

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

Department of Mechanical Engineering

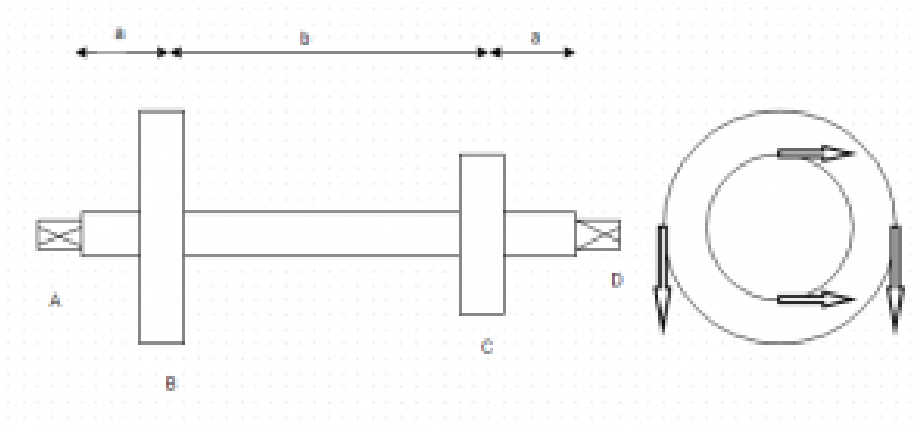
Question Bank

Class:-T.E.Mechanical

Sub.:- Machine Design-I

1. While designing shaft on the basis of torsional rigidity, angle of twist is given by?
 - a) MI/Gd^4
 - b) $584MI/Gd^4$
 - c) $292 MI/Gd^4$
 - d) $300 MI/Gd^4$
2. According to ASME code, maximum allowable shear stress is taken as X% of yield strength or Y% of ultimate strength.
 - a) X=30 Y=18
 - b) X=30 Y=30
 - c) X=18 Y=18
 - d) X=18 Y=30
3. Does ASME Standard take into consideration shock and fatigue factors?
 - a) Yes
 - b) No

For questions 4-7, refer to figure 1.



Problem: The layout of a shaft supported on bearings at A & B is shown. Power is supplied by means of a vertical belt on pulley B which is then transmitted to pulley C carrying a horizontal belt. The angle of wrap is 180° and coefficient of friction is 0.3. Maximum permissible tension in the rope is 3kN. The radius of pulley at B & C is 300mm and 150mm.

4. Calculate the torque supplied to the shaft. Refer above fig.

- a) 453.5N-m
- b) 549.3N-m
- c) 657.3N-m
- d) None of the listed

5. Calculate the tension in the rope of pulley C.

- a) 6778.3N and 7765.3N
- b) 5948.15N and 2288.75N
- c) 5468.4N and 8678.3N
- d) None of the listed

6. If allowable shear stress in the shaft is 70N/mm^2 and torsional and bending moments are $M=1185000\text{N-mm}$ and $m=330000\text{N-mm}$, find the diameter of the shaft.

- a) 36.8mm
- b) 39.7mm
- c) 44.7mm
- d) 40.3mm

7. If bending moment on point B in horizontal plate is M and in vertical plane is m, then the net bending moment at point B is?

- a) M
- b) m
- c) $M + m$
- d) $\sqrt{M^2+m^2}$

8. Calculate the shaft diameter on rigidity basis if torsional moment is 196000N-mm , length of shaft is 1000mm. Permissible angle of twist per meter is 0.5° and take $G=79300\text{N/mm}^2$.

- a) None of the listed
- b) 41.2mm
- c) 35.8mm
- d) 38.8mm

9. The stiffness of solid shaft is more than the stiffness of hollow shaft with same weight.

- a) True
- b) False

10. The strength of hollow shaft is more than the strength of solid shaft of same weight.

- a) True
- b) False

11. Solid shaft is costlier than hollow shaft of same weight.

- a) True
- b) False

12. A coupling is a mechanical device that temporarily joins two rotating shafts to each other.

- a) True
- b) False

13. Oldham coupling is used to connect two shafts having intersecting axes.

- a) True
- b) False

14. Distortion energy theorem is not recommended for ductile materials.

- a) True
- b) False

15. Among maximum shear stress theory and distortion energy theory, which gives the higher value shear yield strength?

- a) Maximum shear stress theory
- b) Distortion energy theory
- c) Both give equal values
- d) Vary from material to material

