

## MECHANICAL ENGINEERING

1. A battery is used to light a bulb, run a fan and heat an electric iron in case of a power failure. If each of the above systems has 100 W rating and is run for 15 minutes, what are the work done ( $W$ ) and heat transferred ( $Q$ ) by the battery?

- $W = 90 \text{ kJ}$  and  $Q = 90 \text{ kJ}$
- $W = 180 \text{ kJ}$  and  $Q = 0$
- $W = 270 \text{ kJ}$  and  $Q = 0$
- $W = 90 \text{ kJ}$  and  $Q = 180 \text{ kJ}$

2. Match List I with List II and select the correct answer using the codes given below the lists:

List I

A. Heat



B. Stirring work

C. Mechanical work

List II

- PMM-2
- High grade energy
- Variable flow
- Nernst Simon statement
- Dissipative work
- Inexact differential
- PMM-1

Codes:

	A	B	C	D
a.	2	5	4	3
b.	2	1	5	7
c.	6	4	4	2
d.	6	1	5	2

3. A system undergoes a change of state during which 100 kJ of heat is transferred to it and it does 50 kJ of work. The system is brought back to its original state through a process during which 120 kJ of heat is transferred to it. What is the work done by the system?

- 50 kJ
- 70 kJ
- 120 kJ
- 170 kJ

4. Which of the following activities pertain to a master production schedule?

- Sizing and timing of specific items production lot
- Sequencing of individual orders or jobs
- Short term allocation of resources to individual operations
- Product design

Select the correct answer using the codes given below

- 1, 2 and 4
- 2, 3 and 4
- 1, 3 and 4
- 1, 2 and 3

5. Which one of the following forecasting techniques is not suited for making forecasts for planning production schedules in the short range?

- Moving average
- Exponential smoothing method
- Regression analysis
- Delphi method

6. Consider the following statements:

Queuing Theory is used for

- inventory problems
- traffic congestion studies
- Job-shop scheduling

Which of the statements given above are correct?

- 1, 2 and 3
- 1 and 2
- 2 and 3
- 1 and 3

7. Which one of the following expressions gives the rate of depreciation by the straight line method? ( $C$  = initial cost,  $S$  = scrap value,  $N$  = life in years)

- $D = (C - S)/N$
- $D(C + S)/N$
- $DC - S$
- $DC + S$

8. On which of the following factors does selection of material handling equipments depend?

- Cost
- Material characteristics
- Type of productions



4. Equipments available and their characteristics

Select the correct answer using the codes given below

- a. 1, 2, 3 and 4  
b. 2 and 3  
c. 1, 3 and 4  
d. 1, 2 and 4

9. Which of the following factors influences a plant layout?

1. Type of industry  
2. Type of machines  
3. Type of products  
4. Volume of production

Select the correct answer using the code given below

- a. 2 and 3  
b. 1, 2 and 4  
c. 1, 3 and 4  
d. 1 and 4

10. Maximum problems in scheduling are encountered in

- a. Job type production  
b. Batch production  
c. Mass production  
d. Flow type production

11. A factory is producing 1000 bolts and nuts per hour on a machine. Its material cost is Rs. 375, labour cost is Rs. 245 and the direct expense is Rs. 80. The factory overhead cost is 150% of the total labour cost. What is the total factory cost?

- a. Rs. 1067.50  
b. Rs. 367.50  
c. Rs. 320.25  
d. Rs. 1387.75

12. Which of the following form the overhead expense?

1. Factory expenses  
2. Material expenses  
3. Administrative expenses  
4. Sales and distribution expenses

Select the correct answer using the code given below

- a. 1, 2 and 3  
b. 1, 3 and 4  
c. 1 and 2  
d. 3 and 4

13. What is a chart representing fundamental motions of two hands known as?

- a. Two hand process chart

- b. Activity chart  
c. SIMO chart  
d. Process chart

14. What is a chart showing sequence of operations for more than one item known as?

- a. Multiple activity chart  
b. Assembly chart  
c. Operation process chart  
d. Multi-product process chart

15. For a gas, pressure  $p$ , volume  $v$  and temperature  $T$  are dependent on each other. Then which one of the following  $p$ - $v$ - $T$  relationships will be observed?

a.  $\left(\frac{\partial p}{\partial T}\right)_v \left(\frac{\partial v}{\partial T}\right)_p \left(\frac{\partial T}{\partial p}\right)_v = 1$

b.  $\left(\frac{\partial p}{\partial T}\right)_v \left(\frac{\partial T}{\partial v}\right)_p \left(\frac{\partial v}{\partial p}\right)_T = -1$

c.  $\left(\frac{\partial p}{\partial T}\right)_v \left(\frac{\partial v}{\partial T}\right)_p \left(\frac{\partial p}{\partial v}\right)_T = -1$

d.  $\left(\frac{\partial p}{\partial T}\right)_v = \left(\frac{\partial T}{\partial v}\right)_p \left(\frac{\partial p}{\partial v}\right)_T$

16. If the objective is to project the trend and seasonal variations in forecasting demand, then which is the appropriate model?

- a. Simple moving average  
b. Time series decomposition  
c. Weighted moving average  
d. Double exponential smoothing

17. A reversible engine exchanges heat from three thermal reservoirs A, B and C at 1000 K, 800 K and 200 K respectively. If the engine receives 500 kJ from A and 400 kJ from B then what is the heat exchanged from thermal reservoir C?

