

MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR
PRINCIPAL, GOVT. INDUSTRIAL TRAINING INSTITUTE
UNDER LABOUR, EMPLOYMENT, SKILL DEVELOPMENT & ENTREPRENEURSHIP
DEPARTMENT, GOVERNMENT OF MIZORAM, JANUARY-2024

MECHANICAL ENGINEERING

PAPER-II

Time Allowed : 3 hours

FM : 200

SECTION - A (Multiple Choice questions) (100 Marks)

All questions carry equal mark of 2 each. Attempt all questions.

This Section should be answered only on the OMR Response Sheet provided.

1. A typewriter constitutes a
 - (a) machine
 - (b) structure
 - (c) mechanism
 - (d) inversion
2. The type of follower used in automobiles is
 - (a) knife edge
 - (b) roller
 - (c) mushroom with flat face
 - (d) mushroom with spherical face
3. The sensitivity of a governor due to frictional resistance at the sleeve
 - (a) increases
 - (b) decreases
 - (c) remains same
 - (d) depends on speed.
4. The flywheel influences the
 - (a) variation of load demand on prime mover
 - (b) mean speed of the prime mover
 - (c) cyclic variation in speed of the prime mover
 - (d) mean torque developed by the prime mover
5. Deformation per unit length in the direction of force is known as
 - (a) Strain
 - (b) Lateral strain
 - (c) Linear strain
 - (d) Linear stress
6. A rod, 120 cm long and of diameter 3.0 cm is subjected to an axial pull of 18 kN. The stress in N/mm^2 is.
 - (a) 22.57
 - (b) 23.47
 - (c) 24.57
 - (d) 25.47
7. Buckling of column means
 - (a) Lateral deflection
 - (b) Axial deflection
 - (c) Torsional deflection
 - (d) None of the listed
8. In simply supported beam deflection is maximum at _____
 - (a) Midspan
 - (b) Supports
 - (c) Point of loading
 - (d) Through out

9. Elastic line is also called as ____
- (a) Deflection curve (b) Plastic curve
(c) Linear curve (d) Hooke's curve
10. Principal planes are those planes on which
- (a) Normal stress is maximum (b) Normal stress is minimum
(c) Normal stress is either maximum or minimum (d) Shear stress is maximum
11. A mechanism where there are no restrictions on the relative motion between the particles, the mechanism is called
- (a) Planar mechanism (b) Flexure mechanism
(c) Spherical mechanism (d) Spatial mechanism
12. The type of gears used to connect two intersecting coplanar shafts are
- (a) spur gears (b) straight bevel gears
(c) helical gears (d) spiral gears.
13. A ball and a socket joint forms a
- (a) spherical pair (b) rolling pair
(c) sliding pair (d) turning pair
14. The relation between the number of pairs (p) forming a kinematic chain and the number of links (l) is
- (a) $l = 2p - 2$ (b) $l = 2p - 3$
(c) $l = 2p - 4$ (d) $l = 2p - 5$
15. The creep in a belt drive is due to the
- (a) Material of the pulleys
(b) Material of the belt
(c) Unequal size of the pulleys
(d) Unequal tension on tight and slack sides of the belt
16. If a force acts on a body, it sets up some resistance to the deformation. This resistance is known as
- (a) stress (b) strain
(c) elasticity (d) modulus of elasticity
17. A cotter joint is capable of transmitting
- (a) the twisting moment (b) an axial tensile as well as compressive load
(c) the bending moment (d) only axial compressive load
18. Design of power transmission shafting is based on
- (a) Maximum shear stress theory of failure (b) St. Venant theory
(c) Rankine's theory (d) Heigh's theory
19. It is essential to check the design of a screw
- (a) for maximum principal stresses (b) for maximum shear stress
(c) for maximum tensile stress (d) for bending
20. Slip is the result of
- (a) insufficient friction between the belt and the pulley
(b) unequal elongation of belt due to T_1 and T_2
(c) elongation of belt due to T_t
(d) none of the above

