



GATE 2022 Examination* (Memory Based)

Mechanical Engineering (Afternoon Paper)

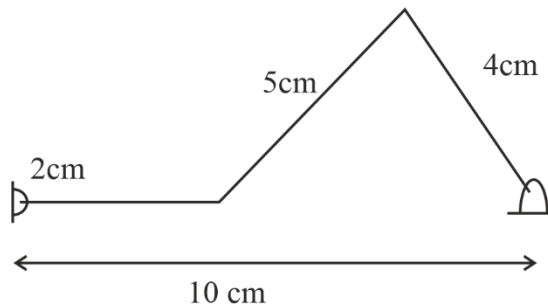
Test Date: 13-2-2022

Test Time: 2:30 p.m.

Stream Name: Mechanical Engineering (Afternoon Paper)

- Q1. The velocity field in a fluid is given to be $\vec{V} = T(4xy)\hat{i} + 2(x^2 - y^2)\hat{j}$, which of the following statement(s) is/are correct?
- The velocity field is 1-0
 - Flow is incompressible
 - actual Experienced by third particle is zero at $(x = 0, y = 0)$
 - the flow is irrational.
- Q2. Which one of the following is an interm div. Proper these mody name system?
- Mass
 - Density
 - Volume
 - Energy
- Q3. The steady velocity field in an inviscid fluid of density 1.5 is given to be $\vec{V} = (y^2 - x^2)\hat{i} + 2xy\hat{j}$. Neglecting Body foxce, the pressure gradient al $(x = 1, y = 1)$ is _____
- $-4\hat{i} - 4\hat{j}$
 - $-6\hat{i} - 6\hat{j}$
 - $20\hat{i}$
 - $10\hat{j}$

Q4.



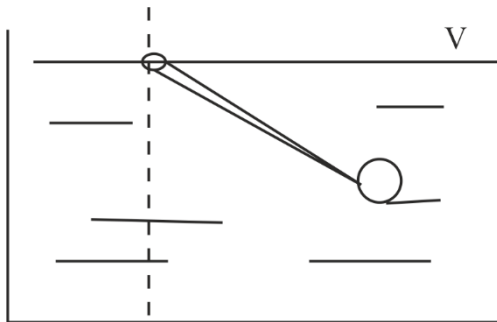
$$W_2 = 5 \frac{\text{rad}}{\text{s}}$$

$$W_4 = 2$$

Q5. One of the following is which Intensive properties

- a) Entropy b) Volume c) Density d) Mass

Q6.



A uniform wooden rod (sp gravity = 0.6, dia = 4 cm and $\ell = 8$ m) is immersed in the water and is hinged w/o friction at point A on the waterline as shown in the fig. A solid spherical ball made of lead ($\text{sg}_L = 11.4$) is attached to the free end of the rod to keep the assembly in static equilibrium inside the water. For simplicity assume that the radius of the ball is much smaller than the length of the rod.

(Assume $S_w = 1000 \text{ kg/m}^3$ $\pi = 3/4$)

Radius of ball is _____ cm.

Q7. Consider 1 kg of an ideal gas at 1 bar and 300 K in rigid and perfectly insulated container. The C_v is $750 \text{ J/kg} \cdot \text{K}^{-1}$. A stirrer performs 225 kJ of work on the gas, Assume that the container does not participate in thermodynamics interaction. The final pressure is _____ .



- Q8. Saturated vapour at 200°C condenses to saturated liquid at the rate of 150 kg/s on the shell side of a heat exchanger. (Enthalpy of condensation = 2480 kJ/kg). A fluid with $C_p = 4\text{ kJ}\cdot\text{kg}^{-1}\cdot\text{K}^{-1}$ enters at 100°C on the tube side. If the effectiveness of the heat exchanger is 0.9 , then the mass flow rate of the fluid in the tube side is _____ kg/s .
- Q9. Which Machining process involves melting of metal work piece
 a) EBM b) LBM c) ECM d) EDM
- Q10. Which one of the following cannot impact linear motion in CNC machine
 a) Linear motor b) Chain and sprocket
 c) Lead screw d) Ball screw
- Q11. Thrust force = cutting force
 Back rake angle is zero degree
 Shear angle = 15°
 Shear strength = 500 Mpa
 Width = 2 mm and uncut chip thickness = 0.5 mm
 Find cutting force?
- Q12. A rigid tank of volume 8 m^3 is being filled up with air from pipeline. Initially tank is evacuated. Pressure and temperature inside pipeline is 600 kPa and 306 K . The filling takes place until tank pressure = pipeline pressure. During filling heat loss is 1000 kJ .
 $C_p = 1.005\text{ kJ/kgK}$
 $C_v = 0.718\text{ kJ/kgK}$
 Find the final temperature of tank?
- Q13. Sum and product of Eigen values of a 2×2 matrix

$$\begin{bmatrix} 3 & p \\ p & q \end{bmatrix}$$
 are 4 and 1 then the value of $|P| = \underline{\hspace{2cm}}$.



- Q22. For the past m days, the average daily production was 100 units per day. If today's production of 180 units changes the average to 110 units per day what is value of m .
- a) 7 b) 10 c) 5 d) 18

- Q23. A person was born on the 5th Monday of February
Select correct option

- a) 1st February is Sunday
b) 2nd February is Sunday
c) 5th February is Sunday
d) All Monday occur on even Date

- Q24. Given $\int_1^2 (4x^2 + 2x + 6) dx$

P(e) = exact value

P(a) = By using Simpson's 1/3 rule with 10 sub intervals

$$\text{Five error\%} = \left(\frac{P(e) - P(a)}{P(a)} \right) \times 100 = ?$$

- Q25. An electric car manufacturing company underestimated the January sales of car by 20 units while the actual sales was 120 units. If the manufacture uses exponential smoothing method $\alpha = 0.2$ then calculate the forecast for month of February.

