

CASCADING TEST - 2

- **DATE.....12/09/2015**
- **TIME.....2.5Hrs**
- **TOTAL QUESTION.....50**
- **NEGATIVE MARKING.....1/4**
- **TOTAL MARKS.....**

SYLLABUS

- 1. THERMODYNAMICS**
- 2. PRODUCTION**
- 3. MD**
- 4. SOM**
- 5. INDUSTRIAL**
- 6. F.M.**

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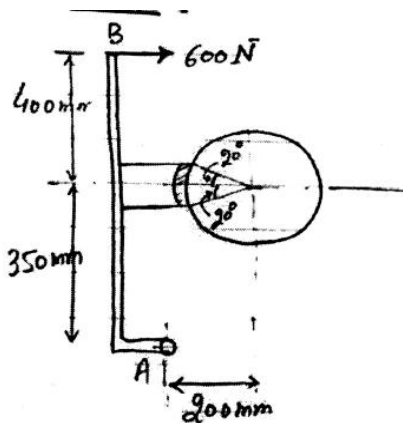
1. A journal bearing 60 mm in diameter and 90 mm long runs at 450 rpm. The oil used for hydrodynamic lubrication has absolute viscosity of 0.06 kg/m-sec. If the diametral clearance is 0.1 mm, for sommer-feld number 0.238, the safe load on the bearing will be-----

cylinder by means of 16 bolts and in between gasket is placed. Each bolt is initially tightened with a preload of 20 kN. The stiffnesses of bolt, each flange and gasket are 1182 kN/mm, 10053 kN/mm and 45238 kN/mm respectively. The resultant load on each bolt will be -----.

2. Fig shows a brake shoe applied to a drum by a lever AB which is pivoted at a fixed point A and rigidly fixed to the shoe. The radius of the drum is 160 mm. The coefficient of friction of the brake lining is 0.3. If the drum rotates clockwise, the breaking torque will be -----

4. Load carrying capacity of Hydrostatic bearing.

- (a) Increases with speed
- (b) Remains constant/same irrespective of journal speed
- (c) Decreases with speed
- (d) First increases and then decrease



3. The cover of a cylindrical pressure vessel is made of cast iron. The inner diameter of cylinder is 500 mm and the internal pressure is limited to 2 MPa. The cover is fixed to the

5. Which of the following statement is incorrect?

- (a) Tapered roller bearings are used for large Radial and thrust loads
- (b) Spherical roller bearings have self aligning property
- (c) Ball bearings can carry radial loads only

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(d) Needle roller bearings can carry heavy radial loads with oscillatory motion such as in Piston pin bearings of heavy duty diesel engines.

6. A liquid has a weight density of 9268 N/m^3 and dynamic viscosity of 131.5 Ns/m^2 . The kinematic viscosity of liquid is ----- m^2/sec .

7. A shaft of 8 c.m. diameter and 30 c.m. length is pulled steadily at $V = 0.4 \text{ m/s}$ through a sleeve of 8.02 c.m. diameter. The clearance is filled with oil of $\nu = 0.003 \text{ m}^2/\text{sec}$ and S.G. = 0.88, the force required to pull the shaft is:-

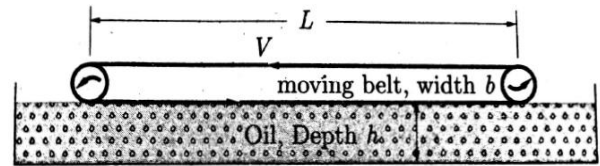
- (a) 793 N (b) 795 N
(c) 79.3 N (d) 7.95 N

8. A liquid film suspended on a rectangle wire frame of one movable side of 12 c.m. What amount of surface tension is required if the movable side of frame is to be moved with 0.018 N?

- (a) 0.075 N/m (b) 0.00432 N/m
(c) 0.055 N/m (d) 0.15 N/m

9. The belt shown in figure below moves at steady velocity of 2.5 m/s and skims the top of a tank of oil SAE 30 ($\mu = 0.29 \text{ kg/m.s}$) at 20°C with

$L = 4\text{m}$, $b = 90 \text{ c.m.}$ and $h = 6 \text{ c.m.}$
What power P in watts is required to remain belt in motion?

