

GATE ME 2019

Questions & Solutions Session 1

POWERED BY:



GA Section

1 Marks:

- Q. John Thomas an _____ writer, passed away in 2018
 A. Eminent B. Imminent
 C. Prominent D. Dominant

(Memory Based)

- Q. A labour works in a factory till the hour hand moves 225 degrees. Find out how much hours he worked in the factory.
 A. 7.5 hr B. 4 hr and 15 min
 C. 3.75 hr D. 8.5 hr

(Memory Based)

- Sol. The hour hand complete one complete revolution in 12 hour
 $\therefore 12 \text{ hour} \rightarrow 360^\circ$
 $\therefore 12 \times 60 \text{ minutes} \rightarrow 360^\circ$
 & x minutes $\rightarrow 225^\circ$

$$\therefore x = \frac{12 \times 60 \times 225}{360}$$

- $\therefore x = 450 \text{ minutes}$
 \therefore he worked for 450 minutes or 7.5 hours in the factory

- Q. Sum of two integer is 26 and product of these two integers is 165 then what is the difference between the two integers?
 A. 3 B. 4
 C. 5 D. 6

(Memory Based)

- Sol. $x + y = 26$ $xy = 165$

$$(x + y)^2 = x^2 + y^2 + 2xy \dots\dots (1)$$

$$\& (x - y)^2 = x^2 + y^2 - 2xy \dots\dots (2)$$

$$\therefore (x + y)^2 = (x - y)^2 + 4xy$$

$$\therefore (26)^2 = (x - y)^2 + 4xy$$

$$\therefore (x - y)^2 = 16$$

$$\therefore x - y = 4$$

- Q. Minister did not speak about women issue. He was accused of _____
 A. Tying B. Collaring
 C. Skirting D. Belting

(Memory Based)

- Sol. A. Tying-to tie somebody
 B. collaring - Cath someone who does not want to be careen
 C. Skirting - skipping a issue

- D. Belting - to hit somebody hard
 Ans. Option C best suits the given case

2 Marks:

- Q. A person invested Rs 1 lakh in 2 schemes. On one he got 10% Profit and on other 12% profit. If these profit ratios are interchanged with their investment he gets Rs 120 less. Find the ratio of his investment in both schemes.

(Memory Based)

- Sol. Let he invested x rs. In 10% profit scheme so he will invest (100000 - x) in 12% profit scheme so we are asked to find

$$\frac{x}{100000 - x}$$

$$\therefore \text{total profit gained} = 0.1x + (100000 - x) \times 0.12$$

Now if the profit ratios are interchanged

$$\therefore \text{total profit gained} = 0.12x + (100000 - x) \times 0.1$$

He get's 120 rs less

$$\therefore (0.1x + 12000 - 0.12x - 0.12x - 10000 + 0.1x = 120$$

$$\therefore 0.04x = 1880$$

$$\therefore x = 47,000$$

- Q. P, Q, R, S are four children of M & N. P and R both are married, and they have two children X and Y. Y is the legitimate son of W.
 Which of these statements is false?
 A. W is the wife of P
 B. W is the wife of R
 C. M is grandmother of Y
 D. R is father of Y

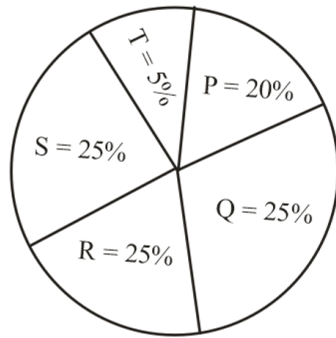
(Memory Based)

- Q. Mobatu, king of Congo changed city and river name to Zaire. He did because he wanted to Africanise its city and all. Zaire is Portuguese alteration of nazdi -e- nazir. That Word meant rives swallowing river. It remained till 16, 17th century. which below can be interred.

- A. Mobatu order Portuguese to do renaming.
 B. Mobatu failed to rename.
 C. Portuguese prevented mobatu from becoming successful
 D. Naire-o-nazir is originated from Portuguese.