- a. 450 kJ rejected to thermal reservoir C  
b. 350 kJ rejected to thermal reservoir C  
c. 250 kJ rejected to thermal reservoir C  
d. 200 kJ rejected to thermal reservoir C

18. A 100  $\Omega$  resistor carrying a constant current of 0.5 A is kept at a constant temperature of 300 K by a stream of cooling water. In a time interval of 30 minutes, what are the changes in entropy for the resistor and that of the universe, respectively?

- a. 0 and 150 J/K  
b. 150 J/K and 0  
c. 300 J/K and 0  
d. 0 and 300 J/K



19. A system of 100 kg mass undergoes a process in which its specific entropy increases from 0.30 kJ/kg K to 0.35 kJ/kg K. At the same time, the entropy of the surroundings decreases from 80 kJ/K to 75 kJ/K. What is the type of this process?

a. Reversible  
b. Irreversible  
c. Impossible  
d. Not identifiable with the data given

20. Two reversible engines are working in series between a high temperature reservoir at 1000 K and a low temperature reservoir at 300 K in such a way that the heat rejected by the preceding engine is completely absorbed by the succeeding engine and both the engines develop the same amount of work per cycle. What is the intermediate temperature between first and second engines?

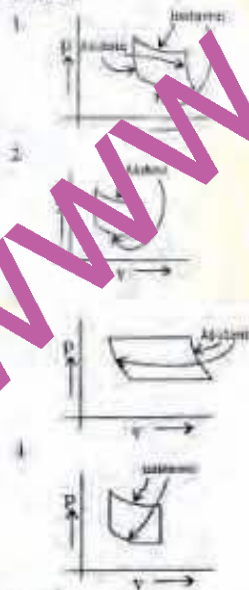
a. 700 K  
b. 650 K  
c. 350 K  
d. Not possible to be estimated with the given data

21. Match List I (Cycle) with List H (p — v Diagram) and select the correct answer using the codes given below the lists:

List I

A. Otto cycle  
B. Stirling cycle  
C. Carnot cycle  
D. Brayton cycle

List II



Codes:

A B C D

a. 2 3 1 4  
b. 1 4 2 3  
c. 2 4 1 3  
d. 1 3 2 4

22. An electrolux system of refrigeration has

a. No liquid pump  
b. One liquid pump  
c. Two liquid pumps  
d. Three liquid pumps

23. In a coupled separating and throttling calorimeter, 0.9 is the dryness fraction of steam in the separating unit and 0.92 is the dryness fraction in the throttling unit. What is the approximate value of the dryness fraction of the steam sample?

a. 0.855  
b. 0.925  
c. 0.947  
d. 0.965

24. A Bell-Coleman air refrigeration system operates on which one of the following cycles?

a. Reverse Diesel cycle  
b. Reverse Carnot cycle  
c. Reverse Brayton cycle  
d. Reverse Otto cycle

25. When the lower temperature is fixed, how can the c.o.p. of a refrigerating machine be improved?

a. By raising the higher temperature  
b. By lowering the higher temperature  
c. By operating the machine at higher speeds  
d. By operating the machine at lower speeds

26. What is/are the effect(s) of supersaturation in nozzle flow?

1. It increases the mass flow  
2. It increases friction in the nozzle  
3. It increases exit velocity  
4. It reduces dryness fraction of steam

Select the correct answer using the code given below

a. 1 only  
b. 1 and 3  
c. 1, 2 and 4  
d. 3 only

27. Consider the following statements A tube section diverging in the direction of fluid flow can be used as

1. supersonic nozzle  
2. subsonic nozzle



3. supersonic diffuser
4. subsonic diffuser

Which of the statements given above is/are correct?

- a. 1 only
- b. 1 and 4
- c. 3 only
- d. 2 and 3

28. Consider the following statements:

1. Fusible plug is a device used to put off fire in the furnace of the boiler when the level of water in the boiler falls to an unsafe limit.
2. Super heater is a device used to increase the temperature of saturated steam without raising its pressure.
3. An economizer decreases the steam raising capacity of boiler. Which of the above statements is/are correct?

- a. 1 and 2
- b. 2 and 3
- c. 1 only
- d. 1, 2 and 3

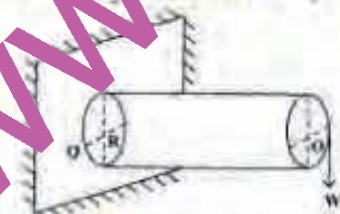
29. What is the cause of reheat factor in a steam turbine?

- a. Reheating
- b. Superheating
- c. Supersaturation
- d. Blade friction

30. In a simple impulse turbine, the nozzle angle at the entrance is  $30^\circ$ . What is the blade speed ratio for maximum diagram efficiency?

- a. 0.25
- b. 0.5
- c. 0.433
- d. 0.125

31. A round bar is fixed at the end PQR and loaded by  $W$  at the end O, as shown below.



Which point(s) will have maximum stress?