21. What is the equation for Grubler's criterion for plane mechanisms with constrained motion?
- (a) $3n-2j_1-4=0$ (b) $3n-3j_1-4=0$
(c) $3n+2j_1+4=0$ (d) $3n+3j_1+4=0$
22. Transmission angle is the angle between
- (a) Input link and coupler (b) Input link and fixed link
(c) Output link and coupler (d) Output link and fixed link
23. The number of links in a planer mechanism with revolute joints having 10 instantaneous centres is
- (a) 3 (b) 4
(c) 5 (d) 6
24. A universal joint is an example of
- (a) Higher pair (b) Lower pair
(c) Rolling pair (d) Sliding pair
25. Length of arc of contact is given by
- (a) Arc of approach – Arc of recess (b) Arc of approach + Arc of recess
(c) Arc of approach / Arc of recess (d) Arc of approach x Arc of recess
26. Which gear is used for connecting two coplanar and intersecting shafts?
- (a) Spur gear (b) Helical gear
(c) Bevel gear (d) None of the above
27. A fixed gear having 200 teeth is in mesh with another gear having 50 teeth. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is
- (a) 2 (b) 4
(c) 3 (d) None of the above
28. Multiple plate clutch is used on two-wheelers as
- (a) it can transmit more torque (b) its size is small for that torque capacity
(c) frequent disengagement is required (d) it can dissipate heat effectively
29. The maximum stress produced in a bar of tapering sections is at
- (a) larger end (b) smaller end
(c) middle (d) anywhere
30. If the value of Poisson's ratio is zero, then it means that
- (a) The material is rigid (b) The material is perfectly plastic
(c) There is no longitudinal strain in the material (d) The longitudinal strain in the material is infinite
31. What are the materials which show direction dependent properties, called?
- (a) Homogeneous materials (b) Viscoelastic materials
(c) Isotropic materials (d) Anisotropic materials
32. Maximum shear stress in a Mohr's Circle
- (a) Is equal to radius of Mohr's circle (b) Is greater than radius of Mohr's circle
(c) Is less than radius of Mohr's circle (d) None of these
33. A simply supported beam is subjected to a distributed loading as shown in the diagram given below:
What is the maximum shear force in the beam?
- (a) $WL/3$ (b) $WL/2$
(c) $WL/3$ (d) $WL/6$

34. Which of the following factors are not responsible for unbalancing in rotating systems?
(a) Errors (b) Tolerances
(c) Shape of the rotor (d) None of the above
35. Whirling speed of the shaft is the speed at which
(a) Shaft tends to vibrate in longitudinal direction
(b) Torsional vibrations occur
(c) Shaft tends to vibrate vigorously in transverse direction
(d) Combination of transverse and longitudinal vibration occurs
36. In a hydrodynamic lubricated bearing
(a) there is a thick film of lubricant between the journal and the bearing
(b) there is a thin film of lubricant between the journal and the bearing
(c) there is no lubricant between the journal and the bearing
(d) the lubricant is forced between the journal and the bearing, by external pressure
37. Stress concentration is caused due to
(a) variations in load acting on a member
(b) variations in properties of materials in a member
(c) abrupt change of cross-section
(d) all of these
38. In a coupling rod of a locomotive, each of the four pairs is a _____ pair.
(a) Sliding (b) Turning
(c) Rolling (d) Screw
39. Which gear train is used for higher velocity ratios in a small space?
(a) Simple gear train (b) Compound gear train
(c) Reverted gear train (d) Epicyclic gear train
40. Which type of gear box is used in automobiles?
(a) Sliding mesh gear box (b) Differential gear box
(c) Synchromesh gear box (d) All of the above
41. In cyclic loading, stress concentration is more serious in
(a) Brittle materials (b) Ductile materials
(c) Brittle as well as ductile materials (d) Elastic material
42. Slenderness ratio is [l = length of column and k = least radius of gyration of cross section about its axis].
(a) l/k (b) k/l
(c) $l/2k$ (d) $k/2l$
43. Engineering stress-strain curve and True stress-strain curve are equal up to
(a) Proportional limit (b) Elastic limit
(c) Yield point (d) Tensile strength point
44. A system in dynamic balance implies that
(a) the system is critically damped (b) there is no critical speed in the system
(c) the system is also statically balanced (d) there will absolutely no wear of bearings

