| Uka Tarsadia University (Diwaliba Polytechnic) |
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| Diploma in Computer Engineering |
| Assignment ( Design of Machine Elements -020020502) |

# Unit-1 Introduction

1. Define: standardization.
2. What is meant by stress concentration?
3. A 15 mm diameter punch has an allowable stress of 55 $N/mm^2$ is used to punch the hole. Determine the thickness of plate having ultimate shear stress of 250 $N/mm^2$.
4. Determined the four standard spindle speeds of the machine having minimum speed of 300 rpm and maximum speed of 800 rpm.
5. Enlist the types of steresses and expalin tensile stess with neat sketch.
6. Explain elasticity and plasticity with stress-strain diagram.
7. Draw stress strain diagram for mild steel and explain yielding.
8. What do you mean by stress concentration?
9. Define machine design and give its type with examples.
10. Discuss buckling with neat sketch.
11. Enlist the main factors affecting the design of machine elements and explain any one in brief.
12. Write a short note on Standardization.
13. Determined the tensile load carrying capacity of M24 bolt having allowable tensile stress of 60 $N/mm^2$. Take the ratio of core diameter bolt to nominal diameter is 0.84.
14. Define: Elasticity, Plasticity and Ductility of material.
15. List out the main influencing factors in design of machine elements.
16. Determine smallest size of the hole that can be punched in 9 mm thick plate. Allowable crushing stress for the punch is twice the ultimate shearing stress of the plate.
17. Enlist various mechanical properties of material and explain any one in brief.
18. Explain the factors affecting the Factor of Safety (FOS).
19. Discuss the types of failure of machine elements with the help of neat sketch.
20. Determined the four standard spindle speeds of the machine having minimum speed of 250 rpm and maximum speed of 750 rpm.
21. Write a short note on stress concentration.
22. What is meant by standardization?
23. Define shear stress and compressive stress.
24. A 30 mm diameter punch has an allowable stress of 150 $N/mm^2$ is used to punch the hole. Determine the thickness of plate having ultimate shear stress of 450 $N/mm^2$.
25. Draw stress-strain diagram of mild steel with nomenclature and explain yielding in detail.
26. What are the relationship between progression ratio, rang ratio & number of terms in geometric series?
27. Write a short note on preferred number.

28. A punch can withstand a safe compressive stress of 300 N/mm2, it is used for punching hole of 15 mm diameter in plate material which has ultimate shear stress of 120 N/mm2. Calculate maximum thickness of plate material through which a hole can be punched.
29. Define torsional shear stress with an equation.
30. List out the various Ferrous and Nonferrous materials used in manufacturing of machine element.
31. What do you mean by yielding and indicate it in stress-strain diagram of material.
32. State the difference between low carbon steel and high carbon steel.
33. Give the classifications of construction material used in the design of machine elements.
34. Describe the design procedure of machine element with suitable example.
35. Explain elastic limit, bearing stress and buckling load in brief.
36. What is the meaning of C45Mn60 and 40Ni2Cr1Mo28?
37. Explain preferred number with suitable example.
38. Draw a flow chart of machine design procedure.
39. What is the meaning of following I.S designation C35Mn75, St55 & 20Cr18Ni2?
40. State the applications of standardization.
41. "The cast iron material is most suitable for lathe bed but not suitable for power transmission shaft." - Explain the statement.
42. How the derived series are obtained?

## Unit-2 Design of Machine Elements Subjected to Direct Stresses and subjected to Bending

1. Write the equation of shear failure of knuckle pin & draw neat sketch of it.
2. Draw the neat sketch of zig zag riveted joint.
3. State the application of power screw.
4. Explain design procedure of cotter joint.
5. Draw any five types of thread with neat sketch.
6. List out the different failures of knuckle joint & explain any one in detail.
7. A cotter joint is subjected to a maximum load of 60 kN, the joint parts are made of 20C8 for which the safe stresses are 50 MPa in tension, 50 MPa in shear and 150MPa in crushing. Determine the spigot diameter of the joint.
8. Define: Modulus of elasticity and Modulus of rigidity.
9. Draw a neat sketch of cotter joint with its various parts.
10. State the applications of riveted joints.
11. Explain design procedure of cotter with a neat sketch.
12. A cotter joint is subjected to a maximum load of 50 kN, the joint parts are made of 20C8 for which the safe stresses are 60 MPa in tension, 40 MPa in shear and 100 MPa in crushing. Determine the spigot diameter of the joint.
13. Explain the elements of screw thread with neat sketch.