(Memory Based)

Q.



In a company P, Q, R, S, T categories of employees' work. In 2010, total number of employees were 600. From 2010 to 2016 total number of employees increased by 15%. In S category number of employees were increased by 40% however, there is no change in number of employees in P, Q and R categories. Calculate number of T category employees in 2016?

(Memory Based)

Sol. → Total employees in 2010 is 600
Employees increased by 15% in 2016

$$\therefore \text{total employer in 2016 is } 600 + 600 \times \frac{15}{100} = 690$$

_____ (I)
Employees in S category in 2010 is
 $600 \times \frac{25}{100} = 150$

Now S category increased by 40% in 2016
 \therefore employees in S category in 2016 is $150 + 150 \times \frac{40}{100} = 210$

_____ (II)
Now P + Q + R contribute 70% of total employer in 2010

Q. A prisoner is allowed to say one statement before he is given the punishment. If he says a true statement, he is hanged and if he says false statement then he is shot. What would have the prisoner said so that the judge has to release him without giving the punishment.
A. You committed the crime
B. I committed the crime
C. I will be shot
D. I didn't commit the crime

(Memory Based)

ME Section

1 Marks:

Q. Solve $\int_2^4 x^3 dx$ using a 2-equal segment by trapezoidal method.

(Memory Based)

Q. Length of large stock of rod follow normal distribution with $\mu = 440 \mu\text{m/mm}$ and $\sigma = 1 \text{ mm}$. Then percentage of rods between 438 mm and 441 mm is:

(Memory Based)

Q. $\frac{dy}{dx} + 7x^2y = 0$, $y(0) = \frac{3}{7}$. Find $y(1)$.

(Memory Based)

Q. $P = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$. Find distinct eigen values of matrix P.

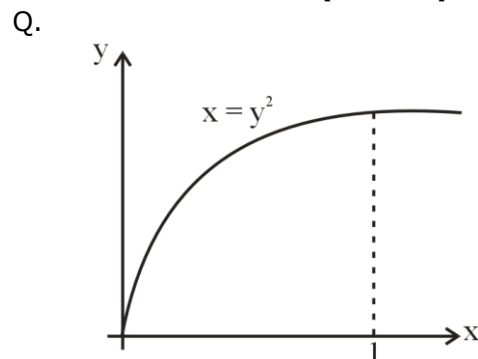
(Memory Based)

Q. Welding method having highest heat flux occurs in which case?
A. Laser Beam Welding
B. Oxy-gas acetylene welding
C. Plasma Arc welding
D. Tungsten Inert Gas welding (TIG)

(Memory Based)

Q. Spur gear of 20 degree full depth involute teeth profile having power output of 20 kW and speed 100 rad/s. Pitch circle diameter is 20 mm. Find force required.

(Memory Based)



Find the volume of solid obtained by rotating shaded area by 360° around x-axis.

For the interval $0 \leq x \leq 1$.

(Memory Based)

Q. Find the value of integral

$$\int_1^e x(\ln x) dx =$$

(Memory Based)

Q. Air mass 1 kg, pressure 10 bar, $T_1 = 300$ K and $P_2 = 1$ bar under goes isothermal expansion with gas constant $= 0.287$, find change in entropy?

(Memory Based)

Q. If throttling process is changed to isentropic expansion, then which of the following is correct?

- A. COP will be high as compare to throttling
- B. COP will be low as compare to throttling
- C. COP will remain same
- D. Refrigeration effect will be low as compare to throttling

(Memory Based)

Q. During non-flow thermodynamic process (1 - 2), $Q_{1-2} = W_{1-2}$. Then process is

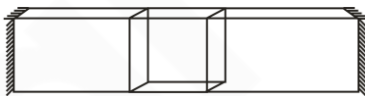
- A. Adiabatic
- B. Isothermal
- C. Isentropic
- D. Polytropic

(Memory Based)

Q. A solid cube of side 1 m is kept at room temperature of 32°C , having co-efficient of thermal expansion $\alpha = 1 \times 10^{-5}/^\circ\text{C}$, $K = 200$ GPa. Cube constrained all around and heated uniformly to 42°C . Calculate the volumetric stress developed, σ (MPa).

