examination, May/June 2012
BASIC CIVIL ENGG. AND ENGG. MECHANICS

Duration : 3 Hours | Total Marks : 100

Instructions : 1) *Attempt* ***any five*** *questions with at least* ***one*** *question from* ***each*** *Module.*
2) ***Make*** *suitable assumptions,* ***if necessary****.*

MODULE – I

1. a) Explain the scope of the following in civil Engineering.
   i) Water Resources and Irrigation Engg.
   ii) Transportation Engineering. **10**
   b) Write short notes on :
   i) Curing of concrete
   ii) Types of steel sections. **6**
   c) Explain properties of hardened concrete. **4**
2. a) Explain various components of a super-structure of a building. **5**
   b) Give general classification of roads. Briefly mention about components and their functions. **10**
   c) Draw a typical sketch of an arch bridge and label its components. **5**

MODULE – II

3. a) Two uniform solid cylinders weighing 5 kN each and radius of 400 mm are placed as shown. Assuming smooth surfaces, find out reactions at all points of contacts at A, B, C and D. **10**

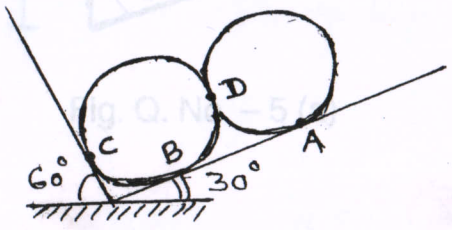

Fig. Q. No.– 3 (a)

b) Replace the given force system into a single force and a moment acting at A. **10**

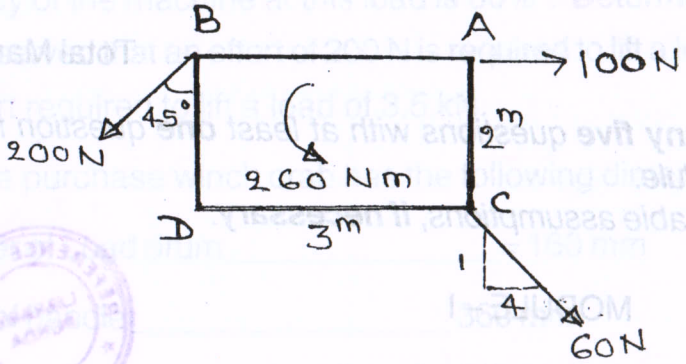

Fig. Q. No. – 3(b)

4. a) Determine the support reactions for the beam shown. **10**

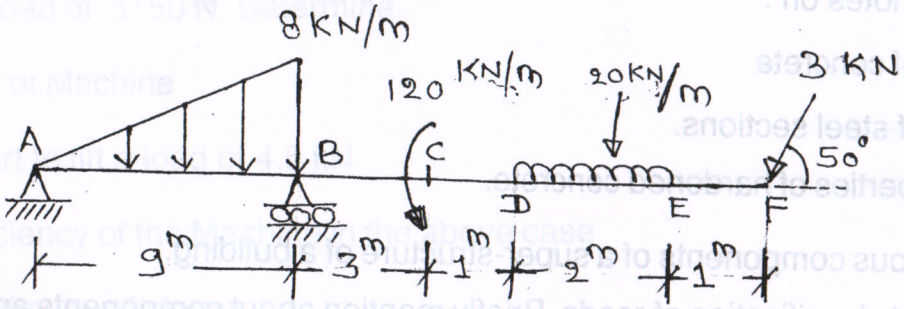

Fig. Q. No. – 4 (a)

b) Find the magnitude of force (P) if the maximum permissible forces in member AC is 3.5 kN and in member BC is 4 kN. **4**

