

# Gate Mock Test-XI

with Solution  
Complete Syllabus

Mechanical  
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**i-Gate Mentor**



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# ***i-Gatementor***

## ***Mock Test- 11***

***Instructions:***

- 1. This paper contains 65 questions*
- 2. All questions are compulsory*
- 3. Q. 1-25 & 56-60 carry one mark each*
- 4. Q. 26-55 & 61-65 carry two marks each*
- 5. Q. 1-25 & 56-60, 1/3 marks deducted for each wrong answer*
- 6. Q. 26-51 & 61-65, 2/3 marks deducted for each wrong answer*
- 7. linked answer questions 52-55, 2/3 marks deducted for wrong answer of 52 & 54.*
- 8. Q 53 & 55, there is no negative marking, but marks will be awarded for these questions if the first part is correct*

***Syllabus: Whole syllabus***

**Q. No. 1 - 25 Carry One Mark Each**

1. A solution is not a basic feasible solution in a transportation problem if after allocation
  - (A) There is no closed loop
  - (B) There is a closed loop
  - (C) Total number of allocations is one less than number of sources and destinations
  - (D) There is degeneracy
2. Two alternative methods can produce a product; first method has a fixed cost of Rs.2000 and variable cost at Rs.20 per piece. The 2<sup>nd</sup> method has a fixed cost of Rs.1500 and an variable cost of Rs.30 per piece, The break even quantity between two alternatives is
  - (A) 25
  - (B) 50
  - (C) 75
  - (D) 100
3. In an orthogonal cutting test, the cutting force & thrust force were observed to be 1000N & 500N respectively. Rake angle of the tool is  $0^\circ$ , the coefficient of friction of chip tool interface will be
  - (A)  $\frac{1}{2}$
  - (B) 2
  - (C)  $\frac{1}{\sqrt{2}}$
  - (D)  $\sqrt{2}$
4. In a tool life test, doubling the cutting speed reduces the tool life to  $\frac{1}{8}$ th of original. The Taylors tool life index is
  - (A)  $\frac{1}{2}$
  - (B)  $\frac{1}{3}$
  - (C)  $\frac{1}{4}$
  - (D)  $\frac{1}{8}$
5. In rolling process, roll separating force can be decreased by
  - (A) Reducing roll diameter
  - (B) Increasing roll diameter
  - (C) Providing back-up rolls
  - (D) Increasing friction between the rolls & the metal
6. Which of the following law is not obeyed by the black body?
  - (A) Lambert's cosine law
  - (B) Wein's displacement law
  - (C) Rayleigh Jean's law
  - (D) None of these
7. A wheel is rolling on a straight level road with uniform velocity V. The instantaneous velocity of a point on the wheel lying at a mid point of a radius varies between
  - (A)  $1.5v$  to  $-0.5v$
  - (B)  $0.5v$  to  $-0.5v$
  - (C)  $1.5v$  to  $0.5v$
  - (D) Does not vary and is equal to v
8. If a two mass system is dynamically equivalent to a rigid body, then the system will not satisfy condition that
  - (A) The sum of two masses must be equal to that of rigid body
  - (B) Polar moment of inertia of the system must be equal to that of rigid body
  - (C) C.G of the two mass systems must coincide with that of rigid body
  - (D) Total moment of inertia about the axis through C.G must be equal to that of rigid body
9. Pick up the correct statement
  - (A) Grashoff number is considered in natural convection where as Reynolds number is considered in forced convection
  - (B) Grashoff number is considered in forced convection and Reynold number is in free convection
  - (C) Both the number are considered in both type of convection
  - (D) None of these

10. Consider the statements given below
1. Emmissivity does not depend on surface characteristics.
  2. Emmissivity of metallic surfaces decreases with temperature
  3. Emmissivity is dependent on formation of oxide layer
  4. Emmissivity of non-metallic surfaces increases with temperature
  5. Polished metallic surfaces have low emmissivity

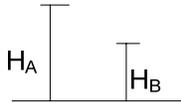
Which of the above statements are not true

- (A) 1, 2 and 5 only (B) 1, 2 and 4 only (C) 2, 3 and 5 only (D) all are false

11. In psychrometric chart,

- (A) Sensible cooling is shown by horizontal line, extending from right to left where as sensible heating is shown by vertical line from up to down
- (B) Sensible cooling is shown by horizontal line, extending from left to right and sensible heating by vertical line from down to up
- (C) Sensible cooling is shown by horizontal line from right to left and sensible heating is also shown by horizontal line from left to right
- (D) Sensible cooling is shown by vertical line from up to down and sensible heating is also by vertical line from down to up.