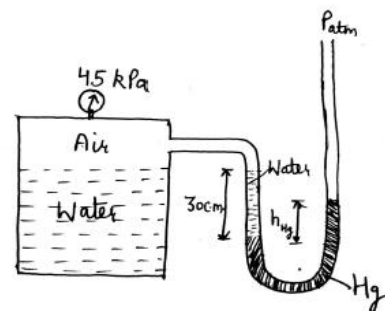


- (a) 11 Watts (b) 44 Watts
(c) 109 Watts (d) 1.1 Watts

10. The barometric reading for a wall is given as 511 mm Hg at the top and 528.5 mm Hg at the bottom. For average air density of 1.18 kg/m^3 , the height of wall is ($\rho_{\text{Hg}} = 13600 \text{ kg/m}^3$)

- (a) 205 m (b) 202 m
(c) 210 m (d) 200 m

11. The gauge pressure of air in the water tank shown in figure below is 45 kPa. The differential height, h_{Hg} of the mercury column will be.



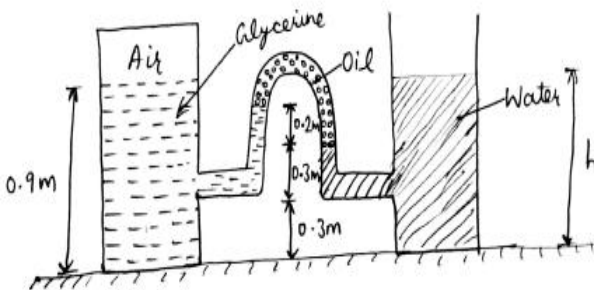
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(a) 30 c.m. (b) 36 c.m.

(c) 13.6 c.m. (d) 51 c.m.

12. A inverted U - tube manometer containing oil having specific gravity of 0.8, is located b/w two reservoirs as shown in the figure. The reservoir on the right, contains water and is open to atmosphere and the reservoir on the left contains glycerin is closed and pressurized to 62 kPa. What will be depth of water in figure.

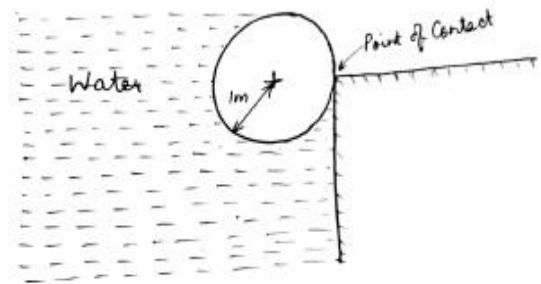
(Take $\gamma_{\text{glycerine}} = 12.4 \text{ kN/m}^3$)



(a) 0.721 m (b) 6.21 m

(c) 7.21 m (d) 0.0721 m

13. A 3m long cylinder floats in water and rests against a wall as shown in figure below. What will be the horizontal force that cylinder exerts on the wall at the point of contact?



(a) 14.7 kN (b) 58.8 kN

(c) 44.1 kN (d) 28.14 kN

14. An idealised incompressible flow has the proposed three dimensional velocity distribution.

$$\vec{V} = -2xy^2\hat{i} + f(y)\hat{j} - zy^2\hat{k}$$

What will be the appropriate form of the function $f(y)$ which satisfies the continuity relation?

(a) $f(y) = 3y^3 + \text{constant}$

(b) $f(y) = 2y + \text{constant}$

(c) $f(y) = y^3 + \text{constant}$

(d) $f(y) = \frac{-y^3}{3} + \text{constant}$

15. Consider the following:-

1. Uniform flow

2. Vortex flow

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3. Irrotational flow
4. Steady flow
- Which of the above are assumptions for Euler/Bernoulli equation:-
- (a) 1, 3 and 4 (b) 3 and 4
(c) 2 and 4 (d) Only 4
16. In casting defect, honey combing/ sponginess refers to
- (a) Presence of impurities in molten metal
(b) Molten metal at low temperature
(c) Formation of number of cavities in close proximity in casting
(d) Defects to poor heat treatment
17. In deep drawing operation, the limiting drawing ratio is defined as:-
- (a) $\frac{D_b}{D_p}$ (b) $\frac{D_p}{D_b}$
(c) $\frac{D_b - D_p}{D_p}$ (d) $\frac{D_p - D_b}{D_p}$
- ($D_b \rightarrow$ max. blank diameter, $D_p \rightarrow$ punch diameter)
18. Which of the following statements is incorrect for heliarc welding?
- (a) It is also known as gas tungsten arc welding (GTAW)
(b) It uses an inert gas to protect the weldzone from the atmosphere.
(c) Heliarc welds are stronger, more ductile and more corrosion resistant than welds made with ordinary metal arc welding.
(d) None of these
19. In metal cutting operation, the Merchant's machinability constant is 70 when rake angle is 20° and friction angle is 40° . For a feed of 0.4 mm/rev, the chip thickness will be.
- (a) 0.707 mm (b) 0.805 mm
(c) 0.943 mm (d) 0.556 mm
20. In abrasive Jet machining process, the abrasive particles should be
- (a) Made of diamond powder
(b) Perfectly round
(c) Of irregular shape
(d) Around 1 mm in size
21. Two blocks of iron and copper, both

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initially at 80°C , are dropped into a large lake at 15°C . The mass of the iron and copper blocks are 50 kg and 20 kg respectively. After a while the system is in thermal equilibrium due to heat transfer between the blocks and lake water. What will be the total entropy change for this process?

