Tatyasaheb Kore Institute of Engineering and Technology, Warananagar
Department of Mechanical Engineering
Question Bank

Sub: Mechanical System Design   **Sem: VII**

1. **For controlling the rotation through more than 360 degree, we use**
   a. Knob
   b. Selector
   c. Crank
   d. Wheel

2. **Which design consideration deals with appearance of the product?**
   a. Ergonomics
   b. Aesthetics
   c. System design
   d. Creative design

3. **The objective of considering ergonomics in machine design is to ____**
   1. decrease physical stresses
   2. make user adapt to the machine
   3. make machine fit for the user
   4. improve appearance of the product
   a. only 2
   b. 3 and 4
   c. 1 and 3
   d. 1, 3 and 4

4. **Ergonomics involves the following:**
   a. How a person interfaces with environmental conditions and how the person interfaces with the physical aspect of his/her workplace.
   b. The speed at which a person can process goods or services through their operation.
   c. The likely strains and stresses on the body caused by continued work on repetitive tasks.
   d. How a person interfaces with environmental conditions

5. **Ergonomics is a body of knowledge concerned with:**
   a. Human abilities
   b. Design of tools, machines, systems, tasks, jobs, and environments
   c. Fitting the job or task to the person
   d. All of the above

6. **Ergonomics' is related to human**
   a. Comfort
   b. Safety
   c. Both 'a' and 'b'
   d. None of the above

7. **Which guidelines may be used in aesthetic design**
   a. the appearance should contribute to the performance of the product.
   b. the appearance should reflect the function of the product.
   c. the appearance should reflect the quality of the product.
   d. all of these

8. **The following subject(s) is (are) related to 'Ergonomics'**
   a. Anthropology
   b. Physiology
   c. Psychology
   d. All of the above

9. **The most frequently used components are arranged in**
   a. Left side
   b. Right side
   c. Central location
   d. Any of the above

10. **Ergonomics principle suggests that**
    a. Monitoring displays should be placed outside peripheral limitations
    b. Glow-in-the dark dials made of reflective substances are good for viewing in the nights
    c. Visual systems should be preferred over auditory systems in noisy locations
    d. All of the above

11. **The following is (are) basic type(s) of dynamic quantitative display(s)**
    a. Fixed scale with moving pointer
    b. Fixed pointer with moving scale
    c. Counters displays
    d. All of the above

12. **In designing an efficient workspace, the left hand will cover**
    a. Maximum working area
    b. Normal working area
    c. Minimal working area
    d. Any of the above

13. **The most frequently used components are arranged in**
    a. Left side
    b. Right side
    c. Central location
    d. Any of the above

14. **The height of the top of the work bench should be __ the height of the elbow of the workmen.**
    a. at
    b. Above
    c. Below
    d. Any of the above

15. **The following subject(s) is (are) related to 'Ergonomics'**
    a. Anthropology
    b. Physiology
    c. Psychology
    d. All of the above

16. **A thin cylinder with both ends closed is subjected to internal pressure p. The longitudinal stress at the surface has been calculated as σ_o. Maximum shear stress at the surface will be equal to**
    a. $2\sigma_o$
    b. $1.5\sigma_o$
    c. σ_o
    d. $0.5\sigma_o$

17. **What is the ratio of hoop stresses in a spherical vs cylindrical shell of same diameter, thickness and under same pressure?**
    a. 4:1
    b. 2:1
    c. 1:2
    d. 1:4

18. **A thick cylinder is subjected to external pressure. The magnitude of hoop stress at internal radius will be**
    a. equal to the magnitude of hoop stress at external radius
    b. less than the magnitude of hoop stress at external radius
    c. greater than the magnitude of hoop stress at external radius
    d. equal to the magnitude of hoop stress at external radius

19. **Design pressure for unfired pressure vessels is 1.05 times of _____**
    a. minimum working pressure
    b. maximum working pressure
    c. hydrostatic test pressure
    d. none of the above

20. **Stresses in a thin cylindrical shell under internal pressure is independent of**
    a. Diameter
    b. Thickness
    c. Length
    d. Diameter and thickness

