Gate ME-2018

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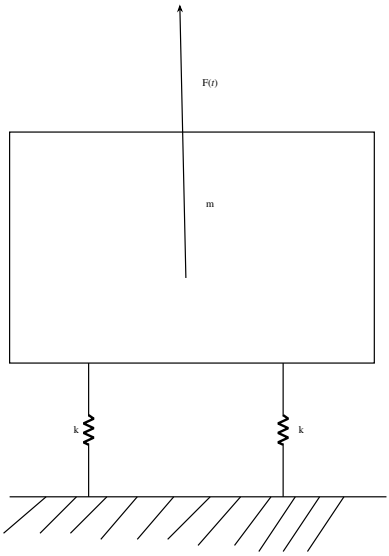
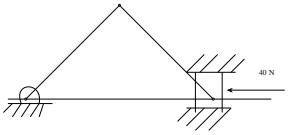
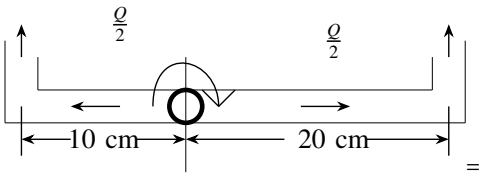
40) A machine of mass $m = 200kg$is supported on two mounts, each of stiffness $k = 10\frac{kN}{m}$. The machine is subjected to an external force (in N) $F(t) = 50\cos 5t$. Assuming only vertical translatory motion, the magnitude of the dynamic force (in N) transmitted from each mount to the ground is _____(correct to two decimal places).



41) A slider crank mechanism is shown in the figure. At some instant, the crank angle is 45° and a force of 40 N is acting towards the left on the slider. The length of the crank is 30 mm and the connecting rod is 70 mm . Ignoring the effect of gravity, friction and inertial forces, the magnitude of the crankshaft torque (in Nm) needed to keep the mechanism in equilibrium is _____(correct to two decimal places).



42) A sprinkler shown in the figure rotates about its hinge point in a horizontal plane due to water flow discharged through its two exit nozzles.



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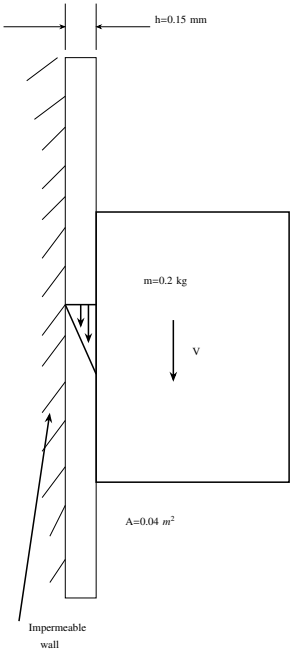
The total flow rate Q through the sprinkler is $1\frac{litre}{sec}$ and the cross-sectional area of each exit nozzle is 1 cm ^{2}. Assuming equal flow rate through both arms and a frictionless hinge, the steady state angular speed of rotation $\left(\text{ in } \frac{rad}{s}\right)$ of the sprinkler is _____(correct to two decimal places).

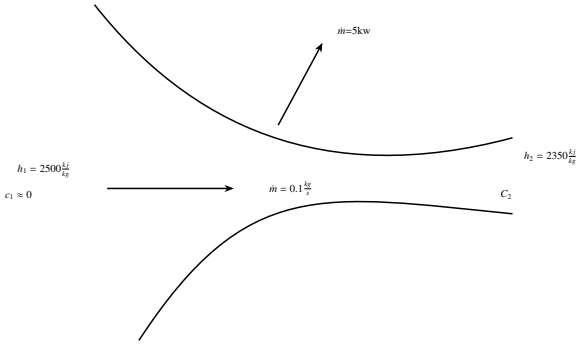
43) A solid block of 2.0 kg mass slides steadily at a velocity V along a vertical wall as shown in the figure below. A thin oil film of thickness h = 0.15 mm provides lubrication between the block and the wall. The surface area of the face of the block in contact with the oil film is $0,04$ m ^{2} . The velocity distribution within the oil film gap is linear as shown in the figure. Take dynamic viscosity of oil as7×10^{-3} Pa $-$s and acceleration due to gravity as$10\frac{m}{s^2}$ .Neglect weight of the oil. The terminal velocity V$\left(\text{ in } \frac{m}{s}\right)$ of the block is _____(correct to two decimal places).