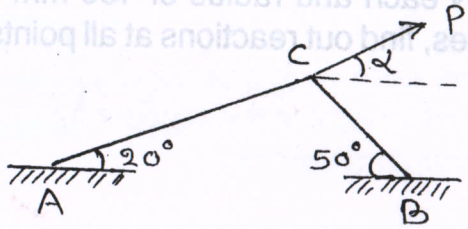

Fig. Q. No. – 4 (b)

c) Five co-planar forces are acting on a triangular plate as shown. Determine the resultant. Locate its position from A. **6**

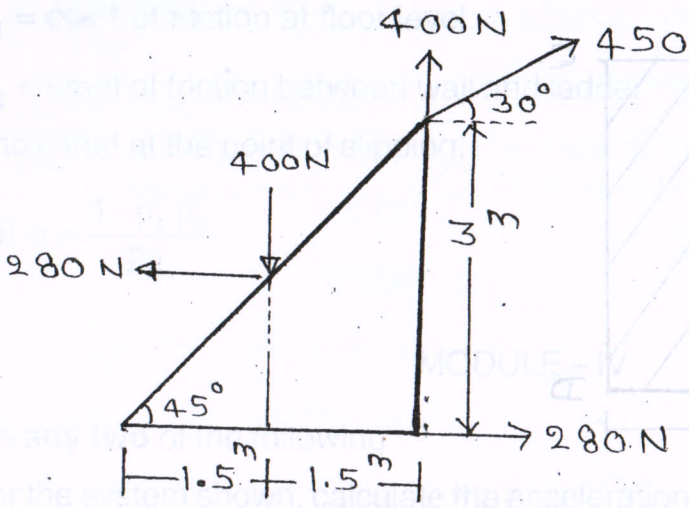

Fig. Q. No. – 4 (c)

MODULE – III

5. a) Determine the position of centroid of the shaded area shown with reference to axes shown. All the dimensions are in mms. **10**

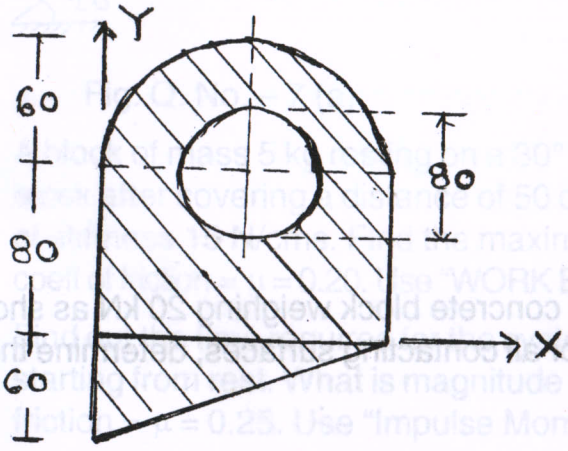

Fig. Q. No. – 5 (a)

b) Find the moment of inertia about both the centroidal axes for the shaded area shown. Also calculate Polar Moment of Inertia about point A. All the dimensions in mms. **10**

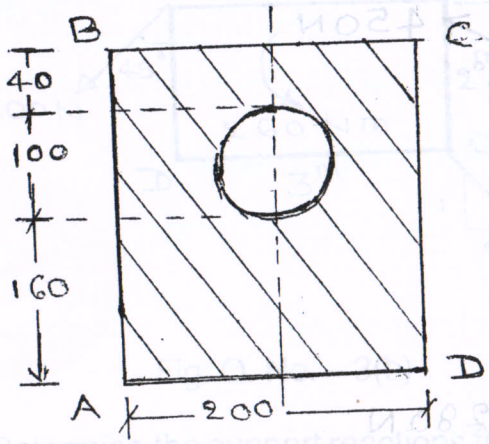

Fig. Q. No. – 5 (b)

6. Solve **any two** of the following :

a) For the system shown, find the least and greatest value of the load (W) for the equilibrium of the system. The coefficient of friction for the plane BC is 0.28 and that for plane AC is 0.20. **10**