(Memory Based)

Sol.



$$\epsilon = \frac{\sigma}{E} - \frac{\mu\sigma}{E} - \frac{\mu\sigma}{E} = \alpha T$$

$$\sigma = \frac{E \alpha T}{1 - 2\mu} = 3K \alpha T$$

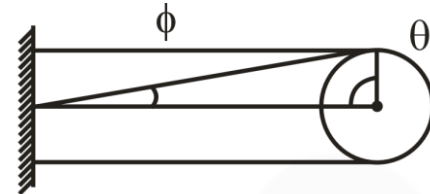
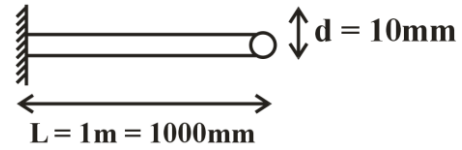
$$= 3 \times 200 \times 10^3 \text{ MPa} \times 1 \times 10^{-5}/^\circ\text{C} \times (42 - 32) = 60 \text{ MPa}$$

Q. Given circular cantilever beam of diameter 10 mm and length 1 m. It is twisted by torque T and has a twisted angle 10° . If shear strain $(\phi) = P \times 10^{-3}$.

Then find the value of P?

(Memory Based)

Sol.



$$\phi L = \theta R$$

Where, $\phi =$ shear strain $= P \times 10^{-3}$

$\theta =$ Angle of twist

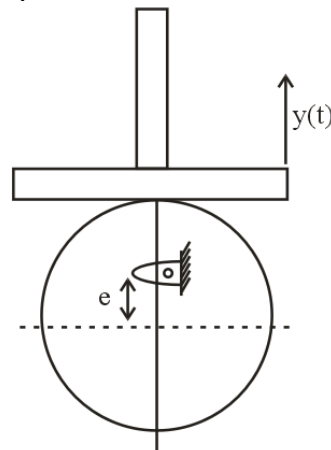
$$= 10^\circ = 10 \times \frac{\pi}{180} \text{ radian}$$

$$\Rightarrow P \times 10^{-3} \times 1000 \text{ mm}$$

$$= \left(10 \times \frac{\pi}{180} \right) \times \frac{10}{2} \text{ mm}$$

$$\Rightarrow P = \frac{4\pi}{9} = 1.39$$

Q. A flat faced follower is driven using a circular eccentric cam rotating at constant angular velocity ω . At $t = 0$, vertical position of follower is $y(0) = 0$.

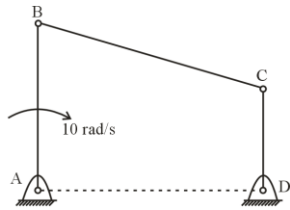


Then vertical position of follower face at $y(t)$ is

- A. $e(1 + \cos 2\omega t)$
- B. $e(1 - \cos \omega t)$
- C. $e \sin \omega t$
- D. $e \sin 2\omega t$

(Memory Based)

Q. In a four-bar mechanism $AB = 5$ cm, $AD = 4$ cm, $DC = 2$ cm. If AB and DC are perpendicular to AD and AB rotates with angular velocity of 10 rad/sec.



Find angular velocity of DC.

- A. 10
- B. 0
- C. 15
- D. 25

(Memory Based)

- Q. During high cyclic loading, mean stress = 140 MPa, minimum stress = - 70 MPa. For cyclic loading, Ratio of minimum to maximum stress is _____.