- a. P
- b. Q
- c. R
- d. Both P and Q

32. What diameter should the driving pulley have on which a rubber belt runs so that

bending stress in belt is limited to  $5 \text{ N/mm}^2$  (The belt cross section is a rectangle  $15 \text{ mm}$  thick  $\times$   $110 \text{ mm}$  wide,  $E$  for belt material is  $100 \text{ N/mm}^2$ )

- a.  $30 \text{ mm}$
- b.  $150 \text{ mm}$
- c.  $300 \text{ mm}$
- d.  $15 \text{ mm}$

33. A beam of uniform cross section is loaded as cantilever. If the load at the end is increased, where will the failure occur?

- a. At the middle
- b. At the tip below the load
- c. At the support
- d. Anywhere

34. Three beams of identical cross-section but of different material (steel, timber and Al-alloy) are subjected to equal bending moment at a certain section. Which one of the following statements is correct?

- a. Maximum bending stress will be same in all the three beams
- b. Maximum shearing stress magnitudes will be different in the three beams
- c. Bending stress magnitude will be the largest in the steel beam
- d. Bending stress magnitude will be the largest in the timber beam

35. A seamless pipe of diameter  $1 \text{ m}$  is to carry fluid under a pressure of  $2 \text{ N/mm}^2$ . What should be the minimum thickness of pipe if the maximum stress is not to exceed  $80 \text{ N/mm}^2$ ?

- a.  $12.5 \text{ mm}$
- b.  $10 \text{ mm}$
- c.  $15 \text{ mm}$
- d.  $7.5 \text{ mm}$

36. Match List I (Mechanical Property) with List II (Mechanical Test) and select the correct answer using the codes given below the lists.

List I

- A. Percentage elongation
- B. Hardness
- C. Toughness
- D. Modulus of rigidity

List II

1. Vickers Pyramid test
2. Tensile test
3. Torsion test
4. Impact test

Codes,

	A	B	C	D
a.	2	1	4	3
b.	4	3	2	1
c.	2	3	4	1
d.	4	1	2	3

37. A hollow circular section column with outer diameter 80 mm and inner diameter 60 mm is subjected to buckling. What is the radius of gyration of the column section?

a. 25mm  
b. 20mm  
c. 15mm  
d. 10mm

38. Match List I (Hardness Test) with List II (Measure of Hardness) and select the correct answer using the codes given below the lists.

List I

A. Rockwell  
B. Brinell  
C. Vickers  
D. Scieroscope

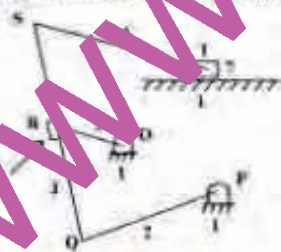
List II

1. Surface area of indentation  
2. Projected area of indentation  
3. Depth of penetration  
4. Height of rebound

Codes;

	A	B	C	D
a.	1	3	2	4
b.	3	1	2	4
c.	3	1	4	2
d.	1	3	4	2

39. Examine the figure shown below wherein the numbers indicate the links.



Which of the statements given below are correct?

1.  $I_{34}$  is at  $\infty$ , perpendicular to QS  
2.  $I_{43}$  is at  $\infty$ , perpendicular to QS  
3.  $I_{71}$  is at T  
4.  $I_{45}$  is at R

Select the correct answer using the code given below

a. 1 and 2  
b. 1 and 4  
c. 2 and 3  
d. 1, 3 and 4

40. Match List I (Gear Train) with List II (Application) and select the correct answer using the code given below the lists:

List I

A. Compound gear train  
B. Epicyclic spur gear train with brake bands  
C. Worm and worm-wheel gear train  
D. Epicyclic bevel gear train

List II

1. Automobile gearbox  
2. Automatic transmission of automobile  
3. Speed reducers for lifts  
4. Automobile differential

Code;

	A	B	C	D
a.	1	2	3	4
b.	3	4	1	2
c.	1	4	3	2
d.	3	2	1	4

Cycloidal tooth profile of a cycloidal gear tooth is a combination of

a. Hypocycloid and involute of a circle  
b. Hypocycloid and epicycloid  
c. Epicycloid and involute of a circle  
d. Straight line and epicycloid

42. Consider the following statements regarding boundary lubrication conditions in hydrodynamic journal bearings:

1. It is an undesirable condition  
2. It always occurs during starting and stopping of the journal  
3. It necessitates frequent repair of the journal  
4. This condition can be completely eliminated by using high viscosity lubricant

Which of the statements given above are correct?

a. 1, 2 and 4  
b. 2, 3 and 4  
c. 1 and 2  
d. 3 and 4

43. When the lubricating oil is forced between the journal and bearing by external pressure, the bearing is known as

a. Zero film bearing



- b. Boundary lubricated bearing  
c. Hydrostatic bearing  
d. Hydrodynamic bearing
44. The performance of a hydrodynamic journal bearing is a function of  
a. Reynolds number  
b. Sommerfeld number  
c. Speed  
d. Bearing modulus
45. Which one of the following statements is not correct?  
a. Response of an inertia governor is faster than that of a centrifugal governor.  
b. An I.C. engine prime-mover always requires both governor and the flywheel  
c. Spring loaded centrifugal governors are effective over a wide range of operating speeds  
d. Flywheel is not necessary in case of electric motor driven punch press
46. The problem of hunting of a centrifugal governor becomes very acute when the governor becomes  
a. Less sensitive  
b. Highly sensitive  
c. Highly stable  
d. Less stable
47. What should be the angle between the cylinder axes if the primary forces of a 2-cylinder V-engine are to be completely balanced?  
a.  $45^\circ$   
b.  $60^\circ$   
c.  $90^\circ$   
d.  $120^\circ$
48. The velocity distribution in laminar boundary layer is given by the relation  $u/u_\infty = y/\delta$ . What is the momentum thickness for the boundary layer?  
a.  $\delta/2$   
b.  $\delta/3$   
c.  $\delta/4$   
d.  $\delta/6$
49. How is the Von-Karman momentum integral equation expressed ( $\theta$  is momentum thickness)?