14. Discuss step by step procedure of knuckle pin design with neat sketch.
15. Give a broad classification of riveted joint.
16. List out the different forms of screw threads with figures.
17. Draw a neat sketch of knuckle joint.
18. A double riveted lap joint with chain riveting is used to join two plates of 10mm thickness. If ultimate stresses are 60 MPa in tension, 50 MPa in shear and 80 MPa in crushing. Determine rivet diameter and pitch.
19. Derive a fundamental equation of pure bending.
20. Draw a neat sketch of double riveted lap joint & Triple riveted butt joint with two cover plate and zigzag riveting.
21. State the basic difference between over hauling and self-locking in case of power screw.
22. What are the advantages of power screw?
23. State a difference between 'V' Threads and Square Threads.
24. Enlist the applications of leaf spring.
25. Write a short note on leaf spring.
26. Compare cotter joint with knuckle joint.
27. The bell crank lever of Hartnell governor has vertical arm of 120 mm length and horizontal arm 100 mm. The maximum centrifugal force acting on the vertical arm is 1500 N. Find the reaction on fulcrum pin.
28. Explain any three failure of cotter joint with neat sketch.
29. Draw a neat sketch of semi elliptical leaf spring.
30. State the overhauling and self-locking condition of power screw.
31. Define: Pitch and Transverse pitch.
32. A screw jack has a capacity of 100 kN. The screw has triple start threads having root diameter of 60 mm and pitch of 10 mm. Determine the Compressive stress in screw and Shear stress in thread. Take number of thread in nut is 14 and coefficient of friction for threads is 0.15.
33. State the difference between 'V' thread and Square thread.
34. Give the classifications of various types of levers and explain any one in detail.
35. Which types of primary loads are acting on a bolt? explain any on in brief.
36. Give the classification of Levers.
37. Draw a neat sketch of double riveted butt joint with two equal cover strap.
38. Draw neat sketch of $1^{st}$, $2^{nd}$ & $3^{rd}$ order levers.
39. With the help of neat sketch explain the working of knuckle joint.
40. Two 16 mm thick plates are to be joined by double riveted zigzag type lap joint using 25 mm diameter rivets. If the joint is subjected to 48 kN tensile load. Determine the crushing stress between plate & rivet.
41. Explain overhauling and self-locking condition with respect to power screw.
42. Explain design of bell crank lever.

# Unit-3 Design of Machine Elements Subjected to Direct Twisting Moments

1. Enlist types of sunk key.
2. What is the function of coupling?
3. Draw neat sketch of Split muff coupling.
4. A shaft has a diameter of 55mm and muff coupling transmit torque of 3300 kN.mm. Determine the diameter of muff. Permissible shear stress for both is $100N/mm^2$.
5. Explain design procedure of flange coupling.
6. Define shaft. And explain flexible shaft in brief.
7. Enlist types of failures occurs in a key and explain any one of them in detail.
8. Give the classification of shaft.
9. Define: Pitch and Spring index.
10. State the name of different types of key.
11. A muff coupling is used to connect two shafts rotating at 300 rpm and transmitting 55 hp. Determine (1) shaft diameter (2) outside diameter of sleeve. Assume permissible shear stress for the shaft and key is 42 $N/mm^2$ and 15 $N/mm^2$ respectively.
12. Derive the equation of twisting moment for a solid circular shaft.
13. Write a short note on design of sunk key.
14. Explain helical spring with neat sketch.
15. What are the basic difference between spindle and countershaft?
16. Give the brief classification of coupling.
17. State the equations for crushing failure of key.
18. Explain protected type flange coupling with neat sketch.
19. A hollow shaft 230 mm inside diameter and 310 mm outside diameter 3000 HP at 210 rpm. Calculate the stress induced in shaft.
20. Give the classifications of shaft in form of chart and explain any one in brief.
21. Explain the crushing failure and shearing failure of rectangular key.
22. State the differences between coupling and clutch.
23. What do you mean by rigid and flexible coupling?
24. Write down the various functions of helical spring.
25. Give the types of flange coupling and explain any one in brief.
26. Define: Solid length, Compressed length, and Spring index.
27. Which types of failure are occur in key? explain any one in detail.
28. A shaft has a diameter of 72 mm and muff coupling transmit torque of
29. 3581 kN-mm. Determine the diameter of muff if permissible shear stress for both is not exceed more than 50 $N/mm^2$.
30. State the differences between muff coupling and flange coupling.
31. Define compressed length and free length of helical spring.
32. Determine the torque of the shaft if power is transmitted at 80 hp at 150 rpm.
33. With the help of neat sketch explain different types of key used in engineering field.
34. A helical spring is attached to a plunger of an engine indicator. Plunger diameter is 20 mm and the steam pressure acting on the plunger is 5 $N/mm^2$. The spring is compressed by 12 mm. if the permissible shear stress for the