(Memory Based)

Sol.

$$\sigma_{\text{mean}} = 140, \sigma_{\text{min}} = -70$$

$$\sigma_{\text{mean}} = \frac{\sigma_{\text{max}} + \sigma_{\text{min}}}{2}$$

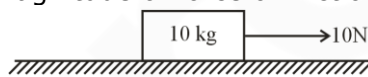
$$\Rightarrow 140 = \frac{\sigma_{\text{max}} + (-70)}{2}$$

$$\Rightarrow 280 = \sigma_{\text{max}} - 70$$

$$\Rightarrow \sigma_{\text{max}} = 280 + 70 = 350$$

$$\text{Ratio, } \frac{\sigma_{\text{min}}}{\sigma_{\text{max}}} = \frac{-70}{350} = \frac{1}{5} = 0.2$$

- Q. A block of mass 10 kg rests on a horizontal floor. Given $g = 9.81 \text{ m/sec}^2$, $\mu = 0.2$. A 10N force is applied in the horizontal direction, then the magnitude of force of friction?



(Memory Based)

- Q. Vertical channel from pouring basin to send molten metal into the runner to reach mould cavity is
- A. Sprue
 - B. Riser
 - C. Blister
 - D. Pinhole

(Memory Based)

- Q. Match the following sand-casting defects and its causing. Defects Causes

1. Blow hole	(a) Poor collapsibility
2. Misrun	(b) Mould erosion
3. Hot tears	(c) Poor permeability
4. Wash	(d) Insufficient fluidity

(Memory Based)

- Q. Water flows through pipe with velocity $\vec{v} = \left(\frac{-t}{2} + x + y \right) \hat{y}$, where \hat{y} is the unit vector in y-direction, at $t = 0$ in sec and x, y in metres. Find total acceleration (x, y) at $t = 2$ sec. Take $[x, y] = 1, 1$.

(Memory Based)

- Q. Gas gets heated in a duct as it flows over resistance heater. Consider 101 KW electric heating system. Volume flow rate = $15 \text{ m}^3/\text{sec}$. Heat lost from the gas to the surrounding takes place at the rate of 51 KW. Find the exit temperature of the gas if $C_p = 1 \text{ kJ/kg K}$ & $R = 0.5 \text{ kJ/kg K}$. Given : $P_1 = 100 \text{ KPa}$, $T_1 = 300 \text{ K}$

(Memory Based)

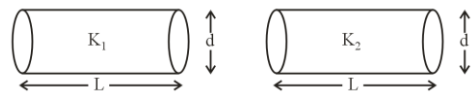
- Q. Arrange the following in decreasing order of flow rate
Pelton, Francis, Kaplan

(Memory Based)

- Q. A Variable X having Values Between 0 to 10 with uniform probability distribution. Y values ranges from 0 to 20 with uniform probability distribution. Then the probability of $(X+Y)$ being greater than 20 is,

(Memory Based)

- Q. Two rods of length L & diameter d [$L \gg d$]



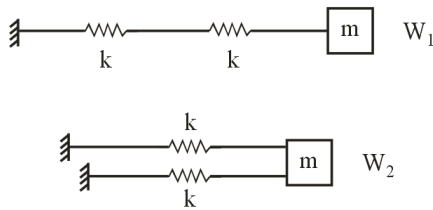
Are connected longitudinally. To form a composite bar. Heat transfer in the radial direction is zero & neglect contact resistance.

Find equivalent thermal conductivity.

- A. $\frac{2k_1k_2}{k_1 + k_2}$
- B. $k_1 + k_2$
- C. $\frac{k_1k_2}{k_1 + k_2}$
- D. $\sqrt{k_1k_2}$

(Memory Based)

- Q. Find the ratio of natural frequency of vibration w_1/w_2



- A. 1/4 B. 4
C. 1/2 D. 2

(Memory Based)

2 Marks:

- Q. For an orthogonal turning operation of a specimen having thickness 5 mm. Axial force & tangential force are given by 1259 N & 1621 N respectively. Chip thickness = 0.3 mm, Rake angle = 10° , feed = 10 mm/min & Speed of rotation of spindle = 1000 rpm. For a perfectly elastic material & Merchant's First theory, the shear strength is
- A. 722 MPa B. 200 MPa
C. 920 MPa D. 875 MPa