a. 
$$\frac{\tau_w}{\frac{1}{2}\rho U_\infty^2} = \frac{\partial \theta}{\partial x}$$

b. 
$$\frac{\tau_w}{2\rho U_\infty^2} = \frac{\partial \theta}{\partial x}$$

c. 
$$\frac{\tau_w}{\rho U_\infty^2} = \frac{\partial \theta}{\partial x}$$

d. 
$$\frac{\tau_w}{\frac{1}{3}\rho U_\infty^2} = \frac{\partial \theta}{\partial x}$$

50. Air (kinematic viscosity =  $15 \times 10^{-6} \text{ m}^2/\text{s}$ ) with a free stream velocity of  $10 \text{ m/s}$  flows over a smooth two-dimensional flat plate. If the critical Reynolds number is  $5 \times 10^5$ , what is the maximum distance from the leading edge up to which laminar boundary layer exists?  
a. 30 cm  
b. 75 cm  
c. 150 cm  
d. 300 cm
51. Using the Prandtl's mixing length concept, how is the turbulent shear stress expressed?  
a.  $\rho l^2 \frac{d^2 u}{dy^2}$   
b.  $\rho l^2 \frac{d\bar{u}}{dy}$   
c.  $\rho l \left( \frac{d\bar{u}}{dy} \right)^2$   
d.  $\rho l^2 \left( \frac{d\bar{u}}{dy} \right)^2$
52. Consider the following statements: The state of stress in a fluid consists of normal pressure only if the fluid  
1. is at rest  
2. is in uniform motion  
3. has non-uniform velocity profile  
4. has zero viscosity  
Which of the statements given above are correct?  
a. 1, 2 and 3  
b. 1, 2 and 4  
c. 1, 3 and 4  
d. 2, 3 and 4
53. The equation of state:  $p v = RT(1 + B/v + C/v^2 + D/v^3 + \dots)$ , is known as  
a. Van der Waals equation  
b. Benedict — Webb — Rubin equation  
c. Gibbs equation  
d. Virial equation



54. In an operation process chart, which of the following are recorded?

1. Operation
2. Inspection
3. Storage

Select the correct answer using the code given below

- a. 1 and 2
- b. 1 and 3
- c. 2 and 3
- d. 1, 2 and 3

55. Assertion (A): A rod of circular cross-section when subjected to twisting action does not experience any change in cross-sectional geometry.

Reason (R): Stress induced in the section is axisymmetric.

- a. Both A and R are individually true and R is the correct explanation of A
- b. Both A and R are individually true but R is not the correct explanation of A
- c. A is true but R is false
- d. A is false but R is true

56. Assertion (A): Herringbone gears are used for high speed and heavy duty speed reduction.

Reason (R): These gears produce large axial thrust on their shafts.

- a. Both A and R are individually true and R is the correct explanation of A
- b. Both A and R are individually true but R is not the correct explanation of A
- c. A is true but R is false
- d. A is false but R is true

57. Assertion (A): Hydrostatic bearings are suitable for heavy load and low speed applications.

Reason (R): Sufficient hydrodynamic pressure is not generated in the fluid film.

- a. Both A and R are individually true and R is the correct explanation of A
- b. Both A and R are individually true but R is not the correct explanation of A
- c. A is true but R is false
- d. A is false but R is true

58. Assertion (A): A shaper is unsuitable for generating flat surfaces on very large parts.

Reason (R): The ram has limitations on the stroke and its overhang.

- a. Both A and R are individually true and R is the correct explanation of A

- b. Both A and R are individually true but R is not the correct explanation of A
- c. A is true but R is false
- d. A is false but R is true

59. Assertion (A): Complex shapes which are difficult to produce by any other method are possible by precision investment casting.

Reason (R): In precision investment casting, the pattern is withdrawn by melting it.

- a. Both A and R are individually true and R is the correct explanation of A
- b. Both A and R are individually true but R is not the correct explanation of A
- c. A is true but R is false
- d. A is false but R is true

60. Assertion (A): Fire tube boilers do not use high pressures unlike water tube boilers.

Reason (R): Fire tubes fail due to creep at high pressures.

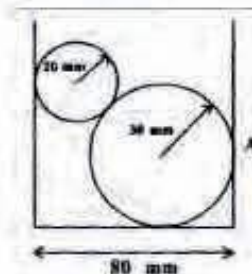
- a. Both A and R are individually true and R is the correct explanation of A
- b. Both A and R are individually true but R is not the correct explanation of A
- c. A is true but R is false
- d. A is false but R is true

61. Assertion (A): Refrigerants  $R_{11}$  and  $R_{12}$  have a greater impact on ozone depletion than  $R_{22}$ .

Reason (R):  $R_{22}$  has a larger number of chlorine atoms.