12. Point A of head  $H_A$  is at higher elevation than point B of head  $H_B$ . If the head loss between the point is  $H_L$  the flow will take place



- (A) Always from A to B (B) From A to B if  $H_A + H_L = H_B$   
 (C) From B to A if  $H_A + H_L = H_B$  (D) From B to A if  $H_B + H_L = H_A$

13. The least radius of gyration of a ship is 9m and met centric height is 750mm. Then time period of oscillation is

- (A) 42.41 sec (B) 75.4 sec (C) 20.85 sec (D) 85 sec

14. Air is 20°C dry bulb temperature and 40% relative humidity is heated upon 40°C using an electric heater, whose surface temperature is maintained uniformly 45°C. The B.P.F. of heater is

- (A) 0.20 (B) 0.25 (C) 0.88 (D) 1.0

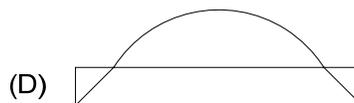
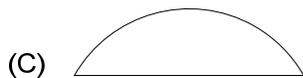
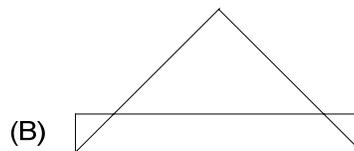
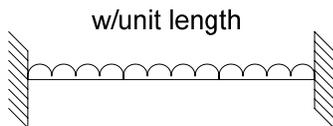
15. Match **List I** with **List II**:

**List I**

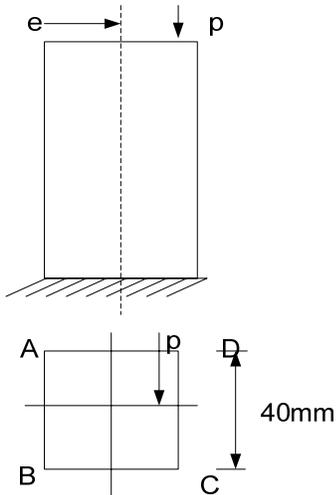
**List II**

- |                  |     |  |
|------------------|-----|--|
| E Sterling cycle | I   | Two isothermal and two isochoric process |
| F Ericsson cycle | II  | Two isobaric and two isentropic process  |
| G Joule's cycle  | III | Two isochoric and two isentropic process |
|                  | IV  | Two isothermal and two isobaric          |
- (A) E – II, F – I, G – III (B) E – II, F – III, G – IV  
 (C) E – I, F – IV, G – II (D) E – I, F – IV, G – III

16. A system of 100 kg mass undergoes a process in which its specific entropy increases from 0.3KJ/kg-k to 0.4kJ/kg-k. At the same time the entropy of surroundings decreases from 80 kJ/K to 75kJ/k. The process is  
 (A) Reversible & isothermal (B) Irreversible (C) Reversible (D) Impossible
17. A reaction turbine discharges 30m<sup>3</sup>/s of water under a head of 10m with an overall efficiency of 92%. The power developed is  
 (A) 2952.5 kW (B) 2870.0 kW (C) 2707.6 kW (D) 2652.0 kW
18. If Eigen value of matrix A is zero then A is  
 (A) Singular (B) Non-singular (C) Orthogonal (D) None of those
19. The differential equation  $\left(\frac{dx}{dy}\right)^2 + ay^{1/2} = x$   
 (A) Linear of degree 2 (B) Non linear of order one & degree 4  
 (C) Non linear of order one & degree 2 (D) None of these
20. If  $\vec{F}$  be a vector function such that  $\text{div } \vec{F} = 0$  then F is called  
 (A) Solenoid (B) Irrotational (C) Conservative (D) None of these
21. The bending moment distribution for the beam is



