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Mizoram MES

Previous Year Paper
Mechanical Engg - II
Aug, 2018

MIZORAM PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. UNDER POWER & ELECTRICITY DEPARTMENT, AUGUST, 2018.

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. Identify the incorrect combination
- (a) Cross head and guides: sliding pair
- (b) A bolt and nut: turning pair
- (c) A ball and socket joint: spherical pair
- (d) Ball bearing and roller bearing: rolling pair

2. In case of lower pairs
- (a) There is no contact between the two elements
- (b) There is contact only at lower point of the two elements while in motion
- (c) There is point or line contact between the two elements while in motion
- (d) There is a surface contact between the two elements while in motion

3. In a four bar linkage, S denotes the shortest link length, L is the longest link length, P and Q are the lengths of other two links. If there is to be continuous relative motion between the links then
- (a) $(S + L) < (P + Q)$
- (b) $(S + L) > (P + Q)$
- (c) $(S + P) < (L + Q)$
- (d) $(S + P) > (L + Q)$

4. Match List-I and List-II and select he correct answer using the codes given below the lists

List-I	List-II
a. Quadratic cycle	1. Elliptical trammel
b. Single slider crank chain	2. Rapson's slide
c. Double slider crank chain	3. Ackerman steering
d. Crossed slider crank chain	4. Eccentric mechanism
	5. Pendulum pump

Codes:	A	B	C	D
(a)	5	4	2	1
(b)	3	1	5	4
(c)	5	3	4	2
(d)	3	5	1	2

5. Instantaneous centre of motion of a piston in an internal combustion engine lies at
- (a) Centre of crank pin
- (b) Centre of piston pin
- (c) Centre of crank shaft bearing
- (d) Infinity

6. Coriolli's component of acceleration exists whenever a point moves along a path that has

    (a) Linear motion   (b) tangential acceleration

    (c) Rotational motion   (d) Centripetal acceleration

7. The creep in a belt drive is due to the

    (a) Weak material of the pulleys

    (b) Weak material of the belt

    (c) Unequal size of pulleys

    (d) Unequal tension on tight and slack sides of the belt

8. When two spur gears are to be in mesh, their

    (a) Module must be same   (b) Axis must be parallel

    (c) Direction of rotation must be same   (d) Number of teeth must be same

9. Gears produced by die casting are generally used for

    (a) Light duty   (b) Low temperature applications

    (c) High torque transmission   (d) High axial thrust transmission

10. For a kinematic chain constituted by lower pairs, the number of links l and the number of joints j are correlated by the expression

    (a) $l = (j + 2)/3$ (b) $l = 2(j + 2)/3$

    (c) $l = (J + 2)/2$ (d) $l = (j + 2)$

11. A four bar chain has

    (a) All turning pairs   (b) All sliding pairs

    (c) One turning pair and others are sliding pairs   (d) One sliding pair and others are turning pairs

12. Match List-I (kinematic pair) and List-II (practical example) and select the correct answer using the codes given below the lists

List-I	List-II
a. Sliding pair	1. A road roller rolling over the ground
b. Revolute pair	2. Crank shaft in the journal bearing of an engine
c. Rolling pair	3. Ball and socket joint
d. Spherical pair	4. Piston and cylinder
	5. Nut and screw

Codes:	A	B	C	D
(a)	5	2	4	3
(b)	4	3	1	2
(c)	5	3	4	2
(d)	4	2	1	3

13. Sensitivity of a governor is defined as the ratio of

    (a) Effort of governor to its speed range   (b) Mean speed to speed range of governor

    (c) Maximum to minimum speed of governor   (d) Speed range to mean speed of the governor

14. Module of a gear is

    (a) The ratio of pitch circle diameter to the number of teeth

    (b) The ratio of number of teeth to pitch circle diameter

    (c) The reciprocal of pitch circle diameter

    (d) The product of pitch circle diameter and the number of teeth

15. According to the law of gearing

 (a) Teeth should be cut with a cutter having the same module

 (b) minimum clearance should be 0.15 mm

 (c) The common normal at the point of contact between a pair of teeth always passes through the pitch point