($C_{\text{iron}} = 0.45 \text{ kJ/kg} \cdot ^\circ\text{C}$, $C_{\text{copper}} = 0.386 \text{ kJ/kg} \cdot ^\circ\text{C}$)

- (a) -4.579 kJ/K (b) -1.571 kJ/K
 (c) 0.670 kJ/K (d) 6.820 kJ/K

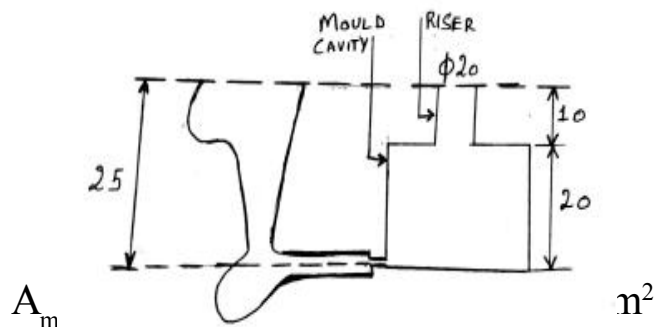
22. A refrigerator transfers 1 kJ of heat from cold region at -20°C to hot region at 30°C . If the COP of the refrigerator is 4, the total entropy change of the regions will be.

- (a) $1.73 \times 10^{-2} \text{ kJ/K}$
 (b) $1.73 \times 10^{-3} \text{ kJ/K}$
 (c) 0.1730 kJ/K
 (d) $1.73 \times 10^{-4} \text{ kJ/K}$

23. In the gating system of a casting process, the ratio of the height of the sprue and the height of the pouring

cup is 4. A sprue is designed in order to avoid air aspiration effect. The ratio of the diameter at the top and bottom of the sprue is -----

24.



A_g (Area of gate) = 5cm^2

Total time to fill the mould cavity along with the riser is ----- sec.

25. In arc welding process, the voltage and current are 50 V and 600 A respectively. The arc heat transfer efficiency is 0.90 and welding speed is 16 mm/sec. The net heat input (in J/mm) is

- (a) 1687.5 (b) 2083.3
 (c) 168.75 (d) 208.33

26. A hole is pierced in $t = 2.5 \text{ mm}$ thick steel sheet having shear strength $\tau = 350 \text{ MPa}$. The punch force for the operation is 68.7 kN. The die

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diameter (in mm) and punch diameter (in mm) respectively are:-
[The diametral clearance is given by $c = 0.0064t \sqrt{\tau}$]

- (a) 25.0, 25.3 (b) 25.0, 24.7
(c) 24.7, 25.0 (d) 25.3, 25.0

27. A 12 mm diameter wire is drawn through a die at a speed of 1m/s to reduce the diameter by 18%. The yield stress of the material is 600 MPa. Without considering the friction and strain hardening, the required stress (in MPa) and power (in kw) for the drawing process respectively are

- (a) 357 and 8.97
(b) 357 and 18
(c) 238.14 and 8.97
(d) 238.14 and 18

28. In an expansion process of air through a very thin pipe from pressure and temperature, respectively of 10 bar and 700 K to pressure of 2.5 bar. The temperature of surrounding is $25^\circ C$. Assuming air to be an ideal gas, the irreversibility associated with the process is ----- kJ/kg

29. Carbon steel balls ($\rho = 7833 \text{ kg/m}^3$ and $c_p = 0.465 \text{ kJ/kg } ^\circ C$) 8 mm in diameter are annealed by heating them first to $900^\circ C$ in a furnace and then allowed them to cool slowly to $100^\circ C$ in ambient air at $35^\circ C$. If 2500 balls are to be annealed per hour, the total rate of heat transfer from the balls to the ambient air is -
-----W.

30. At a certain point in a strained material the intensities of normal stresses on two planes at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both tensile and a shear stress is 10 N/mm^2 . The principal stresses and maximum shear stress [in MPa] respectively are.