22. A column of square section 40mm × 40mm fixed to the ground carries an eccentric load P = 1600N as shown. If stress developed along the edge CD is -1.2N/mm<sup>2</sup>, the stress along the edge AB will be



- (A)  $-1,2N / \text{mm}^2$       (B)  $+1N / \text{mm}^2$       (C)  $+0.8N / \text{mm}^2$       (D)  $-0.8N / \text{mm}^2$

23. The equilibrium condition for a rigid body is  
 (A) sum of all forces should be zero  
 (B) sum of moment about any reference point should be zero  
 (C) both (A) and (B)  
 (D) none of these
24. Cantilever beam of constant flexure rigidity and length  $2L$  carries a concentrated load  $P$  at its midpoint & deflection under this load at the free end is  $S$ . If a cantilever beam of same flexural rigidity & length  $L$  is subjected to load  $P$  at its free end, deflection at its free end is  
 (A)  $\frac{2}{5}\delta$       (B)  $8\delta$       (C)  $\frac{1}{8}\delta$       (D)  $4\delta$
25. Match the following lists:

**List I**[limits]

**List II**[values]

(a)  $\lim_{x \rightarrow -\infty} \frac{e^x}{4 + 5e^{3x}}$

(1)  $\frac{1}{3}$

(b)  $\lim_{x \rightarrow \infty} \frac{5^x}{3^x + 2^x}$

(2)  $0$

(c)  $\lim_{x \rightarrow -\infty} \frac{x + 7}{3x + 5}$

(3)  $\infty$

(A)  $a - 3, b - 3, c - 1$

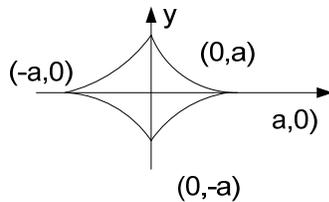
(B)  $a - 2, b - 3, c - 1$

(C)  $a - 2, b - 2, c - 3$

(D) None of the above

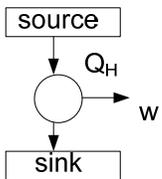
**Q. No. 26 - 51 Carry Two Marks Each**

26. The value of line integral  $\int_c y^2 dx + (2xy + 1) dy$  along the quarter circle in the first quadrant of radius 2 is  
 (A) 1 (B) -1 (C) 2 (D) -2
27. The arc length of asteroid  $x^{2/3} + y^{2/3} = a^{2/3}$

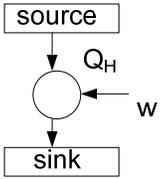


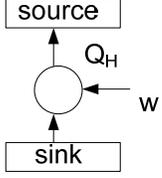
- (A) 6a (B) 2a (C) 4a (D) 8a
28. The integrating factor for the equation  $x(\ln x)^2 \frac{dy}{dx} + y \ln x = 2$  is  
 (A)  $\log x$  (B)  $x \log x$  (C)  $x^2$  (D)  $e^{2x}$
29. What will be the effect on eccentricity ratio for a hydrodynamic journal bearing if there is increase in the diameter of journal (Assume other parameters as constant)  
 (A) it will increase (B) it will decrease (C) it will remain same (D) none of these
30. The braking torque for a single band brake is 1575 Nm and the band brake has a contact of  $270^\circ$ . The diameter of drum on which band brake is working is 600mm and thickness of band is given by the relation  $t = .0005d$ , where  $d$  is diameter of drum. What will the value of tension on the slack side if drum is rotating clockwise? The co-efficient of friction is 0.25.  
 (A) 7579.52Nm (B) 2332.26N (C) 5247.36 (D) None of these
31. A mild steel is welded with a speed of 5m/min. The length of job is 15m and the preparation time for starting the welding operation is 10% of actual welding time. The operation factor for the welding operation will be  
 (A) 99% (B) 92.87% (C) 90.9% (D) 86.76%
32. If the arrival takes place every 10 minutes with a service time 4 minutes per unit then the mean arrival rate ( in unit/minute), mean service rate ( in unit/minute), & the probability that one have to wait will be respectively  
 (A) 10, 4 & 0.25 (B) 0.1, 0.25 & 0.4 (C) 10, 0.4 & 0.25 (D) 0.1, 0.25 & 0.1
33. There are two products A & B with following characteristics
- | Product       | Demand       | Order cost | Holding cost |
|---------------|--------------|------------|--------------|
| (in Rs/order) | (in Rs/unit) |            |              |
| A             | 100          | 100        | 4            |
| B             | 400          | 100        | 1            |
- The economic order quantity of product A and B will in the ratio of  
 (A) 1 : 1 (B) 1 : 2 (C) 1 : 4 (D) 1 : 8
34. Which of the following pairs are correctly matched?  
 1. Resilience - Resistance to deformation  
 2. Malleability - Shape change