 (d) Arc of approach equals the arc of recess

16. Lack of toughness in a material implies

 (a) Brittleness   (b) Plasticity

 (c) Ductility   (d) Softening

17. Hooke's law is valid within the limits of proportionality and this proportional limit depends upon

 (a) Type of loading   (b) Geometry of test piece

 (c) Material of test specimen   (d) Cross-sectional area of test piece

18. The Charpy test is conducted to measure

 (a) Toughness   (b) Creep strength

 (c) Fatigue strength   (d) Elastic strength of a material

19. Dimensional formula for Young's Modulus of elasticity is

 (a) $ML^{-1}T^{-2}$ (b) MLT^{-2}

 (c) $M^{-1}L^{-1}T^{-1}$ (d) $ML^{-2}T^{-2}$

20. Modulus of rigidity is the ratio of

 (a) Axial stress to lateral strain   (b) Linear stress to longitudinal strain

 (c) Shear stress to shear strain   (d) Hydrostatic stress to volumetric strain

21. If Young's modulus E is equal to Bulk modulus K , then the value of Poisson's ratio is

 (a) 1/4   (b) 1/2

 (c) 1/3   (d) 3/4

22. The strain energy stored in a body of volume V due to direct uniform stress ó is

 (a) sE/V   (b) s^2V/E

 (c) $s^2V/2E$ (d) sV^2/E

23. The length, area and the stress to which a bar is subjected are all doubled. The elastic strain energy of the bar will then become _____ times the original value.

 (a) Two   (b) Four

 (c) Eight   (d) Half

24. A simply supported beam carries two equal concentrated loads W at a distance l/3 from either support. The value of maximum bending moment anywhere in the section will be

 (a) WL/2   (b) WL/3

 (c) WL/4   (d) WL/6

25. The shape of the bending moment diagram for a cantilever beam carrying a uniformly distributed load is

 (a) A straight line   (b) A hyperbola

 (c) An ellipse   (d) A parabola

26. The ratio of the polar moment of inertia to the radius of the shaft is known as

 (a) Shaft stiffness   (b) Flexural rigidity

 (c) Torsional rigidity   (d) Torsional section modulus

27. A composite shaft consist of two stepped portions with spring constants K_1 and K_2 respectively. If the shaft is held between two rigid support at ends, the equivalent spring constant will be

    (a) $(K_1+K_2)/2$
    (b) $K_1K_2/(K_1+K_2)$
    (c) (K_1+K_2)
    (d) K_1K_2

28. The ends of leaves of a semi-elliptical leaf spring are made triangular in plan in order to

    (a) obtain variable moment of inertia I in each leaf
    (b) Permit each leaf to act as a overhanging beam
    (c) Have variable bending moment M in each leaf
    (d) make M/I constant throughout the length of leaf

29. A pin ended column of length L, modulus of elasticity E and second moment of the cross-sectional area I is loaded concentrically by a compressive load P. The critical buckling load P_{cr} is given by

    (a) $P_{cr} = EI/P^2L^2$
    (b) $P_{cr} = P^2EI/3L^2$
    (c) $P_{cr} = PEI/L^2$
    (d) $P_{cr} = P^2EI/L^2$

30. Poisson's ratio is defined as the ratio of

    (a) Longitudinal stress to longitudinal strain
    (b) Longitudinal stress to lateral stress
    (c) Lateral strain to longitudinal strain
    (d) Lateral stress to lateral strain

31. A sliding bearing which can support steady loads without any relative motion between the journal and the bearing is called

    (a) zero film bearing
    (b) boundary lubricated bearing
    (c) hydrodynamic lubricated bearing
    (d) hydrostatic lubricated bearing

32. In thrust bearings, the load acts

    (a) along the axis of rotation
    (b) parallel to the axis of rotation
    (c) perpendicular to the axis of rotation
    (d) in any direction

33. The rolling contact bearings are known as

    (a) thick lubricated bearings
    (b) plastic bearings
    (c) thin lubricated bearings
    (d) antifriction bearings