21. **Design of a thin shell under pressure is done on the basis of**
    a. Radial stress
    b. Longitudinal stress
    c. Hoop stress
    d. All the three stresses

22. **Class 3 pressure vessels having welded joints are _____**
    a. fully radio-graphed
    b. partially radio-graphed
    c. spot radio-graphed
    d. not radio-graphed

23. **Thick cylinders are analyzed on the basis of**
    a. Maximum shear stress theory
    b. Lame's theory
    c. Poisson's theory
    d. Rankine's theory

24. **Tangential stress in a cylinder is given by [symbols have their usual meanings].**
    a. PD/2t
    b. 2PD/t
    c. PD/4t
    d. 4PD/t

25. **Longitudinal stress in a cylinder is given by [symbols have their usual meanings].**
    a. PD/2t
    b. 2PD/t
    c. PD/4t
    d. 4PD/t

26. **A seamless cylinder of storage capacity of 0.03m³is subjected to an internal pressure of 21MPa. The ultimate strength of material of cylinder is 350N/mm².Determine the length of the cylinder if it is twice the diameter of the cylinder.**
    a. 540mm(534.60)
    b. 270mm
    c. 400mm
    d. 350mm

27. **A seamless cylinder of storage capacity of 0.03m³is subjected to an internal pressure of 21MPa. The ultimate strength of material of cylinder is 350N/mm².Determine the thickness of the cylinder if it is twice the diameter of the cylinder.**
    a. 12mm
    b. 4mm
    c. 8mm
    d. 16mm

28. **The piston rod of a hydraulic cylinder exerts an operating force of 10kN. The allowable stress in the cylinder is 45N/mm². Calculate the thickness of the cylinder using Lame's equation. Diameter of the cylinder is 40mm and pressure in cylinder is 10MPa.**
    a. 2.05mm
    b. 4.2mm
    c. 5.07mm
    d. None of the listed

29. **The piston rod of a hydraulic cylinder exerts an operating force of 10kN. The allowable stress in the cylinder is 70N/mm². Calculate the thickness of the cylinder using Clavarinoe's equation. Diameter of the cylinder is 240mm.μ=0.3 and pressure in cylinder is 15MPa.**
    a. 35mm
    b. 30mm
    c. 27mm
    d. None of the listed

30. Internal pressure of 2.5 Mpa acts on a pressure vessel of thickness 15 mm and internal diameter of 1500 mm. What is the stress induced in longitudinal direction?
    a. 36.63 N/mm²
    b. 59.13 N/mm²
    c. 65.62 N/mm²
    d. 131.25 N/mm²

31. A cylindrical pressure vessel is subjected to an internal pressure of 3 Mpa on internal diameter of 1000 mm. The vessel is fabricated with single weld butt joint with back strip and is not radio-graphed. What is the thickness of flat head, if head made of alloy steel has an ultimate tensile strength of 400 N/mm² ? (corrosion allowance = 2)
    a. 110 mm
    b. 120 mm
    c. 150.23 mm
    d. 152.13 mm

32. A cylindrical pressure vessel is subjected to operating pressure of 0.55 Mpa and corrosion allowance of 2. What is the thickness of pressure vessel shell if its internal diameter is 2000 mm? (σ_{all} = 120 N/mm² & η_l = 0.75)
    a. 6.5 mm
    b. 7 mm
    c. 9 mm
    d. 9.5 mm

33. A thin-walled cylindrical pressure vessel having a radius of 0.5 m and wall thickness of 254mm is subjected to an internal pressure of 700 kPa. The hoop stress developed is
    a. 14 MPa
    b. 1.4 MPa
    c. 0.14 MPa
    d. 0.014 MPa

34. A thin walled spherical shell is subjected to an internal pressure. If the radius of the shell is increased by 1 % and the thickness is reduced by 1 %, with the internal pressure remaining the same, the percentage change in the circumferential (hoop) stress is
    a. 0
    b. 1
    c. 1.08
    d. 2.02

35. A gas stored in a cylindrical tank of inner radius 7m and wall thickness 50 mm. The gauge pressure of the gas is 2 MPa. The maximum shear stress (in MPa) in the wall is
    a. 35
    b. 70
    c. 140
    d. 280