3. Creep - Progressive deformation  
 4. Plasticity - Permanent deformation  
 (A) 2, 3 & 4 (B) 1, 2 & 3 (C) 1, 2 & 4 (D) 1, 3 & 4
35. A shell and tube heat exchanger is designed to heat water. There are 10 tubes; each of length 40m, for water to flow each tube makes eight passes through the shell. What is the approximate length of shell?  
 (A) 5 (B) 2.5 (C) 10 (D) 40
36. The ratio between two consecutive spindles speeds for a six-speed drilling machine using drills of diameter 6.25 to 25mm size and cutting velocity 18 m/min is  
 (A) 1.02 (B) 1.32 (C) 1.06 (D) 1.82
37. The temperature distribution in a stainless fin having thermal conductivity of  $0.17 \text{ W/cm}^\circ\text{C}$  of constant cross sectional area of  $2 \text{ cm}^2$  and length of 1cm exposed to an ambient of  $40^\circ\text{C}$  (With surface heat transfer  $0.25 \text{ W/cm}^2 - ^\circ\text{C}$ ) is given by  $(T - T_a) = 3x^2 - 5x + 6$  where  $T$  is in  $^\circ\text{C}$  &  $x$  is in cm. The base temperature is  $100^\circ\text{C}$  then net heat dissipated by the fin surface will be  
 (A) 5.64W (B) 3.4W (C) 1.7W (D) 0.17W
38. The operating temperature of a cold storage is  $-2^\circ\text{C}$ . Heat leakage from the surrounding is 30 kW for ambient temperature of  $40^\circ\text{C}$ . The actual COP of the refrigeration plant using  $\frac{1}{4}$ th of an ideal plant working between same temperatures. The power required to drive the plant is  
 (A) 1.86 kW (B) 3.72kW (C) 7.44 kW (D) 18.6 kW
39. The heat pump is shown schematically as
- (A)

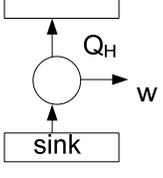


(B)

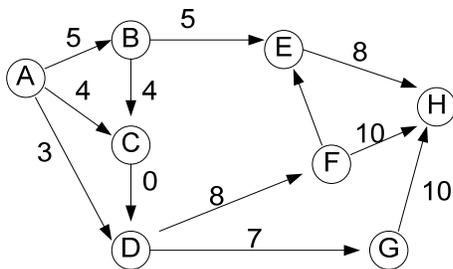

- (C)



(D)