34. Ball and roller bearings in comparison to sliding bearings have

    (a) more accuracy in alignment
    (b) small overall dimensions
    (c) low starting and running friction
    (d) all of these

35. Which of the following screw thread is adopted for power transmission in either direction?

    (a) Acme threads
    (b) Square threads
    (c) Buttress threads
    (d) Multiple threads

36. A screw is said to be self-locking screw, if its efficiency is

    (a) less than 50%
    (b) more than 50%
    (c) equal to 50%
    (d) none of these

37. Screws used for power transmission should have

    (a) low efficiency
    (b) high efficiency
    (c) very fine threads
    (d) strong teeth

38. Which of the following is a positive drive:

    (a) Crossed flat belt drive
    (b) Crossed V-belt drive
    (c) Rope drive
    (d) Chain drive

39. A jaw clutch is essentially a

    (a) positive action clutch   (b) cone clutch

    (c) friction clutch   (d) disc clutch

40. The cone clutches have become obsolete because of

    (a) small cone angles   (b) exposure to dirt and dust

    (c) difficulty in disengaging   (d) all of these

41. All stresses produced in a belt are

    (a) compressive stresses   (b) tensile stresses

    (c) both tensile and compressive stresses   (d) shear stresses

42. The centrifugal tension in the belt

    (a) increases the power transmitted   (b) decreases the power transmitted

    (c) has no effect on the power transmitted   (d) is equal to maximum tension on the belt

43. The gears are termed as medium velocity gears, if their peripheral velocity is

    (a) 1–3 m / s   (b) 3–15 m / s

    (c) 15–30 m / s   (d) 30–50 m / s

44. 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

45. Lewis equation in spur gears is used to find the

    (a) tensile stress in bending   (b) shear stress

    (c) compressive stress in bending   (d) fatigue stress

46. In a solid arch, shear force acts

    (a) Vertically upwards   (b) Along the axis of the arch

    (c) Perpendicular to the axis of the arch   (d) tangentially to the arch

47. A key made from a cylindrical disc having segmental cross-section, is known as

    (a) feather key   (b) gib head key

    (c) woodruff key   (d) flat saddle key

48. Oldham coupling is used to connect two shafts

    (a) which are perfectly aligned   (b) which are not in exact alignment

    (c) which have lateral misalignment   (d) whose axes intersect at a small angle

49. The type of stresses developed in the key is/are

    (a) shear stress alone   (b) bearing stress alone

    (c) both shear and bearing stresses   (d) shearing, bearing and bending stresses

50. The design of shafts made of brittle materials is based on

    (a) Guest's theory   (b) Rankine's theory

    (c) St. Venant's theory   (d) Von Mises Theory

Section - B *(Short answer type question)*

(100 Marks)

All questions carry equal marks of 5 each.

*This Section should be answered only on the <u>**Answer Sheet**</u> provided.*

1. How are the kinematic pairs classified? Explain with examples.

2. What do you mean by degree of freedom of a kinematic pair? How are pairs classified? Give examples.

3. Explain the terms addendum and dedendum. What is clearance?

4. What is the difference between a simple gear train and a compound gear train? Explain with the help of sketches.

5. What is the function of a governor? How does it differ from that of a flywheel?

6. Compare the performance of knife-edge, roller and mushroom followers.

7. What is meant by a self-locking and a self-energised brake.

8. What is stress? In what way does the shear stress differ from direct stress? Explain.

9. Define the term Poisson's ratio. Write the expressions for strains in the three principal directions.

10. What do you mean by point of inflection or contraflexture?

11. What do you mean by the terms 'neutral axis' and 'neutral surface'?

12. How do you distinguish between thin and thick pressure shells?

13. What is shear strain energy?

14. What are journal bearings? Give a classification of these bearings.

15. Write short note on the lubricants used in sliding contact bearings.

16. What is a clutch? Discuss the various types of clutches giving at least one practical application for each.

17. What do you understand by overhauling of screw?

18. Write a short note on gear drives giving their merits and demerits.

19. What do you understand by the term welded joint? How it differs from riveted joint?

20. Distinguish between circumferential stress and longitudinal stress in a cylindrical shell, when subjected to an internal pressure.

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