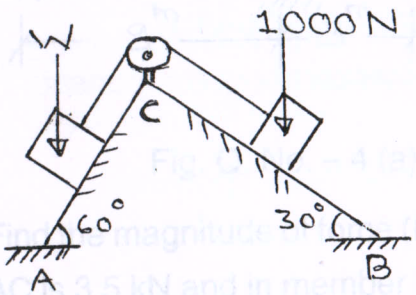

Fig. Q. No. – 6 (a)

b) A 15° wedge is used to tighten the concrete block weighing 20 kN as shown. Assuming angle of friction as 14° for all contacting surfaces, determine the magnitude of force (P). **10**

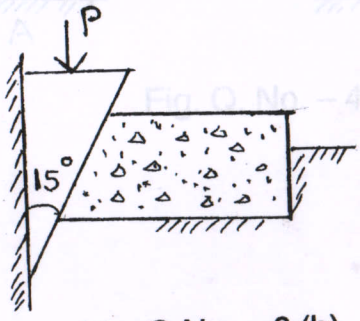

Fig. Q.No. – 6 (b)

c) A uniform ladder of length "L" and weighing "W" is resting against a vertical wall at an angle of "α" with the horizontal. If

μ_1 = coeff of friction at floor level.

μ_2 = coeff of friction between wall and ladder

Show that at the point of slipping,

$$\tan \alpha = \frac{1-\mu_1 \mu_2}{2\mu_1}.$$ **10**

MODULE – IV

7. Solve **any two** of the following :

a) For the system shown, calculate the acceleration and tension in the rope. What is the distance covered by the system in 5 seconds, starting from rest ? Assume coeff of friction = μ = 0.20. Use D'Alembert's principle. **10**

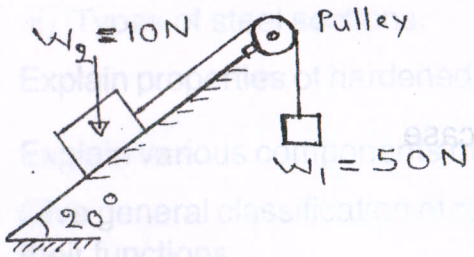

Fig. Q. No. – 7 (a)

b) A block of mass 5 kg resting on a 30° inclined plane is released from rest. The block after covering a distance of 50 cms along the inclined plane hits a spring of stiffness 15 N/cms. Find the maximum compression of the spring. Assume coeff of friction = μ = 0.20. Use "WORK ENERGY" principle to solve the problem. **10**

c) Find out the time required for the system shown to attain a velocity of 20m/sec, starting from rest. What is magnitude of tension in the string ? Assume coeff of friction = μ = 0.25. Use "Impulse Momentum" principle. **10**

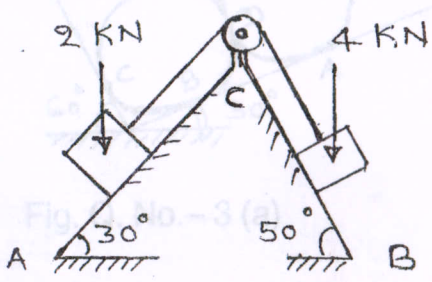

Fig. Q. No. – 7 (c)

8. a) What load can be lifted by an effort of 120 N, if the velocity ratio is 18 and efficiency of the machine at this load is 60% ? Determine the Law of Machine, if it is observed that an effort of 200 N is required to lift a load of 2.6 kN. Determine the effort required to lift a load of 3.5 kN. **8**

b) A double purchase winch crab has the following dimensions :

Diameter of Load drum _____ = 160 mm

Length of handle _____ 360 mm

No. of teeth on pinions _____ 20 and 30

No. of teeth on spur wheels _____ 75 and 90.

It was found that an effort of 90 N lifted a load of 1800 N AND an effort of 135 N lifted a load of 3150 N. Determine.

i) Law of Machine

ii) Effort to lift a load of 4.5 kN

iii) Efficiency of the Machine in the above case

iv) Maximum efficiency. **12**

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