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**Previous Year Paper**  
**2022 Paper 6**



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1. The removal of metal in a drilling operation is done by

- (A) shearing only
- (B) extrusion only
- (C) shearing and compression
- (D) shearing and extrusion ✓

2. Gears can be best produced on mass production by

- (A) shaping
- (B) casting
- (C) forming
- (D) hobbing ✓

3. Which of the following methods can be used for manufacturing 2 m long seamless metallic tubes?

- 1. Drawing
- 2. Extrusion
- 3. Rolling
- 4. Spinning

Select the correct answer using the codes given below.

- (A) 1 and 2 only
- (B) 2 and 3 only ✓
- (C) 1, 3 and 4
- (D) 2, 3 and 4

4. The most preferred process for casting gas turbine blades is

- (A) die moulding
- (B) shell moulding
- (C) investment moulding ✓
- (D) sand casting

5. Match List-I (Applications) with List-II (Various types of welding) and select the correct answer using the codes given below the lists :

List-I	List-II
a. Welding of aluminium alloy	1. Submerged arc welding
b. Ship building	2. Electron beam welding
c. Joining of HSS drill bit to carbon steel shank	3. TIG welding
d. Deep penetration precision welds	4. Gas welding

Codes :

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



6. In a CNC machine tool, encoder is used to sense and control

(A) table position ✓

(B) table velocity

(C) spindle speed

(D) coolant flow

7. In a flat belt drive, the maximum tension which the belt can be subjected to is  $T$  and the mass of the belt per unit length is  $m$  kg. The velocity of the belt for maximum power transmission is

(A)  $\sqrt{\frac{T}{3m}}$  ✓

(B)  $\sqrt{\frac{T}{m}}$

(C)  $\frac{T}{3m}$

(D)  $\frac{T}{m}$

8. Multistart threads are used to get

(A) smaller linear displacement

(B) larger linear displacement with assured self-locking

(C) larger linear displacement with no guarantee of self-locking ✓

(D) None of the above

9. In hydrodynamic bearings

(A) the oil film is maintained by supplying oil under pressure

(B) the oil film pressure is generated only by the rotation of journal ✓

(C) external supply of lubricant is not required

(D) grease is used for lubrication



10. Which of the following is antifriction bearing?

- (A) Journal bearing
- (B) Pedestal bearing
- (C) Collar bearing
- (D) Needle bearing ✓

11. A bolt of M24×2 means that

- (A) the pitch of the thread is 24 mm and the depth is 2 mm
- (B) the cross-sectional area of the thread is 24 mm<sup>2</sup>
- (C) the nominal diameter of the bolt is 24 mm and the pitch is 2 mm ✓
- (D) the effective diameter of the bolt is 24 mm and there are two threads per cm

12. A cotter joint is capable of transmitting

- (A) twisting moment
- (B) an axial tensile as well as compressive load ✓
- (C) bending moment
- (D) only axial compressive load

13. The Lewis equation in spur gears is applied

- (A) only to the pinion
- (B) only to the gear
- (C) to stronger of the pinion or gear
- (D) to weaker of the pinion or gear ✓

14. If the load on a ball bearing is halved, its life

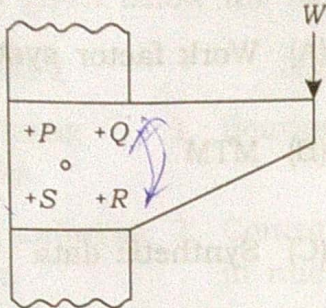
- (A) remains unchanged
- (B) increases two times
- (C) increases four times
- (D) increases eight times ✓

15. What is the efficiency of a self-locking power screw?

- (A) 70%
- (B) 60%
- (C) 55%
- (D) < 50% ✓



16. An eccentrically loaded riveted joint is shown with 4 rivets at P, Q, R and S :



Which of the rivets are the most loaded?

- (A) P and Q
- (B) Q and R
- (C) R and S
- (D) S and P

17. Which of the following input data are needed for MRP?

1. Master production schedule
2. Inventory position
3. Machine capacity
4. Bill of materials

Select the correct answer using the codes given below.

- (A) 1, 2 and 3
- (B) 2, 3 and 4
- (C) 1, 2 and 4
- (D) 1, 3 and 4

18. In a transportation problem, North-West Corner Rule would yield

- (A) an optimum solution
- (B) an initial feasible solution
- (C) a Vogel's approximation solution
- (D) a minimum cost solution

19. Assertion (A) :

In attribute control of quality by sampling, the sample size has to be largest than variable control.

Reason (R) :

Variables are generally continuous and attributes have few discrete levels.

Choose the correct option.

