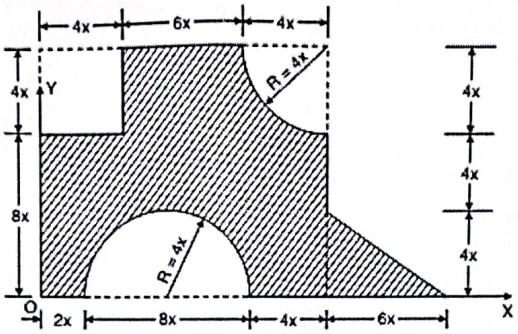
Kathmandu University
Department of Mechanical Engineering
First Internal
CE
SET-A

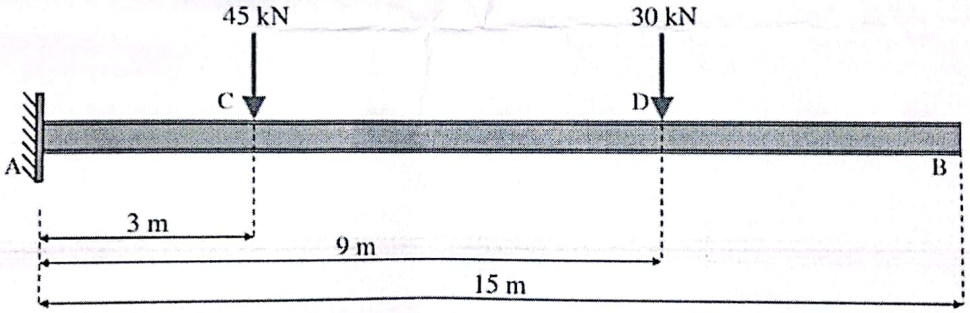
ENGG 111 **FM: 30**
Date: 5/6/2024 **Time: 1hr 30min**

Read the questions carefully. Assume data, if missing. Each question carries 5 marks

1. A pipe is 300 m long and tapers from 1 m diameter at the high end to 0.5 at the low end. The quantity of water flowing is 5400 liters per minute. If the pressure at the high end is 70 kPa, and the desired pressure at the low end is 98 kPa. What slope should the pipe be maintained at? What is the principle that will be applied to solve this? List its assumptions.
2. Find the centroid of the following geometry with respect to an axis with origin located at x= 326.40mm and y =219.12 mm. Take x=40 mm.



3. For the beam structure shown, find the reactions at supports:



4. For a site with very high head but low flow, which hydraulic turbine among Pelton or Francis will you recommend. List its parts, their functions, and the working of the turbine. Differentiate between the two types of turbines.
5. Explain First Law of Thermodynamics. Gas expands in a cylinder according to the relation, $PV^{1.3} = C$ from an initial state of 0.3 m^3 and 1000 kPa to a final state of 101 kPa. Calculate the work done on the piston by the gas pressure.
6. Explain Otto Cycle with process diagram. Determine the barometric reading at a location where the is atmospheric pressure 98.6 kPa and the gravitational acceleration is g=9.805 m/s^2. Assume the temperature of mercury to be 10C at which its density is 15,570 kg/m^3.