spring wire is 550 N/mm$^2$ and the spring index is 3, determine the spring wire diameter, mean diameter of the coil for the spring.

35. Explain the
36. Define shaft and state the difference between shaft, spindle and axle.
37. Draw a neat sketch of sleeve muff coupling.
38. Explain the importance of Wahl's factor in the design of spring.
39. What is meant by torsional rigidity?
40. Design a shaft based on torsional rigidity.
41. Explain the different terms used for the helical compression spring with neat sketch.
42. A protected type flange coupling has to transmit 40 KW at 450 rpm. Shaft, key and bolt are made from steel. Considering effect of overload and key way effect. Determine (1) Shaft diameter and (2) Hub diameter.
43. Explain different types of sunk keys.

## Unit-4 Design Machine Element Subjected to Direct and Bending Stresses

1. Name some applications of the bolted joints under eccentric loading and also list the various cases for eccentric loading of bolts.
2. Draw a neat sketch of pillar crane fastened to the foundation of concrete base by means of bolts
3. Define eccentricity. Explain the concept of eccentric loading with respect to bolted joints.
4. Draw a neat sketch and write the equation for the eccentric load on bolt parallel to the bolt axis and perpendicular to the plane of bolt connection for both rectangular and circular base.
5. Name the machine elements subjected to eccentric loading and draw neat sketch of bracket, clamp, link and welded connections.
6. Write an expression for design of bolts subjected to variable loading and specify each terms.
7. Draw a neat sketch and write the equation for the eccentric load on bolt perpendicular to the bolt axis and parallel to the plane of bolt connection for both rectangular and circular base
8. Which types of stresses are induced in the bolted joint?
9. Draw a neat sketch of C clamp.
10. Define the eccentricity with sketch.
11. The frame of a 'C' Clamp has rectangular section of 50 mm × 15 mm. A maximum clamping load of 27 KN is acting at a distance of 66 mm from the inner edge of the frame. Find the maximum stresses induced in the frame section.
12. A 'C' shape screw press frame has 'I' cross section having flange and web thickness ='t' mm, depth of the section is 6t mm and width of the flange is 3t mm. The load of 120 KN is acting at the end with 270 mm eccentricity. Find out the dimensions of the 'I' section for the permissible stress of 110 N/mm$^2$.

13. Draw the sketches for two situations given below when the bolt joint is subjected to eccentric loading : (a) When load is parallel to bolt axis, (b) when load is perpendicular to load axis.
14. Explain design procedure of bolt which is subjected to static loading.
15. Define: Eccentric loading.
16. List out the various types of loads acting on bolts.
17. Draw a neat sketch of hollow bracket with circular base.
18. Explain the stresses due to eccentric load.
19. A 20 kN vertical loads are acting at the end of the "C" clamp having a rectangular cross section. The perpendicular distance between the load axis and the neutral axis of the cross section is 150 mm. Find the dimensions of the cross section of the clamp for the permissible stresses of 100 $N/mm^2$ (take h=2b)
20. Explain the various types of loads acting on a bolt with proper illustration
21. maximum vertical load of 25 KN is acting at the end of C clamp frame with an eccentricity of 90 mm. The frame of C clamp has rectangular section of 60 mm × 20 mm. Find minimum and maximum stress induced in frame section.
22. Explain the eccentricity in brief.
23. Draw a neat sketch of bracket which is subjected to eccentric load.
24. List out the types of stresses induced in the bolted joint due to initial tightening.
25. A 'C' shape screw press frame has 'I' cross section having flange and web thickness is 't' mm, depth of the section is 6t mm and width of the flange is 3t mm. The load of 100 KN is acting at the end with 250 mm eccentricity. Find out the dimensions of the 'I' section for the permissible stress of 100 $N/mm^2$.
26. Draw the sketches for two situations when a bolt joint is subjected to eccentric loading:
    i. When load is parallel to bolt axis, and
    ii. when load is perpendicular to load axis.
27. The frame of a 'C' Clamp has rectangular section of 60 mm × 20 mm. A maximum clamping load of 20 KN is acting at a distance of 60 mm from the inner edge of the frame. Find the maximum and minimum stresses induced in the frame section.
28. Derive the equation when the eccentric load on bolt is parallel to the bolt axis and perpendicular to the plane of bolt connection for the rectangular base.
29. Draw a neat sketch of bolted foundation of bracket with rectangular base.
30. Enlist the various stresses induced in screw fasteners due to static loads.
31. Define initial tightening for the design of bolts under static load.
32. Explain the various types of eccentric load acting on a bolted joint with appropriate figures.
33. The base of pillar crane is fixed by four foundation bolt. The bolts are evenly placed on 800 mm bolt circle diameter where two bolts are placed on x-x axis and two bolts are placed on y-y axis. The diameter of the base is 1000 mm. 100 kN load is acting vertically down on x-x axis at a distance of 2500 mm from the axis of the pillar. Assuming

