



R22 Regulation

Subject code: 4E4BA

**TKR COLLEGE OF ENGINEERING AND TECHNOLOGY**

(Autonomous, Accredited by NAAC with 'A+' Grade)

**B.Tech IV Semester Supplementary Examinations, December 2025**  
**SOLID MECHANICS AND HYDRAULIC MACHINES**

(EEE)

Maximum Marks: 60

Date: 16.12.2025

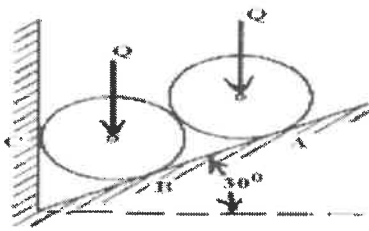
Duration: 3 hours

- Note: 1. This question paper contains two parts A and B.  
 2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.  
 3. Part B consists of 5 Units. Answer any one full question from each unit.  
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks . (10X1M=10 Marks)		Marks	CO	Bloom Tx
1.a)	State and Prove Lami's Theorem.	1M	CO1	BL1
b)	Define free body diagram.	1M	CO1	BL1
c)	State the first and second theorem of pappus.	1M	CO2	BL1
d)	Give the difference between elasticity and plasticity.	1M	CO2	BL2
e)	What are the Components of motion?	1M	CO3	BL1
f)	What is the momentum of an object of mass 'm', moving with velocity 'v'?	1M	CO3	BL2
g)	Define the hydrodynamic force of a jet.	1M	CO4	BL1
h)	What is the use of constructing an inlet and outlet velocity triangle?	1M	CO4	BL2
i)	Mention the key characteristics of Pelton wheel.	1M	CO5	BL1
j)	What is the minimum starting speed of pump?	1M	CO5	BL1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	Bloom Tx
2	Two identical rollers, each of weight 100 N, are supported by an inclined plane and a vertical wall as shown in figure. Assuming smooth surfaces, find the reactions induced at the points of support A, B and C. 	10M	CO1	BL3
OR				
3	Explain the following a. Types of friction      b) Laws of Friction b. Angle of Friction      d) Cone of limiting friction	10M	CO1	BL2

4	<p>A uniform lamina shown in figure consists of a rectangle, a circle and a triangle. Determine the center of gravity of the lamina. All dimensions are in mm</p>	10M	CO2	BL3
OR				
5	<p>The normal stress in two mutually perpendicular directions is <math>200\text{N/mm}^2</math> and <math>120\text{N/mm}^2</math> (both tensile). The complimentary shear stresses in these directions are of intensity <math>45\text{N/mm}^2</math>. Find the normal, tangential stresses on the two planes which are equally inclined to the planes carrying the normal stresses mentioned above.</p>	10M	CO2	BL3
6	<p>a) A train starts from rest and attains a velocity of 45 kmph in 2 minutes, with uniform acceleration. Calculate i) acceleration ii) distance travelled and iii) time required to reach a velocity of 36 kmph.</p> <p>b) A particle is projected with an initial velocity of 60 m/s, at an angle of <math>75^\circ</math> with the horizontal. Determine i) the maximum height attained by the particle ii) horizontal range of the particle iii) time taken by the particle to reach highest point iv) time of flight.</p>	5M 5M	CO3	BL3
OR				
7	<p>a) A man of mass 60 kg dives vertically downwards into a swimming pool from a tower of height 20 m. He was found to go down in water by 2 m and then started rising. Find the average resistance of the water. Neglect the air resistance.</p> <p>b) A spring is stretched by 50 mm by the application of a force. Find the work done, if the force required to stretch 1 mm of the spring is 10 N.</p>	5M 5M	CO3	BL3
8	<p>Derive the expression for force exerted by a jet on stationary curved plate if jet strikes the curved plate at the centre and at one end.</p>	10M	CO4	BL3
OR				
9	<p>Derive the expression for force exerted by a jet of water on an unsymmetrical moving curved plate when jet strikes tangentially at one of the tips and explain the velocity triangles at inlet and outlet and also efficiency of the jet.</p>	10M	CO4	BL3
10	<p>a) Explain the working principle of Francis turbine with diagram &amp; also draw the velocity triangle.</p> <p>b) Distinguish between impulse and reaction turbine.</p>	5M 5M	CO5	BL2
OR				
11	<p>a) Discuss about classification of pumps.</p> <p>b) A fluid is to be lifted against a head of 120 m. The pumps that run at a speed of 1200 rpm with rated capacity of 300 liters/sec are available. How many pumps are required to pump the water if specific speed is 700.</p>	5M 5M	CO5	BL3