(Memory Based)

- Q. A circular shaft have dimensions $65^{+0.01}_{-0.05}$. It is coated with 50mm TiN having variation in thickness = ± 5 mm. Find minimum hole diameter to provide clearance fit.
- A. 65.01 B. 64.95
C. 65.10 D. 65.10

(Memory Based)

- Q. For a fully developed flow across the circular pipe the relationship between Nusselt No. at constant heat flux $\{N_{uq}\}$ & Nusselt No. at constant wall temperature $[N_{ut}]$ is given by
- A. $N_{uq} > N_{ut}$ B. $N_{uq} < N_{ut}$
C. $N_{uq} = N_{ut}$ D. $N_{uq} = [N_{ut}]^2$

(Memory Based)

- Q. In UTM experiment a sample of length 100 mm was loaded in tension. Failure load = 40 kN Displacement at failure = 15 mm. Compliance at UTM is 5×10^{-3} . The stain at failure is _____ %.

(Memory Based)

- Q. At critical point, $\sigma_{xx} = 100$ MPa, $\sigma_{yy} = 220$ MPa $\sigma_{xy} = \sigma_{yx} = 80$ MPa. All other σ are zero. Yield stress; $f_y = 468$ MPa

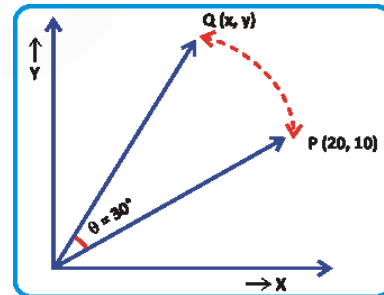
Find F.O.S. using maximum shear stress theory.

(Memory Based)

- Q. The length, width and thickness of steel sample are 400 mm, 40 mm and 20 mm respectively. Its thickness reduced by 2 mm in single pass by using horizontal slab milling. Milling cutter $[d = 100]$, $w = 50$ mm has 20 teeth and $N = 1200$ rpm. If over travel distance is same as approach distance. Then approach distance and time taken for matching is _____?
- A. 21 mm, 28.9 second
B. 14 mm, 21.4 second
C. 21 mm, 39.4 second
D. 14 mm, 18.4 second

(Memory Based)

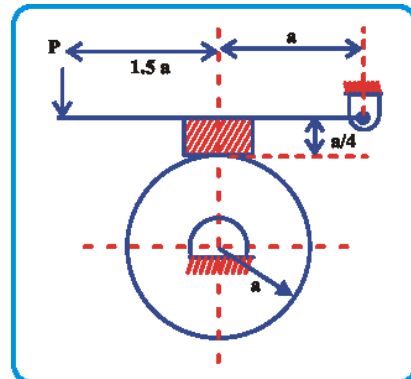
- Q. Position vector \vec{OP} of point P (20, 10) is rotated anti-clockwise by $\theta = 30^\circ$. P occupies position Q. Then coordinates (x, y) of point Q will be?



- A. 13.4, 22.32
B. 18.66, 12.32
C. 22.32, 8.26
D. 12.32, 18.66

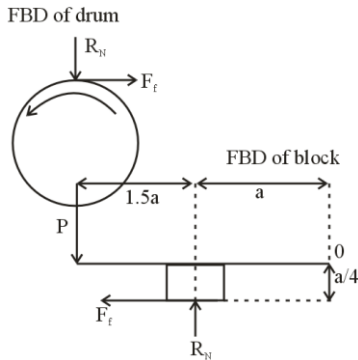
(Memory Based)

- Q. Torque = 250 Nm, $N = 100$ rpm $\mu = 0.2$, a is in mm. If maximum actuating force P is 2000 N. Then the value of a is:



(Memory Based)

Sol.