36. **A thin cylindrical steel pressure vessel of diameter 6cm and wall thickness 3mm is subjected to an internal fluid pressure of intensity 'P', if the ultimate strength of steel 3600 kg/cm², the bursting pressure will be**
 a. 18 kg/cm²
 b. 36 kg/cm²
 c. 180 kg/cm²
 d. 360 kg/cm²

37. **Match the list and choose the correct answer**

A. Single plate clutch	1. Scooters
B. Multiple plate clutch	2. Rolling Mills
C. Centrifugal clutch	3. Trucks
D. Cone clutch	4. Mopeds

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

38. In a multidisc clutch if N1 and N2 are the number of discs on the driving and driven shafts, respectively, the number of pairs of contact surfaces will be
 a. N1+N2
 b. N1+N2-1
 c. N1+N2+1
 d. N1+N2+2

39. **The following is known as positive clutch**
 a. Single plate clutch
 b. Cone clutch
 c. Dog clutch
 d. Centrifugal clutch

40. **The following is not a Friction clutch**
 a. Fluid clutch
 b. Centrifugal clutch
 c. Cone clutch
 d. Disc clutch

41. **On the motors with the low starting torque the type of clutch to be used**
 a. Single plate clutch
 b. Multiple plate clutch
 c. Cone clutch
 d. Centrifugal clutch

42. **Friction affects the engagement force as well as disengagements force in case of**
 a. Centrifugal clutch
 b. Cone clutch
 c. Single plate clutch
 d. Multiple plate clutch

43. **Self-locking is not possible in case of**
    a. Differential band brake
    b. Internal expanding shoe brake
    c. Simple band brake
    d. Simple block brake

44. **In the multiple disc, if there are 6 discs on the driving shaft and 5 discs on the driven shaft, then the number of pairs of contact surfaces will be equal to**
    a. 11
    b. 12
    c. 10
    d. 22

45. **A disc clutch is required to transmit 5 kW at 2000 rpm. The disk has a friction lining with coefficient of friction equal to 0.25. Bore radius of friction lining is equal to 25mm. Assume uniform contact pressure of 1 MPa. The value of outside radius of the friction lining is**
    a. 39.4 mm
    b. 49.5 mm
    c. 97.9 mm
    d. 142.9 mm

46. **A plate clutch consists of 1 pair of contacting surfaces. The inner and outer diameter of the friction disk is 100mm and 200mm respectively. The coefficient of friction is 0.2 and permissible intensity of pressure is 1.5N/mm². Assuming uniform wear theory, calculate the operating force in the clutch**
    a. 15546N
    b. 12344N
    c. 23562N
    d. 24543N

47. **A plate clutch consists of 1 pair of contacting surfaces. The inner and outer diameter of the friction disk is 100mm and 200mm respectively. The coefficient of friction is 0.2 and permissible intensity of pressure is 1.5N/mm². Assuming uniform wear theory, calculate the torque transmitting capacity of the clutch.**
    a. 412.23N-m
    b. 353.43N-m
    c. 334.53N-m
    d. 398.34N-m

48. **A plate clutch consists of 1 pair of contacting surfaces. The inner and outer diameter of the friction disk is 100mm and 200mm respectively. The coefficient of friction is 0.2 and permissible intensity of pressure is 1.5N/mm². Assuming uniform wear theory, calculate the power transmitting capacity of the clutch at 80rad/s.**
    a. 27.8kW
    b. 32.4kW
    c. 21.2kW
    d. 34.5Kw

49. A plate clutch consists of 1 pair of contacting surfaces. The inner and outer diameter of the friction disk is 100mm and 200mm respectively. The coefficient of friction is 0.2 and permissible intensity of pressure is 1.5N/mm². Assuming uniform pressure theory, calculate the operating force in the clutch.
    a. 15546N
    b. 12344N
    c. 23562N
    d. 35343N

50. A plate clutch consists of 1 pair of contacting surfaces. The inner and outer diameter of the friction disk is 100mm and 200mm respectively. The coefficient of friction is 0.2 and permissible intensity of pressure is 1.5N/mm². Assuming uniform pressure theory, calculate the torque transmitting capacity of the clutch
    a. 412.23N-m
    b. 549.78N-m
    c. 567.54N-m
    d. 678.86N-m

