First/Second Semester B.E. Degree Examination, June/July 2017
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting*
at least ONE question from each part.

Module-1

1 a. Draw a neat sketch of an earthen dam and name its components.   **(06 Marks)**
   b. What are the basic idealizations in mechanics?   **(04 Marks)**
   c. A boat is moved uniformly along a canal by two horses pulling with forces P = 890N and Q = 1068N acting under an angle α = 60°[Refer. Fig.Q1(c)]. Determine the magnitude of the resultant pull on the boat and the angles ' β' and 'ρ' as shown in the figure.   **(10 Marks)**

2 a. Draw a neat sketch of an RCC bridge and name its components.   **(06 Marks)**
   b. State and explain the principle of transmissibility of forces.   **(04 Marks)**
   c. Replace the given force system shown in Fig.Q2(c), with an equivalent force and couple system at "A".   **(10 Marks)**

Module-2

3 a. Define : i) resultant ii) equilibrant.   **(04 Marks)**
   b. State and explain parallelogram law of forces.   **(06 Marks)**
   c. Three wires exert the tensions indicated on the ring shown in Fig.Q3(c). Determine the force in a single wire which will replace the three wires.   **(10 Marks)**

4 a. State and prove Varignon's theorem.   **(06 Marks)**
   b. State and explain principle of resolved ports.   **(04 Marks)**
   c. Determine the resultant of the force acting on the bell crank shown in Fig Q4(c).   **(10 Marks)**

Module-3

5 a. State and prove Lami's theorem.   **(06 Marks)**
   b. What do you mean by statically determinate and indeterminate structure?   **(04 Marks)**
   c. To pull up a post, the arrangement shown in Fig.Q5(c), is used. A cable ABC is fixed to the post at "A" and to the frame at "C" having the portion AB vertical and the portion BC inclined there to by a small angle "α". The cable BDE fastened to the ring at "B" to the frame at "E" has the portion BD horizontal and the portion DE inclined to the horizontal by the small angle "β". On the ring at "D" a man pulls vertically downward with his entire weight "Q". Determine the vertical pull "P" applied to the post at "A" if α = β = 6° and Q = 670N.   **(10 Marks)**

6 a. Explain the concept of force body diagram.   **(04 Marks)**
   b. Determine the reactions at supports for the beam loaded as shown in Fig.Q6(b).   **(08 Marks)**
   c. What is the value of "P" in the system shown in Fig.Q6(c) to cause the motion to impend? Assume the pulley is smooth and coefficient of friction between the contact surfaces is 0.20.   **(08 Marks)**

Module-4

7 a. Define : i) centroid ii) axis of symmetry.   **(04 Marks)**
   b. Derive from first principles the centroid of a right angled triangle of base "b" and height "h".   **(08 Marks)**
   c. Locate the centroid of the section of the concrete dam shown in Fig.Q7(c).   **(08 Marks)**

8 a. Define : i) polar moment of inertia ii) radius of gyration.   **(04 Marks)**
   b. State and prove parallel axis theorem.   **(06 Marks)**
   c. Compute the moment of inertia of the 100mm × 150mm rectangle shown in Fig.Q8(c), about xx axis to which it is inclined at an angle θ = $\sin^{-1}[4/5]$.   **(10 Marks)**

Module-5

9 a. What do you mean by Kinematics?   (02 Marks)
   b. With a graph explain the displacement – time curve.   (04 Marks)
   c. A ball is dropped from the top of a tower 30m high. At the same instant a second ball is thrown upward from the ground with an initial velocity of 15m/sec. When and where do they cross each other and with what relative velocity?   (14 Marks)

10 a. With a graph explain the velocity–time curve.   (04 Marks)
   b. With respect to projectiles define : i) velocity projection ii) angle of projection iii) trajectory iv) horizontal range.   (06 Marks)
   c. A pressure tank issues water at "A" with a horizontal velocity "u" as shown in Fig.Q10(c). For what range of values of "u", will water enter the opening "BC"?   (06 Marks)
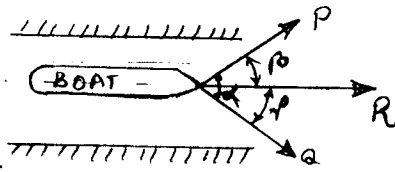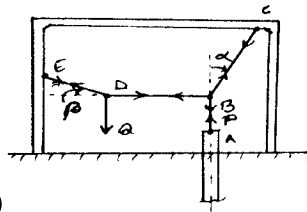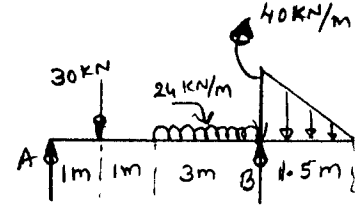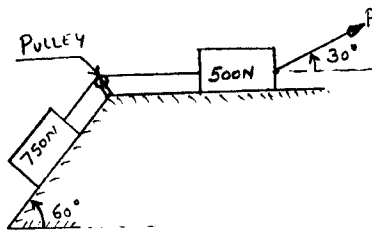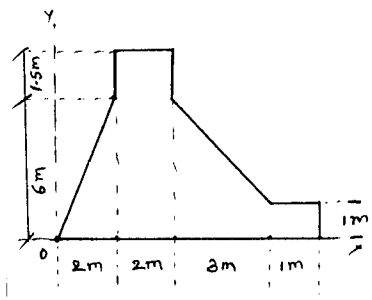
Fig.Q1(c).
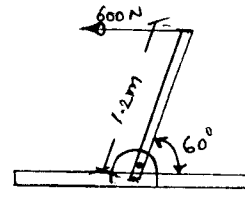
Fig.Q2(c).
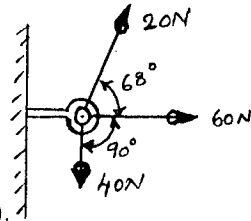
Fig.Q3(c).
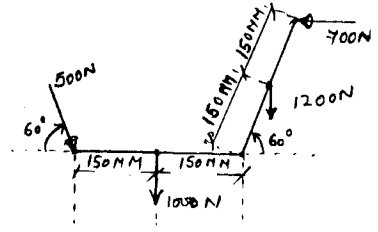
Fig.Q4(c).

Fig.Q5(c)

Fig.Q6(b)

Fig.Q6(c).

Fig.Q7(c)
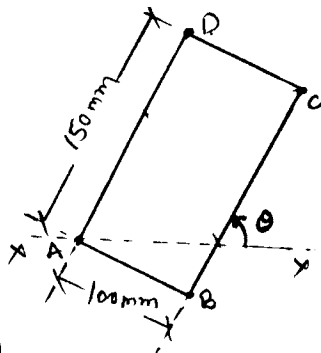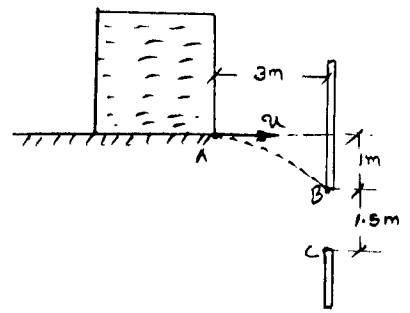
Fig.Q8(c)

Fig.Q10(c)

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