$$T = F_f \times r$$

$$250 = 0.2 R_N a$$

$$F_f = \mu R_N$$

$$\Rightarrow R_N = \frac{1250}{a}$$

$$P \times 2.5a - R_N a - F_f a/4 = 0$$

$$2000 \times 2.5a - \frac{1250}{a} \cdot a - 0.2 \cdot \frac{1250}{a} \cdot \frac{a}{4} = 0$$

$$5000a - 1250 - 62.5 = 0$$

$$\Rightarrow 5000a = 6250 + 1250000$$

$$a = \frac{1312500}{5000}$$

$$250 \times 10^3 = 0.2 R_N a$$

$$A = 262.5$$

$$R_N = \frac{1250000}{a}$$

$$5000a - \frac{1250000}{a} \cdot a - 0.2 \times \frac{1250000}{a} \cdot \frac{a}{4} = 0$$

Q. A Prismatic beam of length $L = \pi$ m pinned at both end having square cross section of side $p = 6$ mm



Given,
 $a = 3 \times 10^{-6}$
 $E = 200$ GPa
 Find minimum temperature rise to cause euler buckling of beam in _____ K.

(Memory Based)

Sol. $\frac{\Delta L}{L} = \infty \Delta T = \epsilon$ (under free support)

If P is the force acting through pinned and cross-section area of A, then,

$$\epsilon' \text{ (due to force P)}$$

$$= \frac{P/A}{E} = \frac{1}{AE} \left(\frac{\pi^2 E I_{\min}}{L_{\text{eff}}^2} \right)$$

$P = P_{cr}$ (if buckling starts)

$$\Rightarrow \epsilon = \epsilon'$$

$$\Rightarrow \infty \Delta T \Rightarrow \infty \Delta T = \left(\frac{\pi^2 E I_{\min}}{L_{\text{eff}}^2} \right) \times \frac{1}{AE}$$

$$(L_{\text{eff}} = L = \pi \text{ m}) = \pi \times 10^3 \text{ mm}$$

$$\Rightarrow \infty \Delta T = \frac{\pi^2 E I_{\min}}{\pi^2 \times 10^6} \times \frac{1}{AE}$$

$$\Delta T = \frac{E}{\infty \times 10^6} \times I_{\min} \times \frac{1}{AE}$$

$$I = \frac{a^4}{12} = \frac{6^4}{12} = 108$$

$$= \frac{108}{3 \times 10^{-6} \times 10^6} \times \frac{1}{6 \times 6}$$

$$= 1^\circ\text{C}$$

$$\Delta T = 1 + 273 + 274 \text{ K}$$

Q. How many Thin Crust pizzas were to be delivered to Party 3?

- A. 398
- B. 162
- C. 196
- D. 364

(Memory Based)

Q. System of linear equations are given

$$x + y + z = 1$$

$$ax - ay + 3z = 5$$

$$5x - 3y + az = 6$$

has infinite solution if $a = ?$

- A. 4
- B. -3
- C. 2
- D. 3

(Memory Based)

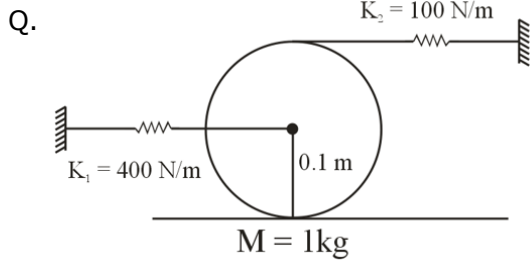
Q. Isentropic efficiency of gas turbine with pressure ratio 3 is 0.70, then what is the isentropic efficiency of steam turbine with pressure ratio is 5.