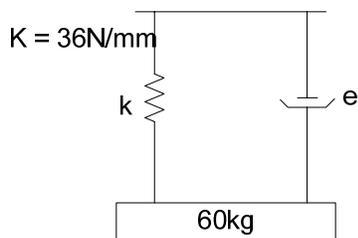

40. The temperature distribution, at a certain instant of time in a slab during curing is given by  $T = 3x^2 - 5x + 17$ . Where  $x$  is in cm &  $T$  is in K. The rate of change of temperature with time is given by [diffusivity is  $0.0003 \text{ cm}^2/\text{s}$ ]  
 (A)  $0.0009 \text{ k/s}$  (B)  $+0.0048 \text{ k/s}$  (C)  $-0.0012 \text{ k/s}$  (D)  $+0.0018 \text{ k/s}$
41. A Newtonian fluid is filled in the clearance between a journal and the bearing, when a force of 500N is applied to the bearing; it attains a speed of 25m/sec. What will be the speed of bearing if force is increased by 75% and distance or clearance between journal and bearing is halved? Area of cross-section remains same.  
 (A) 10.93m/s (B) 16.40m/s (C) 19.25m/s (D) 21.875m/s
42. In a parsons turbine, blade velocity is 320m/s at the mean radius and the rotor blade exit angle is  $30^\circ$ . For minimum K.E of the steam leaving the stage the steam velocity of the exit of the stator will be  
 (A) 369.5 m/s (B) 640 m/s (C) 184.75 m/s (D) 92.38 m/s

43. For a laminar flow over a flat plate, the thickness of a boundary layer at a distance from leading edge is found to be 5mm. Thickness of the boundary layer of down stream section, which is at twice the distance of the previous section from the leading edge will be  
 (A) 10mm (B)  $5\sqrt{2}$  mm (C)  $\frac{5}{\sqrt{2}}$  (D) 2.5mm
44. A cylinder is rotating with 250r.p.m speed. The fluid inside the cylinder has a density  $8830 \text{ kg/m}^3$ . Height and diameter of the cylinder are 3m and 0.3m respectively. The difference between the thrust force between bottom and top surface is  
 (A) 73.5kN (B) 259.9kN (C) 440.8kN (D) 83.5kN
45. Two pipe line of equal length and with diameter of 15cm and 10 cm are in parallel and connect two reservoirs. The difference in water levels of reservoirs is 3m. If the friction factor assumed to be constant the ratio of discharge due to larger diameter pipe to smaller diameter pipe is  
 (A) 3.375 (B) 2.756 (C) 2.25 (D) 1.5
46. For the network shown in the given figure, the earliest expected completion time of the project is



- (A) 26 days (B) 27 days (C) 30 days (D) Indeterminable
47. The maximum heat in resistance welding is at the  
 (A) Tip of the positive electrode  
 (B) Tip of the negative electrode  
 (C) Top surface of the plate at the time of electric contact with electrode  
 (D) Interface between two plates being joined

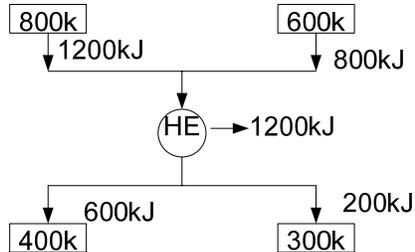
**Common Data Questions: 48 & 49**



For the system shown, the amplitude of vibration reduces from 45 mm to 8mm in two complete oscillations

48. The damping coefficient is  
 (A) 0.23 N/mm/s (B) 0.4 N/mm/s (C) 0.53 N/mm/s (D) 0.632 N/mm/s
49. The periodic time of damped vibration is  
 (A) 0.2536 sec (B) 0.123 sec (C) 0.259 sec (D) 0.289 sec

**Common Data Questions: 50 & 51**



50. The change in entropy for the system  
 (A)  $-1.5\text{kJ/k}$  (B)  $1.5\text{kJ/k}$  (C)  $+0.667\text{kJ/k}$  (D)  $-0.667\text{kJ/k}$
51. The process is  
 (A) Reversible (B) Irreversible (C) Impossible (D) Isentropic

**Linked Answer Questions: Q.52 to Q.55 Carry Two Marks Each**

**Statement for Linked Answer Questions: 52 & 53**

The voltage length characteristic of a direct current arc is given by  $V=(10+40l)$  volts where  $l$  is the length of the arc is in cm. The power source characteristics is approximated by a straight line with an open circuit voltage as 60 Volt and a short circuit current = 1525 amp.