- a. Both A and R are individually true and R is the correct explanation of A
- b. Both A and R are individually true but R is not the correct explanation of A
- c. A is true but R is false
- d. A is false but R is true

62.



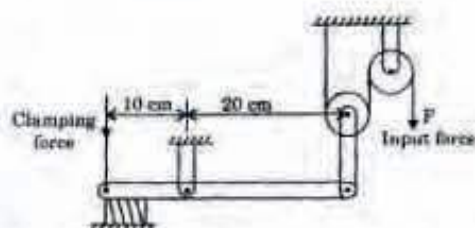
Two cylinders are kept in a container as shown in the figure given above. Top cylinder has a weight  $W$  and bottom cylinder has a weight of  $2W$ .

- a.  $3W$



- b. 2.8 W  
c. 2.5 W  
d. W

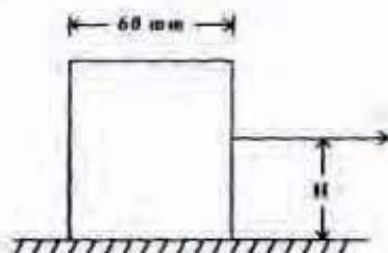
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The figure given above shows a clamping device operated by the input force  $F$  on the rope. What is the magnitude of required input force if the clamping force is 40 N?

- a. 5 N  
b. 10 N  
c. 20 N  
d. 40 N

64



A box is resting on a floor with coefficient of friction equal to 0.4. At what maximum height ' $H$ ', may the box be pulled if it is to move with uniform velocity without overturning?

- a.  $H = 30$  mm  
b.  $H = 60$  mm  
c.  $H = 75$  mm  
d.  $H = 150$  mm

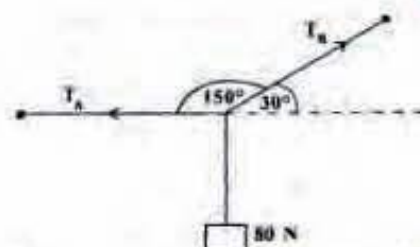
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In the above given structure all the members are equal in length and the joints are pinned and smooth. It carries a load  $P$  at  $D$  along  $DG$ . What is the reaction at  $G$ ?

- a. Zero  
b. Vertically upwards and equal to  $P/4$   
c. Vertically upwards and equal to  $P/2$   
d. Vertically upwards and equal to  $P$

66



If a weight of 80 N is suspended by two fine light strings one of which is horizontal and the other is inclined at an angle of  $30^\circ$  to the horizontal, then what is the tension in the inclined string?

- a.  $160/\sqrt{3}$  N  
b. 160 N  
c. 140 N  
d. 120 N

67

A spring of stiffness  $k$  is compressed by a length ' $\Delta$ ' and a ball is placed on the top of it. When the spring is released the ball is seen to rise through a height  $h$ . When two such springs are kept one over the other, and the combination is compressed by same length  $\Delta$ , what is the height reached by the ball, kept on the combined springs when released?

- a.  $h/2$   
b.  $h$   
c.  $\sqrt{2}h$   
d.  $2h$

68

Which one of the following principles/laws converts a dynamics problem to an equivalent static's problem?

- a. Newton's second of motion  
b. D'Alembert's principle  
c. Principle of conservation of energy  
d. Principle of conservation of momentum

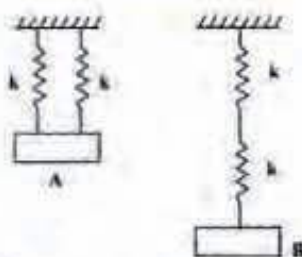
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A stone is dropped from a height of  $h$  m. At the same time another stone is projected upwards from the ground with a velocity of  $h$  m/s. After how much time will the two stones meet?

- a.  $\frac{1}{2} s$   
b. 1 s  
c. 2 s  
d.  $(h/g)s$

70





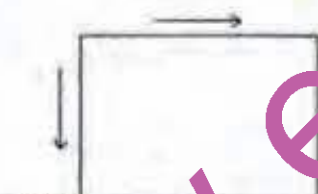
Systems A and B having identical mass and springs are set in simple harmonic motion. Which one of the following statements is correct?

- For systems A and B, the period of vibration is same
- System B has a period of vibration twice that of system A
- System B has a period of vibration half that of system A
- System B has a period of vibration  $\sqrt{2}$  times that of system A

71. When a can of compressed air is punctured, air blows out to the right and the can will move from right to left. When a vacuum can is punctured such that air enters from the right to left

- The can will move left to right
- The can will move right to left
- The can will not move
- The can will initially move from right to left and then reverse the direction

72.



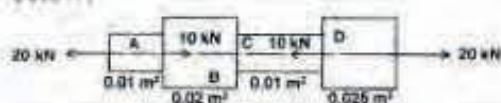
For the biaxial stress system shown, what are the principal stresses?