34. 300 $N/mm^2$ elastic stress for the bolt material and factor of safety of
35. 5, suggest the suitable size of the bolts.
36. Explain the design of bolt subjected to static loading.
37. For the following details of the bolted joints used for cylinder and cylinder cover, design the suitable size of the bolts.
38. Cylinder diameter = 150 mm, Maximum pressure in the cylinder = 3.5 $N/mm^2$ ,Number of bolts used = 6, Allowable stress for the bolt = 50 $N/mm^2$ ,Overall stiffness coefficient K= 6, Initial tightening of each bolt = 20000 N.
39. Give the importance of preloading during the design of bolts under static load.
40. Draw a neat sketch of bolted foundation of pillar crane.
41. Which types of machine elements are subjected to eccentric loading?
42. State the equation when the eccentric load is perpendicular to the bolt axis and parallel to the plane containing the bolts or rivets.
43. In a bolted joint of a cylinder head, maximum external load on each bolt is 10000 N. The stiffness of the compression member is 3 times the stiffness of the bolt. Find the initial tightening load on the bolt so that the joint does not separate.
44. Explain the prestressing/preloading of the bolt with it's advantages.
45. Design the foundation bolt for a pillar crane having eccentric load capacity of 50 KN from the following details:
    a) Eccentricity, e = 5000 mm,
    b) Diameter of the base of pillar crane = 1800 mm, Pitch circle diameter for the bolts = 1600 mm,
    c) Numbers of bolts = 8.
46. Draw a neat sketch of C-clamp subjected to the eccentric loading.
47. Why initial tightening is required for the design of bolt?
48. Define pure tensile load and pure shear load.
49. Explain the need for the fluid tight joint for the bolted connections.
50. Derive an equation for bolts used to fix a hollow cylinder bracket on a wall having circular base with horizontal axis.
51. The load acting on C-clamp is 24 KN. The eccentric gap is 120 mm. The frame is made of steel casting with rectangular cross section having width (b) of 35 mm and height (h) of 90 mm. Calculate the direct and bending stress induced in the section.
52. A spindle of drilling machine is subjected to a maximum load of 10 KN during operation. Determine the diameter of solid cast iron column if the tensile stress is limited to 40 MPa. The distance between the axis of the spindle and the axis of the column is 400 mm.