52. Optimum arc length will be  
 (A) 0.1 cm (B) 0.5 cm (C) 0.4 cm (D) 0.6 cm
53. Corresponding to optimum arc length, the arc power will be  
 (A) 20.8 kVA (B) 14.75 kVA (C) 18.65 kVA (D) 22.875 kVA

**Statement for Linked Answer Questions: 54 & 55**

Steam flows from the nozzles of a single row impulse turbine with a velocity 450m/s at a direction which is inclined at angle of  $16^\circ$  to the peripheral velocity. Steam comes out of the moving blades with an absolute velocity of 100 m/s in a direction  $110^\circ$  with the direction of blade motion. The blades are equiangular and steam flow rate is 6kg/s.

54. Power developed is  
 (A) 250 kW (B) 325 kW (C) 480 kW (D) 30 kW
55. Power loss due to friction will be  
 (A) 825.67 kW (B) 100.5 kW (C) 126.7 kW (D) 250 kW

**Q. No.56 - 60 Carry One Mark Each**

56. Among the four words, choose the word that does not belong to the group.  
(A) Botany (B) Sericulture (C) Horticulture (D) Culture
57. In the following sentence, a part of the sentence is underlined. Beneath each sentence you will find four ways of phrasing the underlined part. Choose the best choice that follows the requirements of standard written English. Stringent measures like banning all those responsible for the mess and refunding money appear to be the only way out.  
(A) appear to be the only way out (B) appears as the only way out  
(C) appears the only way out (D) appear as the only way
58. The simplest animals are those whose bodies are simplest in structure and which do the things done by all living animals, such as eating, breathing, moving, and feeling, in the most ----- way.  
(A) haphazard (B) bizarre (C) primitive (D) advantageous
59. A train without stoppages travels on an average 50 km an hour and with stoppages, 40 km an hour. For how many minutes, on an average, does the train stop in an hour?  
(A) 1/10 (B) 12 (C) 1/5 (D) 20
60. A can complete a job in 12 days, B can finish the same job in 15 days while C can do the same in 20 days. On the first day, A and B work, on the 2<sup>nd</sup> day, B and C work, and on the third day, A and C work. If this series continues till the work finishes, how many days will the work last?  
(A) 6 days (B)  $7\frac{3}{8}$  days (C)  $7\frac{3}{7}$  days (D) 8 days

**Q. No. 61 - 65 Carry Two Marks Each**

61. Identify the pair of words, which has a relationship similar to Wheat : Chaff  
(A) Wine : Dregs (B) Crop : Corn  
(C) Laughter : Revelry (D) Cloud : Rain
62. Each statement has three segments. Choose the alternative where the third segment in the statement can be logically deduced using both the preceding two, but not just from one of them.
1. All physicists are biologists; some biologists are botanists; no botanist is a physicist.
  2. Some cats are dogs. All dogs are rats. All cats are rats.
  3. Carrot is red; radish is red; no vegetable is green in colour.
  4. Sanjay has an MBA; No MBAs have doctorates; Sanjay doesn't have a doctorate.
- (A) only 3 (B) 2 and 4 (C) only 4 (D) 1 and 3
63. Read the following passage carefully, and answer the question that follows.  
The mean per capita income for an individual was 3.5 percent higher in 1996 than in 1995. At the same time, average per capita income declined for individuals at the lower and middle income levels.  
Which of the following can be most logically inferred from the above?  
(A) There were more individuals in 1996 than in 1995  
(B) There were fewer individuals at the upper income level in 1996 than in 1995  
(C) Average per capita income for individuals at the upper level rose by more than 3.5 percent between 1995 and 1996  
(D) Average per capita income for individuals was declining prior to 1995

**Directions for question 64: the questions is followed by two statements, I and II**

Choose **A**; if the question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.

Choose **B**; if the question can be answered by using either of the statements alone

Choose **C**; if the question can be answered by using both the statements together, but cannot be answered using either of the statements alone.

Choose **D**; if the question cannot be answered even by using both the statements together

64. 
$$\frac{y(1+x^2)}{x}$$

I.  $xy > 0$

II.  $x + y < 5$

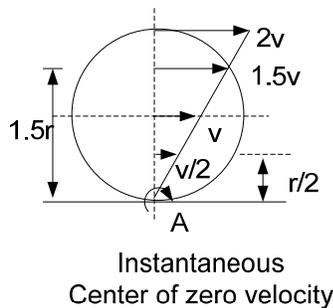
65. Consider the set of numbers  $N=1,2,3,4,5,6,7,8$ . Take every distinct two element subset of  $N$  and write down the number that is smaller. For eg, if you take the subset  $(2,5)$ , you will write down 2, What is the sum of all the numbers  $\pm$ at you write down?