- (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



20. Consider the following statements in respect of PERT and CPM :

1. PERT is event-oriented while CPM is activity-oriented.
2. PERT is probabilistic while CPM is deterministic.
3. Levelling and smoothing are the techniques related to resource scheduling in CPM.

Which of the statements given above are correct?

- (A) 1, 2 and 3
- (B) 1 and 2 only
- (C) 2 and 3 only
- (D) 1 and 3 only

21. If the average arrival rate in a queue is 6/hr and the average service rate is 10/hr, which one of the following is the average number of customers in the line, including the customer being served?

- (A) 0.3
- (B) 0.6
- (C) 1.2
- (D) 1.5

$$\lambda = 6$$

$$\mu = 10$$

$$\frac{0.6}{1 - 0.6}$$

$$\frac{0.6}{0.4} = 1.5$$

22. Which one of the following is not a technique of Predetermined Motion Time Systems?

- (A) Work factor system
- (B) MTM
- (C) Synthetic data
- (D) Stopwatch time study

23. The modulus of elasticity for mild steel is approximately equal to

- (A) 80 GPa
- (B) 100 GPa
- (C) 110 GPa
- (D) 210 GPa

24. Teflon is used for bearings because of

- (A) low coefficient of friction
- (B) better heat dissipation
- (C) smaller space consideration
- (D) All of the above



25. Match List-I (Materials) with List-II (Applications) and select the correct answer using the codes given below the lists :

List-I	List-II
a. Engineering ceramics	1. Bearings
b. Fibre reinforced plastics	2. Control rods in nuclear reactors
c. Metallic and non-metallic materials	3. Aerospace industry
d. Boron	4. Electrical insulators

Codes :

(A) a b c d

1 2 3 4

(B) a b c d

1 4 3 2

(C) a b c d

1 4 2 3

(D) a b c d

4 3 1 2

26. According to Indian Standard IS 1865-1991 specification, SG 350/22 means

(A) spheroidal graphite cast iron with BHN 350 and minimum tensile strength 22 MPa

(B) spheroidal graphite cast iron with minimum tensile strength 350 MPa and 22 percent elongation

(C) spheroidal graphite cast iron with minimum compressive strength 350 MPa and 22 percent reduction in area

(D) spheroidal graphite cast iron with BHN 22 and minimum tensile strength 350 MPa

27. Select appropriate failure planes of the test specimens using the codes given below :

Test specimen under loading

Failure plane

a. Tensile test specimen of mild, ductile steel

1. 

b. Tensile test specimen of brittle cast iron

2. 

c. Torsion test specimen of brittle cast iron

3. 

d. Torsion test specimen of mild, ductile steel

4. 

Codes :

(A) a b c d

1 2 3 4

(B) a b c d

1 4 3 2

(C) a b c d

1 4 2 3

(D) a b c d

4 3 1 2



28. In a four-bar mechanism, the sum of the lengths of shortest and longest links is less than the sum of other two links. If the shortest link is fixed, then the mechanism will act as

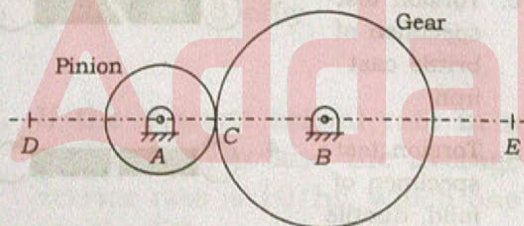
(A) double-crank

(B) double-rocker

(C) crank-rocker

(D) rocker-rocker

29. The instantaneous centre between pinion and gear wheel in a gear set mechanism shown below is located at



(A) pivot point A

(B) pivot point B

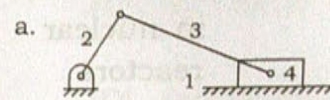
(C) pitch point C

(D) either at D or E depending on the motion

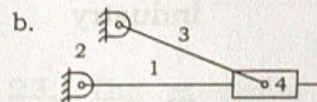
30. Match List-I (Kinematic inversions of slider-crank mechanism) with List-II (Applications) and select the correct answer using the codes given below the lists :

List-I

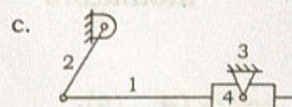
List-II



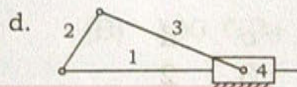
1. Hand pump



2. Compressor



3. Whitworth quick return mechanism



4. Oscillating cylinder engine

Codes :

(A) a b c d  
1 3 4 2

(B) a b c d  
2 4 3 1

(C) a b c d  
2 3 4 1

(D) a b c d  
1 4 3 2



31. Which of the following pairs of devices and their functions are correctly matched?

1. Flywheel : For storing kinetic energy
2. Governors : For controlling speeds
3. Lead screw : For providing feed in lathe to the slides
4. Fixtures : For locating work-piece and guiding tools

Select the correct answer using the codes given below.