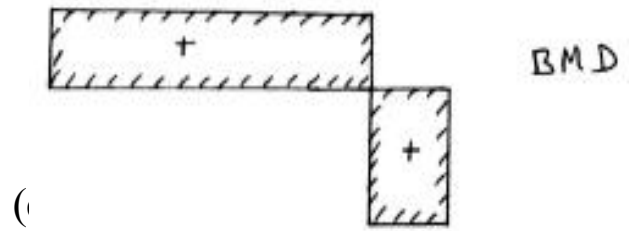
- (a) 26.18, 3.82 and 11.18
(b) 30, 15 and 7.5
(c) 26.18, 3.82 and 13.09
(d) 11.18, 11.18 and 5.6

31. 3 m long steel bar has a uniform diameter of 40 mm for a length of 1m from one end. For next 0.5 m length, the diameter decreases uniformly to 'd' and for next 0.5 m length, the diameter increases

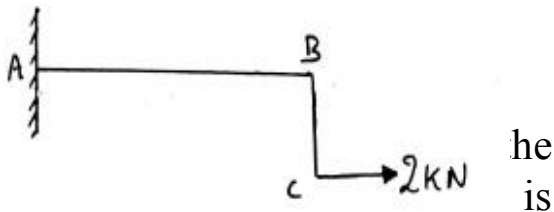
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uniformly to 80 mm and then it has a uniform diameter for next 1 m length. When a load of 200 kN is applied, the observed extension is 2.20 mm. The value of diameter 'd' is -----mm.

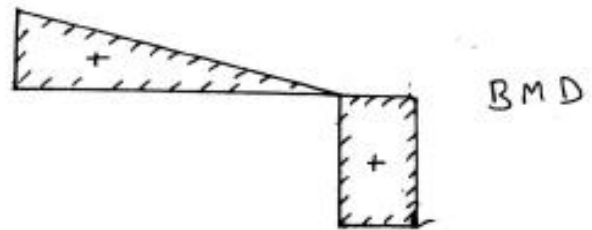
[Take modulus of elasticity for steel as 200 kN/mm²]



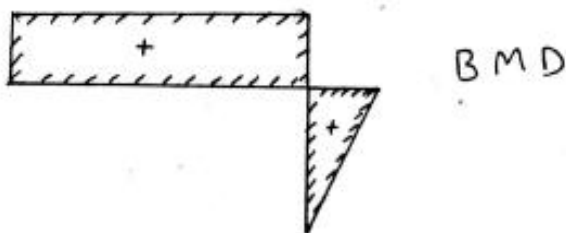
32.



Under 2 kN loading at C, the best possible bending moment diagram can be.



(a)



(b)

33. A simply supported beam of length l carries a point load w at the mid span. considering that the downward deflection at the centre is equal to the upward deflection at either end, the ratio of $[L/l]$ is given by

- (a) $\frac{3}{5}$ (b) $\frac{5}{3}$

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(c) $\frac{4}{3}$

(d) $\frac{3}{4}$

34. A 250 mm long brass rod AB and a 300 mm long aluminium rod BC are bonded together at B. Both rods are 15 mm in diameter. The compound rod is fixed at A and a torque of 50 Nm is applied at the end C. The angle of twist at B and C respectively are [Take rigidity moduli for brass and aluminium as $3.9 \times 10^4 \text{ N/mm}^2$ and $2.85 \times 10^4 \text{ N/mm}^2$ respectively]

- (a) 3.69 degree and 6.067 degree
- (b) 3.69 degree and 9.76 degree
- (c) 6.067 degree and 9.76 degree
- (d) 6.067 degree and 13.34 degree

35. An I-section is selected as a column with pinned ends. The column is 6m long and a factor of safety of 2 is considered. If the column has to carry a safe axial load of 800 kN, the maximum length of the column can be taken as -----m. [Take $E = 2 \times 10^5 \text{ N/mm}^2$, $I_{xx} = 12950.2 \text{ cm}^4$, $I_{yy} = 2246.7 \text{ cm}^4$]

36. A thin cylindrical shell of thickness 5 mm and diameter 350 mm is subjected to an internal pressure

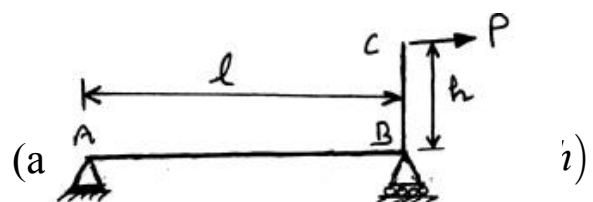
which produces a strain of $\left(\frac{1}{2500}\right)$

in the diameter. The consequent hoop and longitudinal stresses, [in N/mm^2] produced due to the internal pressure. respectively are . [Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $\mu = 0.3$]

- (a) 47.07 and 23.53
- (b) 22.85 and 11.42
- (c) 94.15 and 47.08
- (d) 11.42 and 5.71

37. A circular shaft is subjected to an axial twisting moment T and a bending moment M where $M = 1.2 T$. The ratio of maximum shearing stress to the greatest principal stress is -----.