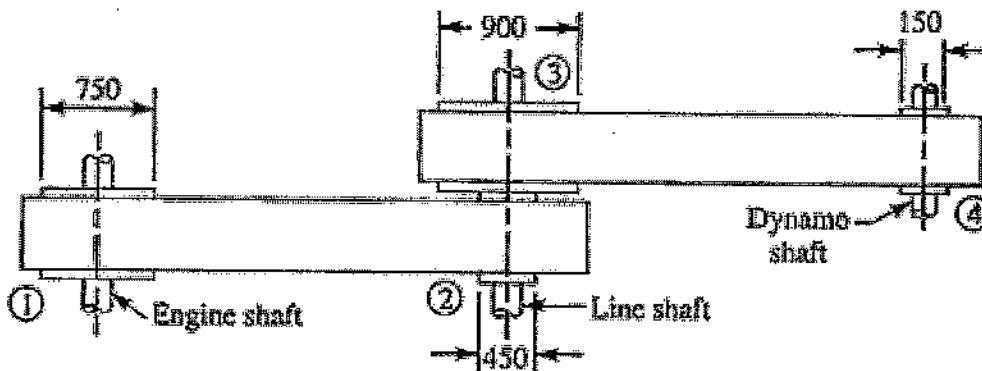
45. The neutral axis of a section is an axis, at which the bending stress is
(a) minimum (b) zero
(c) maximum (d) infinity
46. When a closely coiled spring is subjected to an axial load, it is said to be under
(a) bending (b) shear
(c) torsion (d) all of these
47. In a thin shell, the ratio of longitudinal stress to the circumferential stress is
(a) $1/2$ (b) $3/4$
(c) 1 (d) 2
48. A thin spherical shell of diameter (d) and thickness (t) is subjected to an internal pressure (p). The tensile stress in the shell plates will be
(a) $pd/2t$ (b) $pd/4t$
(c) $pt/2d$ (d) $pt/4d$
49. The slenderness ratio of a long column is
(a) 10 – 20 (b) 20 – 30
(c) 50 – 60 (d) above 80
50. A column of length is hinged at its both ends. Its equivalent length will be equal to
(a) $2l$ (b) l
(c) $0.5l$ (d) $0.707l$

SECTION - B (100 Marks)

All questions carry equal marks of 10 each.

This Section should be answered only on the Answer Sheet provided.

1. An engine running at 150 rpm drives a line shaft by means of a belt as shown in the figure below. The engine pulley is 750 mm diameter and the pulley on the line shaft is 450 mm. Whereas, a 900 mm diameter pulley on the line shaft drives a 150 mm diameter pulley keyed to a dynamo shaft. Find the speed of dynamo shaft, when there is no slip and there is a slip of 2% at each drive. (10)



All dimensions in mm.

2. What is the main function of a governor? How does it differ from that of a flywheel? (10)
3. What is the difference between a simple and compound gear train? (10)
4. A simply supported beam of length 10 m, carries the uniformly distributed load and two-point loads as shown in figure below. Draw the S.F. and B.M. diagram for the beam. Also calculate the maximum bending moment. (10)
5. What do you mean by compound epicyclic gear? Why balancing is necessary for rotors of high speeds engines? (5+5=10)
6. What is Kutzbach's criterion for degree of freedom of plane mechanism and in what way it is different from Gruebler's criterion? (5+5=10)
7. What is Kinematic link, Kinematic pair and Kinematic chain? What do you understand by lower and higher pairs? (5+5=10)
8. What are the advantages of single plate clutch over multi-plate clutch? (10)
9. Derive the relation between bending moment and shear force in a beam. What do you mean by point of inflection or contraflexure? (10)
10. Deduce the torsion equation stating the assumptions made. Deduce the expressions for maximum stresses in solid and hollow shafts. (10)

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