51. A plate clutch consists of 1 pair of contacting surfaces. The inner and outer diameter of the friction disk is 100mm and 200mm respectively. The coefficient of friction is 0.2 and permissible intensity of pressure is 1.5N/mm². Assuming uniform wear theory, calculate the power transmitting capacity of the clutch at 80rad/s.
    a. 27Kw
    b. 32kW
    c. 39kW
    d. 44kW

52. Find the axial thrust to be provided by the springs if the maximum intensity of pressure in a single plate clutch should not exceed 0.2 N/mm². The outer and the inner radius is 75 mm and 35 mm. Assume theory of uniform wear.
    a. 1792.01N
    b. 1789.21N
    c. 1723.41N
    d. 1759.29 N

53. Find the average pressure in a single plate clutch if the axial force is 5 kN. The inside radius and the outer radius is 30 mm and 70 mm respectively. Assume uniform wear.
    a. 398N/mm²
    b. 0.398N/m²
    c. 0.398N/mm²
    d. 398 N/m²

54. A single plate clutch, having n = 2, has outer and inner radii 150 mm and 100 mm respectively. The maximum intensity of pressure at any point is 0.1 N/mm². If the μ is 0.3, determine the power transmitted by a clutch at a speed 3000 r.p.m.
    a. 74031Kw
    b. 740.31kW
    c. 74.031kW
    d. 706.95 kW

55. Calculate torque transmitted by the clutch having four shoes, which has spring force of 700 N and centrifugal force of 4000 N. Rim diameter is 560 mm and coefficient of friction is 0.3
    a. 1100N
    b. 1000N
    c. 1579N
    d. 1108.8 N
56. In a conical clutch, the mean radius of the bearing surface is 300 mm whereas the breadth is 20 mm. find the inner and outer radii. The semi cone angle is 30°.
    a. 145mm,155mm
    b. 140mm,160mm
    c. 160mm,140mm
    d. 155 mm, 145 mm
57. If the outer and inner radius of the contact surfaces are 100 mm and 75 mm respectively and the semi cone angle is 22.5°, find the value of the face width required
    a. 89.43mm
    b. 78.94mm
    c. 65.33mm
    d. 23.87 mm
58. A conical friction clutch is used to transmit 75 kW at 1500 r.p.m. The semi cone angle is 20° and the coefficient of friction is 0.3. If the mean diameter of the bearing surface is 500 mm and the intensity of normal pressure is not to exceed 0.1 N/mm², find the dimensions of the conical bearing surface.
    a. 118.07mm,131.93mm
    b. 131.93mm,118.07mm
    c. 121.72mm,128.28mm
    d. 128.28 mm, 121.72 mm
59. A conical friction clutch is used to transmit 50 kW at 1000 r.p.m. The semi cone angle is 15° and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 450 mm and the intensity of normal pressure is not to exceed 0.15 N/mm², find the axial spring force necessary to engage the clutch.
    a. 4796N
    b. 4774N
    c. 4785N
    d. 4742 N
60. A conical friction clutch is used to transmit 40 kW at 1300 r.p.m. The semi cone angle is 12.5° and the coefficient of friction is 0.25. If the mean diameter of the bearing surface is 400 mm and the intensity of normal pressure is not to exceed 0.2 N/mm², find the axial spring force necessary to disengage the clutch.
    a. 154.28N
    b. 121.45N
    c. 201.78N
    d. 162.39 N

61. **A clutch has outer and inner diameters 100 mm and 40 mm respectively. Assuming a uniform pressure of 2 Mpa and coefficient of friction of liner material 0.4, the torque carrying capacity of the clutch is**
   a. 148 Nm
   b. 196 Nm
   c. 372 Nm
   d. 490 Nm

62. **The brake is said to be self-energizing if**
   a. Direction of application of force is same as that of friction force
   b. An external force is required to disengage the brake
   c. No external force is required to operate the brake
   d. The direction of moment due to external force and frictional force is same