(A) 28      (B) 84      (C) 168      (D) None of these

**ANSWER KEYS**

1	B	2	B	3	A	4	B	5	A	6	D	7	C
8	B	9	A	10	B	11	C	12	C	13	C	14	A
15	B	16	B	17	C	18	A	19	B	20	A	21	D
22	D	23	C	24	A	25	B	26	C	27	A	28	A
29	B	30	B	31	C	32	B	33	C	34	A	35	A
36	B	37	A	38	D	39	C	40	D	41	D	42	A
43	B	44	A	45	B	46	C	47	D	48	B	49	C
50	D	51	C	52	B	53	D	54	C	55	B	56	D
57	A	58	C	59	B	60	C	61	A	62	A	63	C
64	D	65	B										

1. A basic feasible solution will contain  $(m + n - 1)$  independent non zero allocations and indication of independence of a set of individual positive allocations is that we can't form a closed loop by joining allocations by horizontal and vertical lines only,
2.  $2000 + X \times 20 = 1500 + 30 \times X$ ,  $x = 506$ .
7. The wheel is rotating about the point A with angular velocity  $\frac{V}{r}$



- ∴ The variation
12. According to energy equation a flow will take place between the pt 1 & 2 if  $H_1 = H_2 = H_1$  & if will flow from 1 to 2. Here total energy at B is higher than total energy at A. [datum head is the par of total head. ]
  13. Time period =  $2\pi \sqrt{\frac{(\text{radius of gyration})^2}{(\text{metacentric height})}} = 2\pi \sqrt{\frac{9^2}{0.75 \times 9.81}} = 20.85 \text{ sec}$
  14.  $BF = \frac{45 - 40}{45 - 20} = \frac{5}{25} = 0.2$
  16. Entropy change of system  $S_{\text{sys}} = (0.4 - 0.3) \times 100 = 10 \text{ kJ/k}$

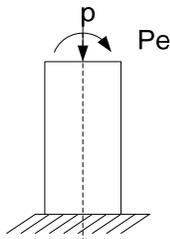
Entropy change of surroundings, the place  $\Delta S_{surr} = (75 - 80) = -5 \text{ kJ / k}$ , Net change  $\Delta S_{syst} + \Delta S_{surr} = 5 \text{ kJ / k} > 0$

Hence irreversible

19. Rearranging,  $ay^{1/2} = X - \left(\frac{dx}{dy}\right)^2$ ,  $a^2 y = \left\{x - \left(\frac{dx}{dy}\right)^2\right\}^2 = x^2 - 2x \cdot \left(\frac{dx}{dy}\right)^2 + \left(\frac{dx}{dy}\right)^4$

Hence non linear of order 1 & degree 4

22. In CD face compressive load will act due to force P & eccentricity

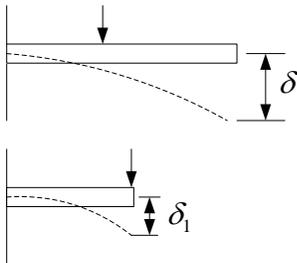


$$\sigma_c + \sigma_f = -1.2 \text{ N / mm}^2, \quad \sigma_f = -\frac{1600}{40 \times 40} = -1 \text{ N / mm}^2, \quad \sigma_e = -0.2 \text{ N / mm}^2$$

Hence if face AB  $0.2 \text{ N / m}^2$  tensile load will act.