16. A Sunk key fits in the keyway of the _____ only.

- a) Hub
- b) Sleeve
- c) Both hub and sleeve
- d) Neither hub nor sleeve

17. Hollow saddle key is superior to flat saddle key as far as power transmitting capability is concerned.

- a) True
- b) False

18. Saddle key is more suitable than Sunk key for heavy duty applications.

- a) True
- b) False

19. The main advantage of Sunk key is that it is a _____ drive.

- a) Positive
- b) Negative
- c) Neutral
- d) None of the listed

20. Woodruff key permits _____ movement b/w shaft and the hub.

- a) Axial
- b) Radial
- c) Eccentric
- d) None of the listed

21. Splines are keys.

- a) True
- b) False

22. Knuckle Joint can't be used to connect two intersecting rods.

- a) Yes
- b) No, it can't be used
- c) It can be used with some modifications
- d) It is expensive and hence isn't used

23. A knuckle joint is unsuitable for two rotating shafts, which transmit torque

- a) True
- b) False

24. A maximum of how many roads may be connected using a knuckle joint?

- a) 2
- b) 3
- c) 4
- d) 5

25. Which of the following are important parts of knuckle joint?

- a) Eye
- b) Pin
- c) Fork
- d) Each of the mentioned

26. Calculate the diameter of pin from shear consideration with maximum shear stress allowed is 40N/mm^2 and an axial tensile force of 50kN is acting on the rod.

- a) 39mm
- b) 44mm
- c) 49mm
- d) 52mm

27. Turn buckle has

- A. right hand threads on both ends
- B. left hand threads on both ends
- C. left hand threads on one end and right hand threads on other end
- D. no threads

28. Mechanical advantage is the ratio of effort to load.

- a) True
- b) False

29. Leverage is the ratio of load arm to effort arm.

- a) True
- b) False

30. The distance between fulcrum and dead weights is 100mm. Dead weights are of 2945.2N. An effort of 294.52N acts on the other hand. Find the distance between the fulcrum and other end of the lever.

- a) 1000mm
- b) 100mm
- c) 10mm
- d) 10000mm

31. A right angled bell-crank is designed to raise a load of 5kN at short arm whose length is 100mm. Longer arm is of length 500mm. Calculate the reaction or force acting on the fulcrum.

- a) 5.1
- b) 5.8
- c) 6.1
- d) 6.8

32. A right angled bell-crank is designed to raise a load of 5kN at short arm whose length is 100mm. Also longer arm is of length 500mm. If permissible bearing pressure on pin is 10N/mm^2 and diameter of the 20mm, find the length of the pin.

- a) 35.5mm
- b) 25.5mm
- c) 20mm
- d) 30mm

33. A right angled bell-crank is designed to raise a load of 5kN at short arm whose length is 100mm. Also longer arm is of length 500mm. If permissible bearing pressure on pin is 10N/mm^2 and diameter of the 20mm, find the shear stress in the pin.

- a) 8.12
- b) 8.51
- c) 9.12
- d) 9.51

34. All welding processes require pressure along with heat.

- a) Yes
- b) No, fusion doesn't require
- c) Can't be stated
- d) None of the listed

35. If force act in a direction parallel to the direction of weld, then fillet weld is called as?

- a) Transverse
- b) Longitudinal
- c) Parallel
- d) Longitudinal or Parallel

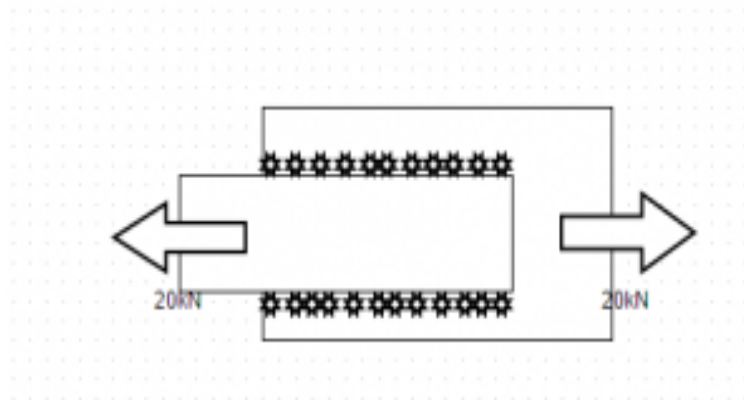
36. The length of each of the two equal sides of a parallel fillet weld is called