63. **When brakes are applied on a moving vehicle; the kinetic energy is converted to**
   a. Mechanical energy
   b. Heat energy
   c. Electrical energy
   d. Potential energy

64. **On what principle does the braking system in the car work?**
   a. Frictional force
   b. Gravitational force
   c. Magnetic force
   d. Electric force

65. **When the intensity of pressure between the block and brake drum is uniform, the angle of contact between the block and brake drum is less than**
   a. 45°
   b. 90°
   c. 60°
   d. 30°

66. **In block brake with long shoe, the semi- block angle is**
   a. θ
   b. $\theta/2$
   c. 2θ
   d. 4θ

67. **The energy absorb by brake is always kinetic.**
   a. No, potential
   b. Kinetic or potential
   c. Potential
   d. Strain Energy

68. **For anticlockwise rotation of brake drum in block brake, the actuating force or braking effort is _____that of clockwise direction**
   a. More than
   b. Less than
   c. Equal to
   d. Any of the above

69. In case of the pivoted shoe brake, the location of the pivot can be selected in such way that the moment of frictional force about the pivot is
    a. Zero
    b. Minimum
    c. Maximum
    d. One

70. In block brakes with long shoe, equivalent coefficient of friction is given by
    a. $\mu[(4\sin\theta)/(2\theta + \sin\theta)]$
    b. $\mu[(2\sin\theta)/(2\theta + \sin\theta)]$
    c. $\mu[(4\sin\theta)/(\theta + \sin\theta)]$
    d. $\mu[(4\sin\theta)/(\theta + \sin\theta)]$

71. A pivoted double block brake has a drum radius of 280mm with two shoes subtending an angle of 100^0. Calculate the distance of pivot from axis of drum.
    a. 321.5mm
    b. 314.3mm
    c. 289.5mm
    d. None of the mentioned

72. A pivoted double block brake has a drum radius of 280mm with two shoes subtending an angle of 100^0. Maximum pressure intensity is 0.5N/mm². If the width of friction lining is 90mm, find the torque capacity of each shoe. Assume coefficient of friction as 0.2.
    a. 789N-m
    b. 1081N-m
    c. 945N-m
    d. None of the listed

73. A pivoted double block brake has a drum radius of 280mm with two shoes subtending an angle of 100^0. Maximum pressure intensity is 0.5N/mm². If the width of friction lining is 90mm, find the reaction at pivot in horizontal direction. Assume coefficient of friction as 0.2.
    a. None of the listed
    b. 21123N
    c. 17200N
    d. 16789N

74. Moment of normal force and frictional forces about the pivot axis are 640000N-mm and 250000N-mm respectively. If force acts at a distance of 190mm from the pivoted point, calculate the actuating force.
    a. 1078.6N
    b. 2052.6N
    c. 3223.5N
    d. 4454.5N

75. In a band brake the ratio of tight side band tension to the tension on the slack side is 3. If the angle of overlap of band on the drum is 180° the coefficient of friction required between drum and the band is
   a. 0.20
   b. 0.25
   c. 0.30
   d. 0.35

76. A band brake having bandwidth of 80 mm, drum diameter of 250 mm, coefficient of friction of 0.25 and angle of wrap of 270 degrees is required to exert a friction torque of 1000 Nm. The maximum tension (in KN) developed in the band is
   a. 1.88
   b. 3.56
   c. 6.12
   d. 11.56

77. What is the maximum percentage loss of economic cutting speed if geometric progression ratio = 1.06?
   a. 17.0 %
   b. 11.5 %
   c. 5.7 %
   d. 2.9 %

78. Ratio of two spindle speeds is constant in _____ progression.
   a. Arithmetic
   b. Geometric
   c. Harmonic
   d. None of the above

79. A machine tool has minimum speed of 100 r.p.m. How many speed steps are required by it to achieve speed of 200 rpm? (Geometric progression ratio = 1.06).
   a. 11
   b. 12
   c. 13
   d. 14

80. Maximum and minimum diameter of a shaft to be machined is 100 mm and 80 mm respectively. What is the maximum spindle speed if cutting velocity is 40 m/min?
   a. 120 r.p.m
   b. 127 r.p.m
   c. 160 r.p.m.
   d. 636 r.p.m.