- 50 MPa (tensile)
- 50 MPa (compressive)
- 10 MPa (tensile)
- Zero

Select the correct answer using the code given below

- 1 and 2
- 2 and 3
- 3 and 4
- 1 and 4

73. Consider a steel bar loaded as shown below:



Match the stress in the four sections given the code given below the lists:

Section

- A
- B
- C
- D

Stress, MPa

- 1.0
- 2.0
- 0.5
- 0.8

Codes:

	A	B	C	D
a.	1	4	2	3
b.	2	3	1	4
c.	1	3	2	4
d.	2	4	1	3

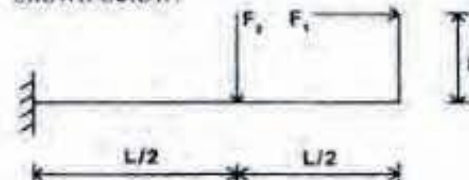
74. Consider the following statements for a 2-D pure shear stress state at a point:

- The principal stresses at the point have the same magnitude as the shear stress but are of opposite sign.
- The Mohr's circle for the stress state reduces to zero.
- Principal planes are inclined at  $45^\circ$  to the planes of shear stresses.
- Maximum shear stress at the point is zero.

Which of the statements given above are correct?

- 2 and 4
- 1 and 4
- 1 and 3
- 1, 2 and 3

75. A cantilever beam is subjected to loads as shown below:



Which one of the following is its correct BM diagram?

- 
- 
-



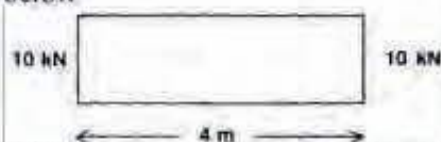
(d)



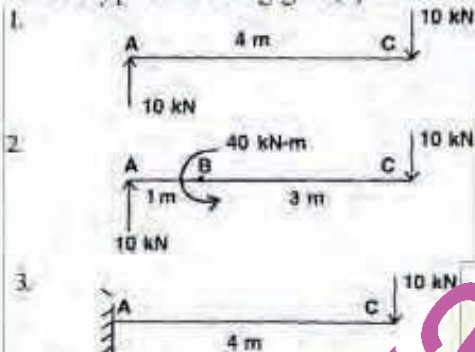
76. If a simply supported beam at its ends is loaded by a central concentrated load, then the maximum bending moment is  $M$ . If the same load is equally distributed over the beam, then what is its maximum bending moment?

a.  $M$   
b.  $M/2$   
c.  $M/3$   
d.  $M/4$

77. Consider the shear force diagram shown below



Which type of loading give(s) this SFD?



Select the correct answer using the code given below

a. 3 only  
b. 1 and 2  
c. 2 and 3  
d. 1 and 3

78. Which one of the following statements is correct?

Gang process chart

- a. helps us in identifying the group leader  
b. is used for studying the activities of a group of people working together  
c. has the basic purpose to analyze the activities of a group so as to reduce to minimum all waiting time and delays  
d. uses operation and transportation symbols to identify different activities of people working together, so as to reduce to a minimum all non-operational times.

79. Consider the following statements in respect of motion economy related to the use of human body

1. Smooth continuous motions of the hand are preferable to zig-zag motions.
2. Rhythm is essential to the smooth and automatic performance of an operation.
3. The hands should be relieved of all work that can be done more advantageously by a jig, fixture or a motor operated device.

Which of the statements given above are correct?

a. 1, 2 and 3  
b. 1 and 2  
c. 2 and 3  
d. 1 and 3

80. Motion economy is better achieved by

- a. Method study  
b. Time study  
c. Work space design  
d. Process planning

81. Overblights are associated with

- a. Fatigue allowance in work measurement  
b. Efficiency of the operator  
c. Scheduling techniques  
d. Elementary motions in time study

82. Match List I (Job) with List II (Recording Technique Used) and select the correct answer using the codes given below the lists.

List I

- A. Sequences of manufacturing operations  
B. Factory layout to indicate the movement of materials  
C. Factory layout to indicate the movement of workers  
D. Automatic operations

List II

1. Flow process chart  
2. SIMO chart  
3. String diagram  
4. Outline process chart  
5. Multiple activity chart

Codes;

	A	B	C	D
a.	4	1	3	5
b.	5	3	2	4
c.	4	3	2	5
d.	5	1	3	4



83. The total observed time for an operation of assembling an electric switch is 1.00 mm. If the rating is 120% and an allowance of 10% is allowed for the operation, what is the standard time?

a. 1.32 mm  
b. 1.20 mm  
c. 0.12 mm  
d. 1.30 mm

84. What is an analysis of methods, materials, tools and equipments used or to be used in the performance of a piece of work called?

a. Method study  
b. Time study  
c. Work study  
d. Work measurement

85. Match List I with List II and select the correct answer using the codes given below the lists:

List I

A. Wage incentive Plan  
B. Financial incentive  
C. Semi-financial incentive  
D. Non-financial incentive

List II

1. Job security  
2. Pension facility  
3. Bonus  
4. Straight piece rate  
5. Energy savings

Codes:

	A	B	C	D
a.	1	3	5	4
b.	4	2	3	1
c.	4	3	2	1
d.	1	2	5	4

86. Plastics are organic polymers with high molecular weight.

What are the main constituents of polymers?

a. Hydrogen, carbon and chlorine  
b. Carbon and oxygen  
c. Carbon and hydrogen  
d. Carbon, oxygen and chlorine

87. Which of the following parts can be made economically by powder metallurgy?

1. Gears  
2. Automobile cylinders  
3. Filters  
4. Gun barrels

Select the correct answer using the code given below

a. 1 and 2  
b. 1 and 3  
c. 2 and 3  
d. 2 and 4

88. Which of the following gases can be used for GMAW as a shielding gas?

1. Argon  
2. Oxygen  
3. Carbon dioxide

Select the correct answer using the code given below

a. 1, 2 and 3  
b. 1 and 2  
c. 2 and 3  
d. 1 and 3

89. Consider the following statements associated with extrusion process:

1. In forward hot extrusion, the problem of friction is prevalent because of the relative motion between the heated metal billet and the cylinder walls.  
2. The backward hot extrusion completely overcomes the friction.  
3. It is possible to make components which have a constant cross section over any length.