- a) Leg
- b) Throat
- c) Arm
- d) None of the listed

37. If length of weld is l and leg h , then area of throat can be given by

- a) $0.707 hl$
- b) $1.414hl$
- c) hl
- d) None of the listed

Fig.2 Que. 38-41

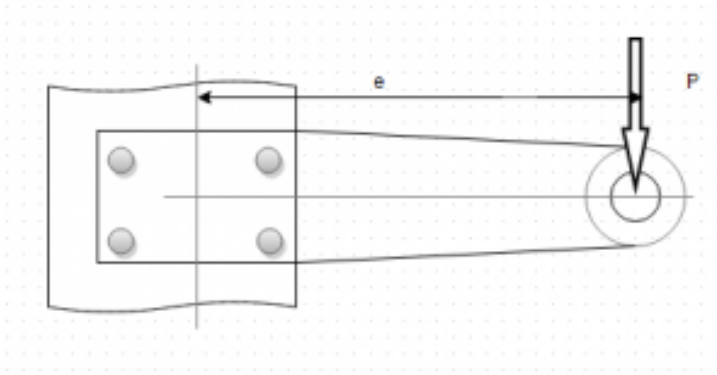


38. A steel plate is welded to another steel plate as shown in the figure 2. This is an example of transverse fillet weld.

- a) True
- b) False

39. Referring to figure 2, determine the required length of the weld joining two steel plates which are 10mm wide and 10mm thick. The permissible shear stress in the weld is 80N/mm^2
- a) 18mm
 - b) 15mm
 - c) 16mm
 - d) 14mm
40. The two plates are welded as shown in the figure 2. It is an example of
- a) Parallel fillet weld
 - b) Transverse fillet weld
 - c) Parallel as well as transverse fillet weld
 - d) None of the mentioned
41. With reference to figure 2, a plate, 75mm wide and 10mm thick, is joined with another plate as shown. The permissible tensile and shear stress in the welds are $50/\text{mm}^2$ and 40N/mm^2 . Determine the required length of each parallel fillet weld if length of transverse weld is 40mm.
- a) 11mm
 - b) 9mm
 - c) 8mm
 - d) 7mm
42. If core diameter of bolt is 13.8cm then it's nominal diameter is given by?
- a) 17.27mm
 - b) 15.34mm
 - c) 14.67mm
 - d) 16.34mm

Fig.3 Que,43-45



Problem: The structure shown is subjected to an eccentric force $P=5\text{kN}$ and eccentricity $=500\text{mm}$. The horizontal distance between two bolts is 200mm and vertical distance between bolts is 150mm . The yield strength of bolts is 400N/mm^2 and factor of safety is 3.

43. Referring to fig 3, Determine the primary shear force.

- a) 625N
- b) 1250N
- c) 2500N
- d) 1000N

44. In figure 3, determine the size of the bolts.

- a) 10.74mm
- b) 9.23mm
- c) 11.54mm
- d) 8.68mm

45. Determine the primary shear stress to which the bolts are subjected if $P=3\text{kN}$.

- a) 3000N
- b) 1000N
- c) 2000N
- d) None of the listed

46. Spring having square ends has 1 inactive coil.

- a) True
- b) False

47. The axial deflection of spring for the small angle of θ is given by?

- a) $328PD^3N/Gd^4$
- b) $8PD^3N/Gd^4$
- c) $16PD^3N/Gd^4$
- d) $8PD^2N/Gd^4$

48. Find the Wahl's factor if spring index is 6.

- a) 1.2020
- b) 1.2424
- c) 1.2525
- d) 1.5252

49 . Find the shear stress in the spring wire used to design a helical compression sprig if a load of 1200N is applied on the spring. Spring index is 6, and wire diameter 7mm.

- a) 452.2N/mm²
- b) 468.6N/mm²
- c) 512.2N/mm²
- d) None of the listed

50. Find the mean coil diameter of a helical compression sprig if a load of 1200N is applied on the spring. Spring index is 6, and wire diameter 7mm.

- a) 7/6mm
- b) 42mm
- c) $1200 \times 6/7$ mm
- d) None of the listed

51. Find total number coils in a spring having square and ground ends. Deflection in the spring is 6mm when load of 1100N is applied. Modulus of rigidity is 81370N/mm². Wire diameter and pitch circle diameter are 10mm and 50mm respectively.