- (A) 1, 3 and 4  
(B) 2 and 3  
(C) 1 and 2  
(D) 2 and 4

32. The masses and accelerations of the mass centres of crank, connecting rod and slider of a slider-crank mechanism are  $m_1$ ,  $m_2$ ,  $m_3$  and  $a_1$ ,  $a_2$ ,  $a_3$  respectively. The shaking force transmitted to the frame of the mechanism is given by

- (A)  $-(m_1 a_1 + m_2 a_2 + m_3 a_3)$   
(B)  $-(m_1 a_1 + m_3 a_3)$   
(C)  $m_1 a_1 + m_2 a_2 + m_3 a_3$   
(D)  $m_1 a_1 + m_3 a_3$

33. Which of the following cam follower motion functions is required to be zero velocity, zero acceleration and zero jerk at the both ends of rise and fall segments of a double-dwell cam?

- (A) Harmonic displacement  
(B) Cycloidal displacement  
(C) Fifth degree polynomial displacement  
(D) Seventh degree polynomial displacement

34. The equation of free vibrations of a system is

$$\frac{d^2 x}{dt^2} + 36\pi^2 x = 0$$

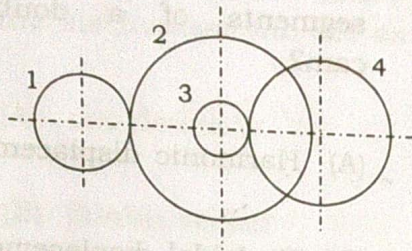
$$\frac{6\pi}{2\pi}$$

Its natural frequency is

- (A) 3 Hz  
(B)  $3\pi$  Hz  
(C) 6 Hz  
(D)  $6\pi$  Hz



35. The speed ratio of the fourth gear to the first gear in a compound gear train (gear 2 and gear 3 are mounted on the same shaft) as shown below is



(A)  $\frac{N_4}{N_1} = \frac{T_4}{T_1}$

(B)  $\frac{N_4}{N_1} = \frac{T_4}{T_2} \times \frac{T_3}{T_4}$

(C)  $\frac{N_4}{N_1} = \frac{T_4}{T_2} \times \frac{T_4}{T_3}$

(D)  $\frac{N_4}{N_1} = \frac{T_2}{T_1} \times \frac{T_3}{T_4}$

where  $T_1$ ,  $T_2$ ,  $T_3$  and  $T_4$  are numbers of teeth on gears 1, 2, 3 and 4 respectively.

36. The line of action or pressure line of meshing spur gear pair is

- (A) tangent at contact of teeth surfaces and normal to base circles of meshing pair  
(B) normal at contact of teeth surfaces and tangent to pitch circles of meshing pair

(C) normal at contact of teeth surfaces and tangent to base circles of meshing pair

(D) tangent at contact of teeth surfaces and normal to pitch circles of meshing pair

37. A shaft has two heavy rotors mounted on it. The transverse natural frequencies, considering each of the rotors separately, are 100 cycles/s and 200 cycles/s respectively. The lowest critical speed of the shaft is

(A) 5367 r.p.m.

(B) 6000 r.p.m.

(C) 9360 r.p.m.

(D) 12000 r.p.m.

38. A bar of uniform cross-section and homogenous material weighing 1000 N and having cross-section of  $1 \text{ cm}^2$  and length 1 m, hangs vertically while suspended from one end. The value of Young's modulus of the material,  $E = 10000 \text{ N/mm}^2$ . The extension of the bar due to its own weight will be

(A) 1 mm

(B) 0.5 mm

(C) 2 mm

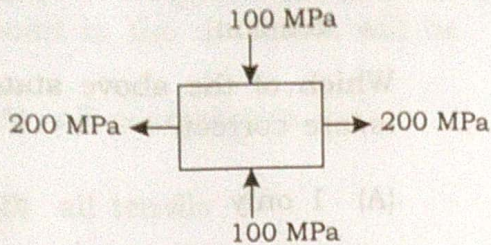
(D) 0.25 mm

$$\frac{1000 \times 1}{2 \times 1 \times 10^4 \times 10^4}$$

$$\frac{pb}{2AE} = 10$$



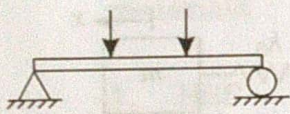
39. Consider a two-dimensional state of stress given for a stress element as shown in the diagram given below :



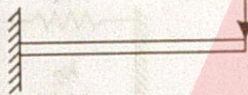
What are the coordinates of the centre of Mohr's circle?