$$\therefore \sigma_t = \sigma_{e/AB} + \sigma_f = -0.8 \text{ N / mm}^2$$

24. Deflection in first case



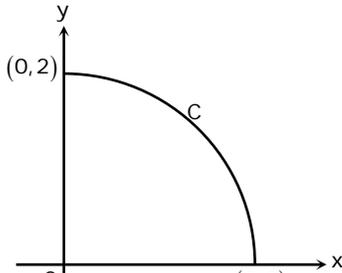
$$\delta = \frac{PL^3}{3EI} + \frac{PL^2}{2EI} (2L - L) = \frac{5PL^3}{6EI}$$

$$\delta_1 = \frac{PL^3}{3EI} \times \frac{6EI}{5PL^3} = \frac{2}{5}$$

$$\delta_1 = 2 / 5 \delta$$

25.  $\lim_{x \rightarrow -\infty} \frac{e^x}{4 + 5e^{3x}} = 0$ ,  $\lim_{x \rightarrow -\infty} \frac{5^x}{3^x + 2^x} = \infty$ ,  $\lim_{x \rightarrow -\infty} \frac{x+7}{3x+5} \left(\frac{\infty}{\infty}\right) = \lim_{x \rightarrow -\infty} \frac{1}{3}$  (L'Hopital rule) =  $\frac{1}{3}$

26.



The parametric equation of the circular arc C is  $C: \begin{cases} x = 2 \cos t \\ y = 2 \sin t \end{cases} \quad \left( t = 0 \rightarrow \frac{\pi}{2} \right)$

$$dx = (-2 \sin t) dt, dy = (2 \cos t) dt$$

$$\int_C y^2 dx + (2xy + 1) dy$$

$$= \int_0^{\pi/2} (4 \sin^2 t)(-2 \sin t dt) + (8 \cos t \sin t + 1)(2 \cos t dt)$$

$$= \int_0^{\pi/2} [-8(1 - \cos^2 t) \sin t + (16 \cos^2 t \sin t + 2 \cos t)] dt$$

$$= 8 \cos t - 8 \cos^3 t + 2 \sin t \Big|_0^{\pi/2}$$

$$= 2$$

29.  $\epsilon = 1 - \frac{2h_0}{c} \quad c = D - d$

30.  $\theta = 270^\circ = 4.712 \text{ rad}$

$$\frac{T_1}{T_2} = e^{\mu\theta} = 3.25$$

$$T_1 = 3.25 T_2$$

$$T_B = (T_1 - T_2) r_e$$

$$r_e = r + \frac{t}{2} = 300 + .005 \times \frac{600}{2} = 300.15 \text{ Nmm}$$

$$1575 = (3.25T_2 - T_2) \times 300.15 \times 10^{-3}$$

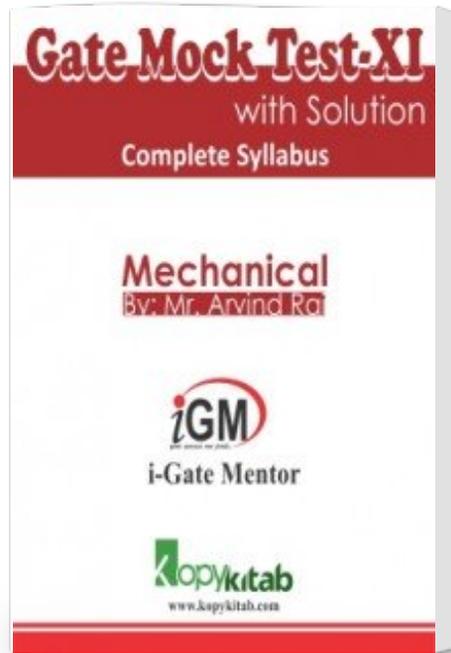
31.  $t = \text{Actual welding time} = \frac{L}{V} = \frac{15}{5} = 3 \text{ min}, \quad t_p = \text{preparation time} = 10\% \text{ of } t = .3$

$$\text{Operation factor} = \frac{\text{Actual time}}{\text{Total time}} \times 100 = \frac{3}{3.3} \times 100 = 90.9\%$$

32. Arrival  $A = 1/10 = 0.1 \text{ unit/min}$ , service rate  $\mu = 1/4 = 0.25 \text{ unit/min}$

$$\text{Probability that one have to wait} = \frac{0.1}{0.25} = 0.4$$

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