Which of the statements given above are correct?

a. 1, 2 and 3  
b. 1 and 2  
c. 2 and 3  
d. 1 and 3

90. For calculating the blank diameter  $D$  for thin cylindrical shell of outer diameter  $d$  and with height of the shell  $h$ , which one of the following formulae is used when  $d \geq 20r$ . Where  $r$  is the corner radius on the punch?

a.  $D = \sqrt{d^2 + 4dh}$   
b.  $D = \sqrt{d^2 + 4dh - 0.5r}$   
c.  $D = \sqrt{d^2 + 4dh - r}$   
d.  $D = \sqrt{d^2 + 4dh - 15r}$

91. How are tooth-paste capsules produced?

a. By boring operation  
b. By tube turning operation  
c. By impact extrusion  
d. By tube drawing



92. What is the force required to be exerted by the punch in order to shear out the blank (from a circular disc) of 20 mm diameter and 1.5 mm thickness and having a shear strength equal to 300 MPa?
- 9.0 kN
  - 18.0 kN
  - 28.3 kN
  - 45.0 kN
93. In blanking operation, the clearance is provided
- on the punch
  - on the die
  - both on the punch and the die
  - Neither on the punch nor on the die
94. Darcy-Weisbach equation for the head loss in a flow through a pipe is given by  $h_f = 4 f l v^2 / (2gd)$  (the symbols have the usual meaning). For the laminar flow through a circular pipe, how does the friction factor  $f$  vary with a Reynolds number ( $Re$ )?
- $f = 8/Re$
  - $f = 6/Re$
  - $f = 32/Re$
  - $f = 64/Re$
95. The velocity distribution in laminar boundary layer is given by the relation  $u/u_\infty = y/\delta$ . What is the momentum thickness for the boundary layer?
- $\delta$
  - $\delta/2$
  - $\delta/3$
  - $\delta/4$
96. Which one of the following equations gives the velocity distribution across a circular pipe for a viscous flow?
- $u = u_{\max} \left[ 1 - (r/R)^2 \right]$
  - $u = u_{\max} \left[ R^2 - r^2 \right]$
  - $u = u_{\max} \left[ 1 - (r/R) \right]^2$
  - $u = u_{\max} \left[ 1 + (r/R) \right]^2$
97. In a two-dimensional fluid flow,  $u = 6x + xy$ . Which one of the following gives the component of the velocity to satisfy the continuity equation?
- $6x + xy$
  - $6 + xy$
  - $-(6y + xy)$
  - $-(6y + \frac{1}{2}y^2)$
98. If  $u = ax$  and  $v = -ay$  give the velocity distribution for a two-dimensional flow, what is the equation of a stream line passing through the point (3, 1)?
- $xy = 3$
  - $x + y = 4$
  - $x + 3y = 6$
  - $x^2y = 9$
99. The pressure inside a soap bubble of 20 mm diameter is 25 N/m<sup>2</sup> above the atmospheric pressure. What is the surface tension in soap film?
- 0.156 N/m
  - 0.312 N/m
  - 0.624 N/m
  - 0.948 N/m
100. In a vapour compression refrigeration cycle, following data are obtained:
- Enthalpy at suction to the compressor — 150 kJ/kg
  - Enthalpy at discharge from the compressor — 210 kJ/kg
  - Enthalpy at exit from the condenser — 80 kJ/kg
- What is the c.o.p. of the cycle?
- 5.53
  - 4.33
  - 3.33
  - 2.33
101. Consider the following statements pertaining to Room Sensible Heat Ratio (RSHR) line
- It is the line drawn on psychrometric chart through the room conditions.
  - Its slope is the ratio of sensible cooling load to room latent heat load.
  - The supply air condition must lie on this line for satisfactory performance.
- Which of the statements given above are correct?
- 1, 2 and 3
  - 1 and 2
  - 1 and 3
  - 2 and 3
102. When 40° C and 25° C are the dry bulb temperatures of air entering and leaving a cooling coil, then the cooling coil temperature is 25° C. What is the bypass factor for the case of sensible cooling?
- 0.20



- b. 0.25
- c. 0.50
- d. 0.60

103. A water chiller with a capacity of 30 tons of refrigeration cools 20 m<sup>3</sup>/hr of water entering at 12° C. What is the temperature of water leaving the chiller?