44) A tank of volume contains a mixture of saturated water and saturated steam at 200° The mass of the liquid present is 8 kg. The entropy $\left(\text{ in } \frac{kj}{kg} \text{ k }\right)$ of the mixture is _____(correct to two decimal places). Property data for saturated steam and water are: At 200°C,

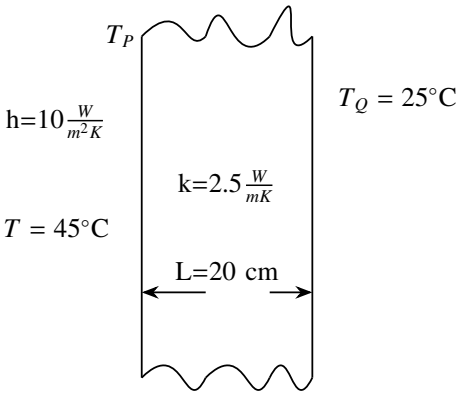
$$p_{\text{sat}} = 1.5538\,\text{MPa},$$
$$v_f = 0.001157\,\frac{m^3}{kg}, v_g = 0.12736\frac{m^3}{kg},$$
$$s_{fg} = 4.1014\,\frac{kJ}{kg}\ \text{K}\ , s_f = 2.3309\frac{kJ}{kg}\ \text{K}\ .$$

45) Steam flows through a nozzle at a mass flow rate of $\dot{m} = 0.1\frac{\text{kg}}{\text{s}}$ with a heat loss of 5kW. The enthalpies at inlet and exit are $2500\frac{\text{kJ}}{\text{kg}}$and $2350\frac{\text{kJ}}{\text{kg}}$, respectively. Assuming negligible velocity at inlet $(C_1 \approx 0)$, the velocity $(C_2)$of steam $\left(\text{ in } \frac{m}{s}\right)$ at the _____(correct to two decimal places).

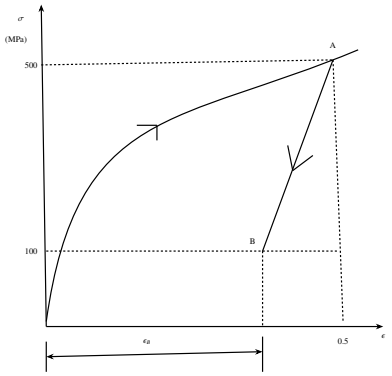


46) An engine working on air standard Otto cycle is supplied with air at 0.1 MPa and 35° The compression ratio is 8. The heat supplied is$500\frac{\text{kJ}}{\text{kg}}$ Property data for air: $c_p = 1.005\frac{\text{kJ}}{\text{kg}}, c_v = 0.718\frac{\text{kJ}}{\text{kg}}, R = 0.287\frac{\text{kJ}}{\text{kg}}$ K.The maximum temperature (in K) of the cycle is _____(correct to two decimal places).

47) A plane slab of thickness L and thermal conductivity k is heated with a fluid on one side (P), and the other side (Q) is maintained at a constant temperature, T_Q of 25°C, as shown in the figure. The fluid is at 45°C and the surface heat transfer coefficient, h, is $10\frac{\text{W}}{\text{m}^2\text{K}}$ The steady state temperature, T_P (in °C) of the side which is exposed to the fluid is _____(correct to two decimal places).



48) The true stress (σ) – true strain (ϵ) diagram of a strain hardening material is shown in figure. First, there is loading up to point A, up to stress of 500 MPa and strain of 0.5 . Then from point A,there is unloading up to point B,i.e., to stress of 100 MPa . Given that the Young's modulus E = 200GPa, the natural strain at point B(ϵ_B) is _____(correct to two decimal places).



49) An orthogonal cutting operation is being carried out in which uncut thickness is 0.010 mm cutting speed is 130$\frac{\text{m}}{\text{min}}$, rake angle 15°and width of cut is 6 mm It is observed that the chip thickness is 0.015 mm the cutting force is 60 N and the thrust force is 25 N . The ratio of friction energy to total energy is _____(correct to two decimal places).

50) A bar is compressed to half of its original length. The magnitude of true strain produced in the deformed bar is _____(correct to two decimal places).

51) The minimum value of $3x + 5y$ such that :

$$3x + 5y \leq 15$$
$$4x + 9y \leq 8$$
$$13x + 2y \leq 2$$
$$x \geq 0, y \geq 0$$

is_____

52) Processing times (including setup times) and due dates for six jobs waiting to be processed at a work centre are given in the table. The average tardiness (in days) using shortest processing time rule is _____(correct to two decimal places).

Job	Processing time (*days*)	Due date (*days*)
A	3	8
B	7	16
C	4	4
D	9	18
E	5	17
F	13	19