(Memory Based)

Q. A rotor of Turbojet engine $M = 180$ kg and polar moment of inertia 10 kg-m^2 . The rotor speed is 1100 rad/s clockwise. The aircraft speed is 800 km/h takes a left turn with radius 1.5 km. Find the direction of moment

- A. 162.9 Nose up
- B. 162.9 Nose down
- C. 1629.6 Nose up
- D. 1629.6 Nose down

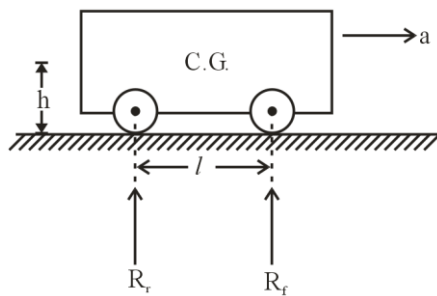
(Memory Based)



$\omega_n = ?$

(Memory Based)

Q. Find the reaction on front and rear wheel?



A. $R_f = R_r = \frac{W}{2} - \frac{W}{g} \left(\frac{h}{l} \right) a$

B. $R_f = \frac{W}{2} + \frac{W}{g} \left(\frac{h}{l} \right) a,$

$R_r = \frac{W}{2} - \frac{W}{g} \left(\frac{h}{l} \right) a$

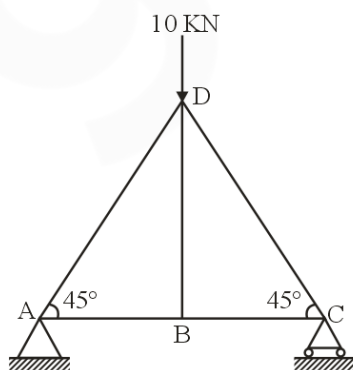
C. $R_f = \frac{W}{2} - \frac{W}{g} \left(\frac{h}{l} \right) a,$

$R_r = \frac{W}{2} + \frac{W}{g} \left(\frac{h}{l} \right) a$

D. $R_f = R_r \frac{W}{2} + \frac{W}{g} \left(\frac{h}{l} \right) a$

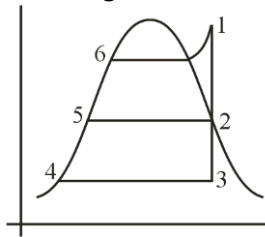
(Memory Based)

Q. Find the tension in member BC?



(Memory Based)

Q. A steam turbine with regeneration is given in figure.



Point 2 → entry of feed water heater

Point 1 → turbine point

Find the ratio of

steam bled

Total flow rate at inset of turbine in % is _____ ?

Enthalpy values at different points are given

1	2	3	4	5	6
3350	2800	230	175	700	1000

(Memory Based)

Q. Below is the list of activities with time

Maximum duration of activity S without delaying project _____

Activity	Precedence	Time
P	—	5
Q	—	1
R	Q	2
S	P, R	4
T	P	6
U	S, T	3

(Memory Based)

Q. By simple 3 months moving average method, the demand forecast of the product for the month of September is

Month	Demand
Jan	450
Feb	440
March	460
Apr	510
May	520
June	495
July	475
Aug	560

A. 536.67

B. 530

C. 490

D. 510

(Memory Based)

Q.

	I	II	III	IV	V
M	40	30	50	50	58
N	26	38	60	26	38
O	40	34	28	24	30
P	28	40	40	32	48
Q	28	32	38	22	44

Find the optimal cost for minimization.

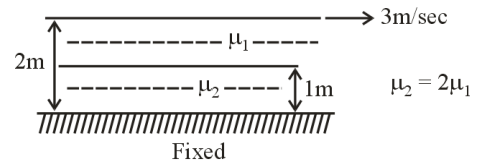
(Memory Based)

Q. Two immiscible, incompressible viscous fluid having same density & different viscosity follow

momentum equation $\frac{\partial^2 U}{\partial y^2} = 0$

Assuming Newtonian fluids & steady fully developed laminar flow with zero pressure gradient. Find the

velocity at the interface of two fluids. Lower plate is fixed & upper plate moves in right direction at 3m/sec



(Memory Based)

Q. Taylor's tool life eqⁿ is $VT^n = C$, where V is in m/min & T is in min. In a turning operation two tools X and Y are used. For X, $n = 0.3$ and $c = 60$ and for Y, $n = 0.6$ and $c = 90$. Both the tools have same tool life for cutting speed (in min) of _____?

(Memory Based)



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