- a. 5° C
- b. 6° C
- c. 7° C
- d. 7.5° C

104. Match List I (Reactor) with List II (Characteristic) and select the correct answer using the codes given below the lists:

List I

- A. Heterogeneous reactor
- B. Candu reactor
- C. Boiling water reactor
- D. Fast breeder reactor

List II

- 1. May not need moderator
- 2. Natural uranium fuelled and heavy water cooled
- 3. Fuel and moderator are at different phases
- 4. Coolant water boils in the core of reactor

Codes:

- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 3 | 4 | 2 | 1 |
| b. | 1 | 2 | 4 | 3 |
| c. | 3 | 2 | 1 | 4 |
| d. | 1 | 4 | 3 | 2 |

105. Match List I (Type of Turbine) with List II (Specific Speed) and select the correct answer using the codes given below the lists

List I

- A. Pelton
- B. Francis
- C. Propeller
- D. Kaplan

List II

- 1. 0.1
- 2. 3.0
- 3. 4.0
- 4. 1.0

Codes:

- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 1 | 4 | 2 | 3 |

- |    |   |   |   |   |
|----|---|---|---|---|
| b. | 3 | 2 | 4 | 1 |
| c. | 1 | 2 | 4 | 3 |
| d. | 3 | 4 | 2 | 1 |

106. Consider the following statements:

In hydraulic power plants

- 1. Pelton turbines are used for high heads.
- 2. Kaplan turbines are used for medium heads.
- 3. Francis turbines are used for low heads.

Which of the above statements is/are correct?

- a. 1 only
- b. 2 only
- c. 3 only
- d. 1, 2 and 3

107. Which of the following methods is/are adopted to bring down the speed of an impulse turbine to practical limits?

- 1. Use of flywheels
- 2. Use of governor
- 3. Compounding
- 4. Increasing the load

Select the correct answer using the code given below

- a. 1 and 2
- b. 1, 2 and 3
- c. 3 only
- d. 1, 2, 3 and 4

108. At which temperature is cold working of metals carried out?

- a. At the recrystallisation temperature
- b. Below the recrystallisation temperature
- c. Above the recrystallisation temperature
- d. At any temperature

109. What is the process of making sheet metal components to the contour of a die by making use of an explosive impact known as?

- a. Explosive cladding
- b. Explosive welding
- c. Explosive forming
- d. Explosive joining

110. In a multi-spindle automatic machine, on which one of the following factors does the cycle time for each operation depend?

- a. Shortest single-operation
- b. Shortest multi-operations
- c. Longest single-operations
- d. Longest multi-operations



111. Which of the following statements is true for the case of a transfer line?
- The work stations must form a closed-loop.
  - The cycle time is total time taken by all the machining operations.
  - All the machine tools must be automatic.
  - All the machine tools must be of conventional and general purpose type.
112. Which of the following is not a characteristic of the climb milling (down milling) operation?
- The work piece is fed in the opposite direction.
  - Forces are less.
  - High rigidity of the machine tool is required.
  - Chip thickness is maximum at the end of the cut.
113. Match List I (Part) with List II (Method of Holding on a Lathe) and select the correct answer using the codes given below the lists:
- List I
- Cylindrical parts
  - Non-cylindrical parts
  - Very complicated shapes
  - Material in bar form on small lathe
- List II
- Circular face plate
  - Collet
  - Three jaw chuck
  - Four jaw chuck
- Codes:
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 3 | 1 | 4 | 2 |
| b. | 2 | 4 | 1 | 3 |
| c. | 3 | 4 | 1 | 2 |
| d. | 2 | 1 | 4 | 3 |
114. In the expression of average production cost per component which of the following costs are dependent on the cutting speed?
- Machining cost
  - Tool changing cost
  - Tool cost
- Select the correct answer from the code given below:
- 1, 2 and 3
  - 1 and 2
  - 2 and 3
  - 1 and 3
115. Which one of the following properties is not possessed by ceramic tools?

- High hardness
- High compressive strength
- High thermal conductivity
- High brittleness

116. Which of the following are the reasons for low values of unreformed chip thickness in grinding?

- Small grains
- High cutting speed
- Low feed rate

Select the correct answer using the code given below

- 1, 2 and 3
- 1 and 2
- 2 and 3
- 1 and 3

117. If  $t$  = undeformed chip thickness,  $t_c$  = chip thickness and  $\phi$  = shear angle, then what is the length of the shear plane?

- $t \sin \phi$
- $t / \sin \phi$
- $t \cos \phi$
- $t / \cos \phi$

118. What is the polar plot for the function  $\frac{1}{(1+j\omega\tau)}$  where  $\omega$  stands for the frequency (angular),  $\tau$  the time constant and  $j = \sqrt{-1}$ ?

- Semi circle
- Parabola
- Ellipse
- Circle

119. Suppose two rotors with inertias  $I_1$  and  $I_2$  on shafts of lengths  $l_1$  and  $l_2$  respectively, are connected by gears such that the speed of the  $I_2$  rotor is always  $G$  times that of the  $I_1$  rotor. This system may, for vibration analysis, be treated as being on one shaft (integral with  $l_1$ ) if

- $I_1$  is changed to  $G^2 I_1$
- $I_2$  is changed to  $G^2 I_2$
- $I_1$  is changed to  $I_1/G^2$
- $I_2$  is changed to  $I_2/G^2$

120. Two rotors A and B are connected to the two ends of a shaft of uniform diameter. The mass moment of inertia of rotor A about the axis of the shaft is four times that of B. If the length of the shaft is 1 m and C is the position of node for torsional vibrations, then what is the length of AC?

- 1/5 m
- 4/5 m
- 1/25 m
- 16/25 m



Examrace