- a) 7
- b) 6
- c) 5
- d) 4

52. A power screw is only used to convert rotary motion into linear motion and not for transmitting power.

- a) True
- b) False

53. If nominal diameter of screw thread=50mm and pitch=10mm then the mean diameter of the screw thread will be?

- a) 40mm
- b) 45mm
- c) 60mm
- d) 55mm

54. Find the torque required to raise the load of 15kN and mean diameter of triple threaded screw being 46mm. Also given pitch=8mm and coefficient of friction is 0.15.

- a) 11831.06N-mm
- b) 11813.06N-mm
- c) 12811.06N-mm
- d) None of the listed

55. For a double threaded screw, what will be the tangent of helix angle if nominal diameter and pitch are 100mm and 12mm respectively?

- a) 0.045
- b) 0.081
- c) 0.094
- d) 0.023

56. 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

57. Multiple threads are used to secure

- a) low efficiency
- b) high efficiency
- c) high load lifting capacity
- d) high mechanical advantage

58. Screws used for power transmission should have

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

59. If α denotes the lead angle and ϕ , the angle of friction, then the efficiency of the screw is written as

- a) $\tan(\alpha - \phi)/\tan\alpha$
- b) $\tan\alpha/\tan(\alpha - \phi)$
- c) $\tan(\alpha + \phi)/\tan\alpha$
- d) $\tan\alpha/\tan(\alpha + \phi)$

60. A screw jack has square threads and the lead angle of the thread is α . The screw jack will be self locking when the coefficient of friction (μ) is

- a) $\mu > \tan \alpha$
- b) $\mu = \sin \alpha$
- c) $\mu = \cot \alpha$
- d) $\mu = \operatorname{cosec} \alpha$

61. To ensure self locking in a screw jack, it is essential that the helix angle is

- a) larger than friction angle
- b) smaller than friction angle
- c) equal to friction angle
- d) such as to give maximum efficiency in lifting

62. 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 the mentioned

63. A screw is said to be over hauling screw, if its efficiency is

- a) less than 50%
- b) more than 50%
- c) equal to 50%
- d) none of the mentioned

64. The load cup of a screw jack is made separate from the head of the spindle to

- a) enhance the load carrying capacity of the jack
- b) reduce the effort needed for lifting the working load
- c) reduce the value of frictional torque required to be countered for lifting the load
- d) prevent the rotation of load being lifted

65. Belt, chain and rope are called rigid drives.

- a) True
- b) Belt is a flexible drive only
- c) All three are flexible drives
- d) None of the listed

66. Flexible drive can absorb shock loads and damp vibrations.

- a) True
- b) No
- c) Depends on the load applied
- d) Doesn't damp vibrations

67. Velocity ratio in both flexible and rigid drive is constant.

- a) True
- b) False

68. A circular solid shaft is subjected to bending moment of 400 kN-m and torsional moment of 300 kN-m. On the basis of maximum principal stress theory, the direct stress is σ and according to maximum shear stress theory, the shear stress is τ . The ratio of σ/τ is

A) $\frac{9}{5}$

B) $\frac{10}{9}$

C) $\frac{5}{9}$

D) $\frac{9}{10}$

69. Which of the following is considered for design of axles?

- A) Bending Moment only.
- B) Twisting moment only.
- C) Combined bending moment and torsion.
- D) Combined bending moment, twisting moment and axial thrust.

70. The equivalent B.M under combined action of B.M (M) and Torque (T) is

A) $\sqrt{M^2 + T^2}$

B) $\frac{1}{2} \sqrt{M^2 + T^2}$

C) $M + \sqrt{M^2 + T^2}$

D) $\frac{1}{2} [M + \sqrt{M^2 + T^2}]$

71. Bending Moment (M) and Torque (T) is applied on a solid circular shaft. If the maximum bending stress equals to maximum shear stress developed, then (M) is equal to

A) 0.5T

B) T

C) 2T

D) 4T

72. For the two shafts connected in parallel

A) Torque in each shaft is same.

B) Angle of twist in each shaft is same.

C) Shear stress in each shaft is same.

D) Torsional stiffness in each shaft is same.