- (A) (0, 0) (B) (100, 200)  
(C) (200, 100) (D) (50, 0)

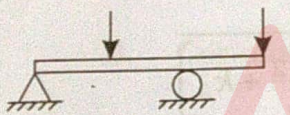
40. Six fundamental methods of supporting beam are shown below :



(a) Simple beam



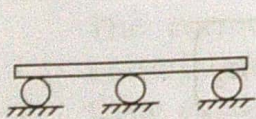
(b) Cantilever beam



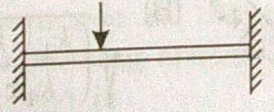
(c) Over-hanging beam



(d) Propped beam



(e) Continuously supported beam



(f) Built-in beam

Which cases fall under the category of statically indeterminate beams?

- (A) a, b, c (B) c, d, e  
(C) b, c, d (D) d, e, f

41. Match List-I (End conditions of columns) with List-II (Equivalent length in terms of hinged-hinged column) and select the correct answer using the codes given below the lists :

List-I

List-II

- |  |                |
|--|----------------|
| a. Both ends hinged                    | 1. $L$         |
| b. One end fixed and other end free    | 2. $\sqrt{2}L$ |
| c. One end fixed and other pin-jointed | 3. $L/2$       |
| d. Both ends fixed                     | 4. $2L$        |

Codes :

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

42. A circular solid shaft is subjected to a bending moment of 400 kN-m and twisting moment of 300 kN-m. On the basis of the maximum principal stress theory, the direct stress is  $\sigma$  and according to the maximum shear stress theory, the shear stress is  $\tau$ . The ratio  $\sigma/\tau$  is

- (A)  $\frac{1}{5}$  (B)  $\frac{3}{9}$   
(C)  $\frac{9}{5}$  (D)  $\frac{11}{6}$

$$\sigma = \frac{1}{2} [400 + 500] = 450$$

$$\tau = \frac{1}{2} [500 - 400] = 50$$

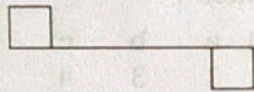
$$\frac{\sigma}{\tau} = \frac{450}{50} = 9$$



43. The property by which an amount of energy is absorbed by a material without plastic deformation is called

- (A) toughness
- (B) impact strength
- (C) ductility
- (D) resilience

44. The shear force diagram for a simply supported beam is given in the figure below :



Select the possible bending moment diagram for the beam.

- (A)
- (B)
- (C)
- (D)

45. Consider the following statements :

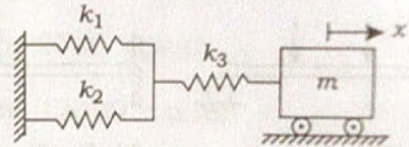
1. Based on the experiment results, the distortion energy theory predicts failure of a component made of ductile material most accurately.

2. According to the distortion energy theory, the shear yield strength is less than the shear strength in tension.

Which of the above statements is/are correct?

- (A) 1 only
- (B) 2 only
- (C) Both 1 and 2
- (D) Neither 1 nor 2

46. The natural frequency  $\omega_n$  of the system given below is



- (A)  $\sqrt{\frac{1}{m \left( \frac{k_1 + k_2}{k_1 k_2} + k_3 \right)}}$
- (B)  $\sqrt{\frac{m}{\left( \frac{k_1 + k_2}{k_1 k_2} + k_3 \right)}}$

- (C)  $\sqrt{\frac{\left( \frac{k_1 + k_2}{k_1 k_2} + k_3 \right)}{m}}$
- (D)  $\sqrt{\frac{(k_1 + k_2 + k_3)}{m}}$



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47. If a thick cylindrical shell is subjected to internal pressure, the hoop stress, the radial stress and the longitudinal stress at a point in the thickness will be

- (A) all compressive
- (B) all tensile
- (C) tensile, compressive and compressive respectively
- (D) tensile, compressive and tensile respectively ✓

48. Consider the following tool materials :

1. HSS
2. Cemented carbide
3. Ceramics
4. Diamond

The correct sequence of these materials in decreasing order of their cutting speed is

- (A) 4, 3, 1, 2
- (B) 4, 3, 2, 1 ✓
- (C) 3, 4, 2, 1
- (D) 3, 4, 1, 2

49. The high cutting speed and large rake angle of the tool will result in the formation of

- (A) continuous chips ✓
- (B) discontinuous chips
- (C) continuous chips with built-up edge
- (D) None of the above

50. Which of the following forces are measured directly by strain gauges or force dynamometers during metal cutting?

1. Force exerted by the tool on the chip acting normally to the tool face
2. Horizontal cutting force exerted by the tool on the workpiece
3. Frictional resistance of the tool against the chip flow acting along the tool face
4. Vertical force which helps in holding the tool in position

Select the correct answer using the codes given below.

- (A) 1 and 3
- (B) 2 and 4 ✓
- (C) 1 and 4
- (D) 2 and 3

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