38. The bracket ABC of uniform section as shown in figure is subjected to a horizontal load P at C. The horizontal deflection at C is given by



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(c) $\frac{2Ph^2}{EI}(l+h)$ (d) $\frac{Ph^2}{6EI}(l+h)$

(a) 1, 2 and 3 (b) 1 and 3

(c) 2 and 4 (d) 1, 2, 3 and 4.

39. A cylindrical air receiver for a compressor is 2 m in internal diameter and made of plates 15 mm thick. If hoop stress is not to exceed 90 N/mm² and the axial stress is not to exceed 60N/mm². The maximum safe air pressure is.

- (a) 1.8 N/mm² (b) 0.9 N/mm²
 (c) 1.35 N/mm² (d) 2.7 N/mm²

40. Consider the following statements.

1. A reversible process undergone by an isolated system is isentropic
2. Maximum work produced in a process corresponds to the conversion of available energy to unavailable energy
3. If an internally irreversible process is isentropic it must be non adiabatic
4. Available energy of the universe is conserved

Which of the above statements are correct.

Common Data Question 41 and 42

Following table shows the data about a set of single operation jobs to be machined in a lathe machine.

Job	A	B	C	D	E
Processing Time	6	17	5	7	11

41. Optimum sequence that minimize mean flow time is

- (a) ABCDE
 (b) EDCBA
 (c) CADEB
 (d) BEDAC

42. What is mean flow time?

- (a) 7.8 (b) 5.4
 (c) 9.2 (d) 11.4

43. There are two machines M₁ and M₂ which process jobs A, B, C, D, E and F. Processing sequence for these jobs is M₁ M₂. Processing of jobs is given on machines as

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Job	A	B	C	D	E	F
M ₁	4	7	3	12	11	9
M ₂	11	7	10	8	10	13

Processing sequence of jobs that would minimize makespan is

- (a) CABFED (b) CABDEF
(c) CADBFE (d) EFDBAC

44. Five jobs are being processed on a single machine. Processing time for each job is given below. Find average in process inventory following shortest processing time rule.

Job	A	B	C	D	E
Processing Time	3	6	2	8	4

- (a) 2.35 (b) 4.2
(c) 5.3 (d) 3.2

45. Annual carrying cost for an item is Rs. 4. Economic ordered quantity works out to be 500 units. What is total ordering cost per annum?
(a) Rs. 500 (b) Rs. 1000
(c) Rs. 2000 (d) Rs. 125

46. Find the maximum value of the objective function.

$$Z = 4x + 6y \text{ where } x \geq 0, y \geq 0$$

Subjected to constraints

$$-x + y \leq 11$$

$$x + y \leq 27$$

$$2x + 5y \leq 90$$

- (a) 118 (b) 116
(c) 132 (d) 66

47. Patients arrive at doctor's clinic according to Poisson's distribution. Checkup time by doctor follow exponential distribution. If on an average, 9 patient's per hour arrive at clinic and doctor takes on an average 5 minutes to check patient, the number of patient's in queue will be.

- (a) 1.4 (b) 2.25
(c) 3.4 (d) 4.1

48. Inter arrival time at booth is exponential with average time of 10 minutes and length of service time 6 minutes is assumed exponential.

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Probability that a person arriving at booth will have to wait is equal to

- (a) 0.15 (b) 0.4
(c) 0.42 (d) 0.6

49. A repair shop is owned by single person. Customers arrive at rate of 30/h. The required to provide service is exponentially distributed with mean of 100 seconds. What is mean waiting time of a customer, needing repair facility in queue?

- (a) 8.1 minutes
(b) 9 minutes
(c) 8.33 minutes
(d) 9.33 minutes

50. On an average, there are 30 customers in a queue. If arrival rate of customers in the system is 16 customers per hour. On an average 32 customers leave the system per hour. Average number of customers in the system is.

- (a) 16.5 (b) 30.5
(c) 32 (d) 46