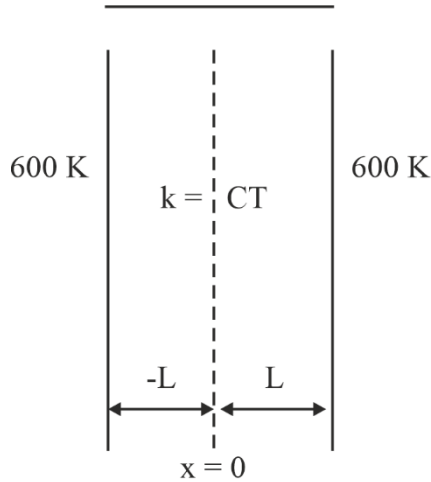
- Q26. Two machines

	Milling m/c	Polishing m/c
A	8	6
B	3	2
C	3	4
D	4	6
E	5	7
F	6	4
G	2	1

Find the minimum time

- a) 30 b) 31 c) 32 d) 33

Q27.



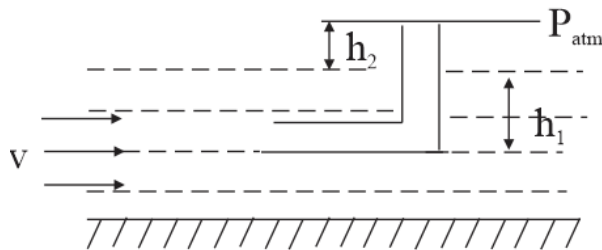
$c = 2$

$L = 1\text{ m}$

$l = 1280\text{ kw/m}^3$

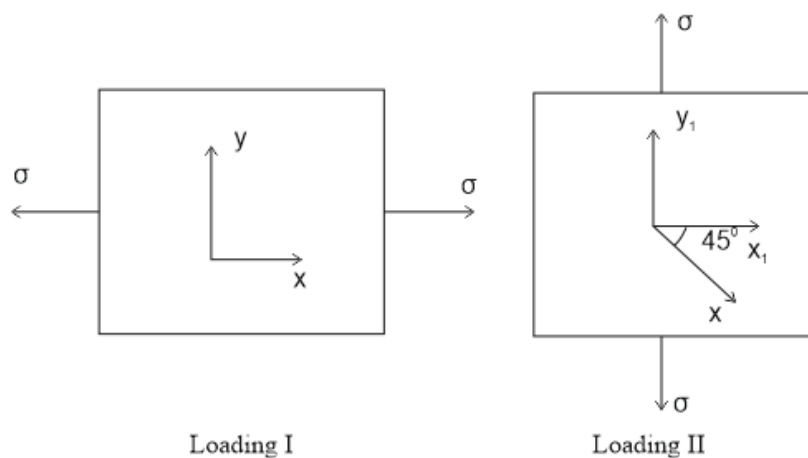
Temp at $x = ?$

Q28. A tube of uniform diameter D is immersed in a steady inviscid liquid stream of velocity v as shown in figure. Volume flow rate through tube is:



- a) $\frac{\pi}{4} D^2 \sqrt{2g(h_1^2 + h_2^2)}$
- b) $\frac{\pi}{4} D^2 v$
- c) $\frac{\pi}{4} D^2 \sqrt{v^2 - 2gh_2^2}$
- d) $\frac{\pi}{4} D^2 \sqrt{2gh_2^2}$

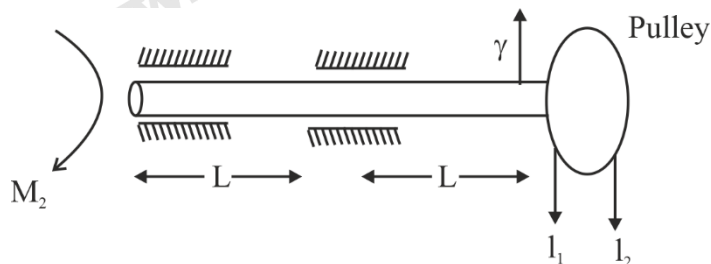
Q29.



A linear elastic structure under plane stress condition is subjected to two sets of loading I & II. The resulting states of stress at a point corresponding to these two loadings are as shown. If these two sets of loading are applied simultaneously then the net normal component of stress σ_{xx} is:

- a) $\sigma(1 + 1/\sqrt{2})$
- b) $\sigma(1 - 1/\sqrt{2})$
- c) $\sigma/2$
- d) $3\sigma/2$

Q30.



Given $T_1 = 300 \text{ N}$

$T_2 = 100 \text{ N}$

$T_{yt} = 80 \text{ MPa}$

Find diameter of shaft?

$R = 0.4 \text{ m}$

$L = 0.5 \text{ m}$



Q31. In a under system $\xi = \frac{1}{2\pi} \ln 2$

Initial amplitude = 5 mm

Find next amplitude:

Q32. A metric thread with 4 mm pitch and 60° thread angle is inspected for pitch diameter using a 3 wire method. The diameters of the best size of wire is _____

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