73. A solid shaft of diameter (D) applied a twisting moment that develops maximum shear stress τ . If is replaced by a hollow one of outside diameter (D) and inside diameter (D/2), then maximum shear stress will be

A) 1.067 τ

B) 1.143 τ

C) 1.333 τ

D) 2 τ

74. When a shaft transmits power through gears, the shaft experiences

A) torsional stresses alone

B) bending stress alone

C) constant bending and varying torsional stresses

D) varying bending and constant torsional stresses

75. The key connecting a flange coupling to a shaft is likely to fail in

- A) shear
- B) tension
- C) torsion
- D) bending

76. In the assembly of key, pulley & shaft

- A) pulley is made weakest
- B) key is made of weakest
- C) key is made the strongest
- D) all are designed for equal strength

77. A spur-gear transmitting power is connected to the shaft with a key of rectangular section. The type(s) of stresses developed in the key is/are

- A) shear stress alone.
- B) bearing stress alone.
- C) both shear and bearing.
- D) shearing, bearing and bending.

78. The distance which a screw thread advances axially in one rotation of the nut is known as

- A) pitch
- B) lead
- C) included angle
- D) Helix Angle

79. Smallest diameter of an external or internal screw thread is known as

- A) minor diameter.
- B) major diameter.
- C) pitch diameter.
- D) None.

80. A screw is specified by its

- A) minor diameter
- B) major diameter
- C) pitch diameter
- D) None

81.In single start threads, lead as compared to pitch is

- A)more
- B)less
- C)same
- D)None of the above.

82.On a triple thread screw, lead equal

- A)pitch
- B) $2 \times$ pitch
- C) $3 \times$ pitch
- D) $6 \times$ pitch

83. Creep in a belt occurs due to

- A)weak material of the belt.
- B)weak material of the pulley.
- C)improper crowning.
- D)uneven contraction and extension of the belt.

84.The mid section of flat pulleys is slightly raised to

- A)reduce tension in the belt
- B)increase the angle of the belt
- C)avoid lateral slip of the belt
- D)independent of the belt width and speed of pulleys

85.An idler pulley is used

- A)for frequent of motion
- B)to maintain requisite tension in the belt
- C)to change the direction of motion of the belt
- D)to run only during non-load periods

86)The ratio between tensions in tight and slack sides of a flat belt drive increases

- A)in direct proportion to the angle of lap
- B)exponentially to the product of angle of lap and coefficient of friction
- C)in direct proportion to the coefficient of friction
- D)in direct proportion to the belt width

87)In a close coiled spring, other quantities remaining the same if the wire diameter is doubled, then the stiffness of spring when compared to the original one, will become

- A)twice
- B)four times
- C)eight times
- D)sixteen times

88) When a closely coiled helical spring is subjected to an axial load, the deflection of the spring is directly proportional to

- A) modulus of rigidity of spring material
- B) diameter of spring wire
- C) diameter of spring wire
- D) number of turns of the spring

89) Ratio of strength of the weld material to that of parent body is

- A) more than one
- B) less than one
- C) equal to one
- D) None

90) Weakest plane in a fillet weld is

- A) smaller of the sides
- B) sides parallel to the force
- C) sides normal to the force
- D) the throat

91) In fillet weld, throat is

- A) perpendicular distance from the root to the hypotenuse
- B) the smaller side of triangle of the fillet
- C) the larger side of triangle of the fillet
- D) None

92) Cross-section of a standard fillet weld is a triangle with base

- A) 30° and 60°
- B) 35° and 55°
- C) 40° and 50°
- D) 45° and 45°

93) Transverse fillet welded joints are designed for

- A) tensile strength
- B) compressive strength
- C) bending strength
- D) shear strength

94) Parallel fillet welded joint is designed for

- A) Tensile strength.
- B) Compressive strength.
- C) Bending strength.
- D) Shear strength.

95) A properly made butt weld has strength equal to

- A) Half the tensile strength of plate.
- B) Half the compressive strength of plate.
- C) Double the compressive strength of plate.
- D) Strength of the welded plates.

96) The spindle speed range in general purpose lathe is divided into steps is approximately follows

- A) Idler pulley drive.
- B) Fast pulley drive.
- C) Stepped pulley drive.
- D) Loose pulley drive.

97) The suitable material for belt in agricultural machinery is

- A)leather
- B)rubber
- C)cotton duck
- D)balata gum

98) The power transmitted by belt drive depends upon

- A)belt velocity
- B)initial belt tension
- C)arc of contact
- D)all of the above

99) The suitable material for belt used in floor mill is

- A) Leather.
- B) Rubber.
- C) Canvas or cotton duck.
- D) Balata gum.

100) The coefficient of friction in belt drive depends upon

- A) Material of belt.
- B) Material of pulley.
- C) Materials of belt and pulley.
- D) Belt velocity.