81. What is the geometric progression ratio if maximum and minimum spindle speeds are 500 r.p.m and 300 r.p.m respectively? (Number of speed steps = 7).
   a. 0.91
   b. 1.5
   c. 1.08
   d. 2.0

82. Diameter range is high in geometric progression due to _____ spindle speed.
   a. Low
   b. High
   c. Constant
   d. none of the above

83. What is harmonic progression?
   a. Difference between reciprocal of two successive spindle speeds is constant
   b. Difference between two successive spindle speeds is constant
   c. Ratio of two successive spindle speeds is constant.
   d. Ratio of two successive spindle speeds is variable.

84. Which of the following statements is true for structure/speed diagrams?

   a. Structure diagrams gives range ratio of spindle speeds
   b. Speed diagrams do not give range ratio of spindle speeds
   c. Speed diagrams consider motor speed
   d. All of the above

85. What does Ψ mean in Lagrange's equation $(LE = U + \lambda\Psi)$?

   a. Lagrange's multipliers
   b. Functional constraints
   c. Multiple variable objective
   d. None of the above

86. The limit equation $st = Sut / Nf$ is expressed as _____
   a. loose limit equation
   b. rigid limit equation
   c. rigid on one side and loose on other side
   d. none of the above

87. Which of the following is not expressed by primary design equation?
   a. Functional parameters
   b. Material parameters
   c. Geometrical parameters
   d. None of the above

88. Which of the following parts of piston act as bearing for connecting rod side thrust?
   a. Reinforcing ribs
   b. Piston barrel
   c. Piston gudgeon
   d. Piston skirt

89. If diameter of cylinder of bore is 120mm, then thickness of the cylinder will be

   a. Information not sufficient
   b. 7mm
   c. 12mm
   d. 6mm

90. Which stress is induced in cylinder wall due to side thrust of the piston?
   a. Axial stress
   b. Circumferential stress
   c. Longitudinal stress
   d. Bending stress

91. If diameter of cylinder bore is 120mm, then thickness of water jacket wall will be
   a. 4.26mm
   b. 5.25mm
   c. 2.56mm
   d. All of the listed

92. Compression Ratio in diesel engine is lesser than that in Spark Ignition engine.
   a. True
   b. No
   c. They are equal
   d. Doesn't matter

93. The ignition quality of petrol is expressed by

   a. Cetane number
   b. Octane number
   c. Calorific value
   d. All of these

94. The ratio of indicated thermal efficiency to the corresponding air standard cycle efficiency is called

   a. Net efficiency
   b. efficiency ratio
   c. relative efficiency
   d. overall efficiency
   e. cycle efficiency

95. If the intake air temperature of I.C. engine increases, its efficiency will
   a. Increase
   b. Decrease
   c. Remain same
   d. Unpredictable
   e. Depend on other factors

96. The maximum temperature in the I.C. engine cylinder is of the order of
   a. 500- 1000°C
   b. 1000- 1500°C
   c. 1500-2000°C
   d. 2000-2500°C

97. The fuel in diesel engine is normally injected at pressure of
   a. 5-10 kg/cm^2
   b. 20-25 kg/cm^2
   c. 60-80 kg/cm^2
   d. 90-130 kg/cm^2

98. The temperature of interior surface of cylinder wall in normal operation is not allowed to exceed
    a. 80°C
    b. 120°C
    c. 180°C
    d. 240°C.

99. Calculate the Value of Geometrical progression when multi speed with Z=12 speed machine tool gearbox running at minimum speed Nmin=60 r.p.m and maximum speed Nmax= 2880 r. p. m and operating at a motor speed Nem=1440 rpm at 5kW.
    a. 1.4218
    b. 1.6223
    c. 1.5502
    d. 1.234

100. Calculate the Value of Geometrical progression when multi speed with Z=9 speed machine tool gearbox running at minimum speed Nmin=100 r.p.m and maximum speed Nmax= 1000 r. p. m and operating at a motor speed Nem=720rpm at 5kW.
    a. 1.4218
    b. 1.6223
    c. 1.5500
    d. 1.234