The Assam Royal Global University, Guwahati

Royal School of Architecture
Bachelor of Architecture, 1st Semester
Semester End Examination, December 2018
Course Title : Theory of Structures I and Mathematical Tools
Course Code : ARC132G106

Time: 3 Hours

Maximum Marks: 50

Note: Attempt all questions as per instructions given.
*The figures in the right-hand margin indicate marks.*

Section – A

Q.1. Attempt **all questions**. (Maximum word limit 50)   2 x 8

a. The base of an isosceles triangle is 12 m and its perimeter is 32 m. Find its area.   2

b. The height and radius of a right circular cylinder (closed at both ends) are h cm and r cm respectively. What is its total surface area of the cylinder?   2

c. Describe the force-displacement criteria of roller support with neat diagrams.   2

d. What do you mean by centroid of a body? Where is the centroid of a rectangular lamina located?   2

e. What are Rigid Frame structures? Explain with neat sketches.   2

f. What do you mean by Free Body Diagram? Draw the Free Body Diagram of a rectangular box of W weight resting on a rigid surface.   2

g. What is meant by Radius of Gyration of a body?   2

h. Define Lami's Theorem with neat sketches.   2

Section – B

Q.2. Attempt **any one set of the following**   4 x 2

a. The radius and the slant height of a right circular cone are 35 cm and 37 cm respectively. Find its volume and total surface area.   4

b. A rectangular lawn is 30 m × 20 m has two roads each 2 m wide running in the middle of it, one parallel to the length and the other parallel to the width. Find the cost of paving the roads at Rs. 12.50 per sq. m.   4

OR

a. The ratio of circumference of two circular gardens is 11:7. If the difference of their radii is 28 cm, then find the circumference of the two gardens.   4

b. The thickness of a closed wooden box is 3 cm. The outer measure of the box is 60 cm × 46 cm × 30 cm. Find its inner volume.   4

Q.3. Attempt **any two questions**.   4.5 x 2

a. Find the reactions of the following beam: 4.5
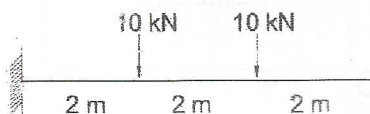
b. Explain the different systems of equilibrium of forces with neat sketches.   4.5
c. Find the tension forces in the strings T1 and T2 considering rigid massless beam.   4.5
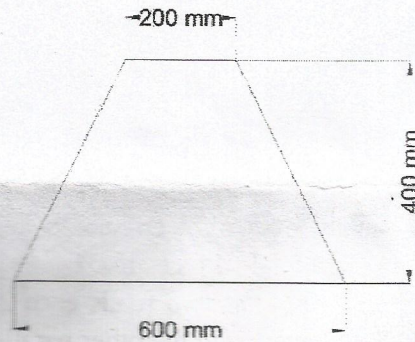
T1   6 kN   8 kN   T2

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    |_____|_____|_____|
      2 m      2 m         4 m
```
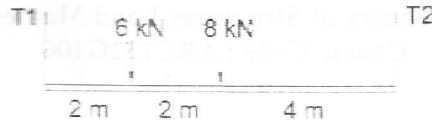
Q.4.   Attempt **any two question**.   4 x 2

a. Write short notes on: 4
   i.   Dome Structures
   ii. Shell Structures

b. Describe the following with neat sketches: 4
   i.   Plates in Structures
   ii. Arches in Structures

c. Write the differences between a beam, a column and a beam-column with   4
   appropriate diagrams.

Q.5.   Attempt **any two question**.   4.5 x 2

a. Derive the Moment of Inertia about the centroidal axis of a rectangular lamina of   4.5
   width **b** and depth **d**.

b. Find the centroid of the trapezoidal lamina about the left-bottom corner: 4.5

```
            ←200 mm→
            _____
           /        \        ↑
          /          \
         /            \      400 mm
        /              \
       /_____\    ↓
       ←     600 mm     →
```

c. Find the centroid of the plate about the left-bottom corner (O)   4.5
   i.   If only area A is removed
   ii. If only area B is removed

```
     ←100→ ←100→



         ___ ___
        | B | A |
        ←40→←40→
    O
```