# Unit-5 Pressure Vessels

1. Name and draw the types of pressure vessel according to geometric shape.
2. Enlist the assumptions made in the design of cylinder having D/t ratio less than 10.
3. Write the equation for circumferential (hoop) stress and longitudinal stress for thin cylinders.
4. Give classification of various pressure vessels based on different considerations.
5. Enlist the points to be considered for the design of pressure vessels.
6. A hydraulic type testing machine has a capacity of 2000 KN. The piston diameter is 300 mm and maximum permissible stress for the cylinder is 200 MPa. Determine thickness of cylinder.
7. Derive an expression for the thickness (t) of wall for thin spherical shell.
8. State the suitable materials for the pressure vessels.
9. Draw a neat sketch of stress distribution for thick cylinder with internal pressure.
10. Enlist the assumptions require during the design of thick cylinder.
11. A cylinder of hydraulic press has internal diameter of 68 cm and thickness of 12 cm. Calculate the internal pressure in the cylinder so that the circumferential stress do not exceed 72 $N/mm^2$.
12. A C.I. pipe of 110 mm internal diameter and 6 mm thick is subjected to water pressure of 1.7 $N/mm^2$. Determine hoop stress and longitudinal stress.
13. Enlist the main considerations for the design of pressure vessel.
14. Derive the equation to find out the thickness of thin cylinder.
15. Define pressure vessel and draw a neat sketch of cylindrical pressure vessel.
16. State the diameter to thickness (D/t) ratio for thick cylinder and thin cylinder.
17. Draw a neat sketch of open ended pressure vessel and closed ended pressure vessel.
18. Derive an equation for longitudinal stress of thin cylinder.
19. Give the classification of pressure vessels in detail.
20. A thin cylinder pressure vessel of 150 mm internal diameter and 15 mm thickness is subjected to an internal pressure of 5 $N/mm^2$. Find the magnitude of hoop stress and longitudinal stress of vessel.
21. A pipe used for hydraulic crane has inner diameter of 25 mm is subjected to internal oil pressure of 4 MPa, determine the thickness of the pipe.
22. Define hoop stress with equation.

23. State the suitable materials for the pressure vessels.
24. State the use of Lame's theory
25. Enlist the considerations in design of pressure vessel.
26. A steel cylinder of closed ends has outside diameter of 200 mm and thickness of plate is 15 mm. the cylinder is subjected to internal processes of 6 $N/mm^2$. Determine hoop stress and longitudinal stress.
27. A hydraulic accumulator has internal diameter of 40 cm and working pressure of water is 7 Mpa. If the permissible stress for the cylinder material is 28 Mpa, calculate the thickness of the cylinder.
28. Explain in detail: Stresses in thick cylinder.
29. List out the applications of pressure vessels.
30. Give the difference between thick and thin cylinder.
31. Enlist the various types of fired and unfired pressure vessel.
32. Explain the design of thin spherical shell.
33. A thin cylindrical shell of 4000 liter capacity is to be designed. The internal pressure is 1.2 $N/mm^2$ and allowable hoop stress is not to exceed 70 $N/mm^2$ for this shell material. Assuming joint efficiency for the shell as 75%. Find the thickness of the spherical shell.
34. Explain the design of thin cylinder with neat sketch.
35. A hydraulic cylinder is subjected to internal pressure of 15 N/mm2. Internal diameter of the cylinder is 220 mm. Determine the thickness of the cylinder if the permissible stress for cylinder is 30 N/mm2.
36. Draw a neat sketch of stress distribution for thick cylinder with internal pressure.
37. Which types of assumptions are made during the design of thick cylinder?
38. State the equation of stresses in thin cylinder.
39. Discuss Lame's theory for designing of thick cylinder.
40. A cylinder of hydraulic press has internal diameter of 40 cm and thickness of 10 cm. Calculate the internal pressure in the cylinder so that the circumferential stress do not exceed 60 $N/mm^2$.
41. A C.I. pipe of 200 mm internal diameter and 3 mm thick is subjected to water pressure of 1.2 $N/mm^2$. Determine hoop stress and longitudinal stress.
42. Derive the equation of thickness for thin cylinder.
43. Write down the assumptions made in the design of thin cylinder.
44. Give the name of open ended and closed ended pressure vessels.
45. Draw neat sketches of both failures in thin cylinder subjected to internal pressure.
46. A ram of a hydraulic cylinder having 200 mm internal diameter is subjected to oil pressure of 10 Mpa. If the permissible stress for the cylinder material is 28 Mpa. Find outside diameter of the cylinder.
47. A cast steel hydraulic cylinder having internal diameter of 200 mm is subjected to oil pressure of 31.5 $N/mm^2$. Determine the thickness of the shell for maximum permissible hoop stress of 70 $N/mm^2$.
48. Write a short note on Lame's theory for pressure vessel.
49. A hydraulic type testing machine has a capacity of 1000 KN. The piston diameter is 250 mm and maximum permissible stress for the cylinder is 100 MPa. Determine thickness of cylinder.

# Unit-6 Selection Procedure for Bearings

1. How is the rolling contact bearing advantageous compared to sliding contact bearing?
2. Write the names of different types of sliding contact bearing and rolling contact bearings.
3. Name some commonly used non-metals used as bearing materials.
4. Give the list of important properties of bearing materials and explain any two.
5. Discuss the reasons for the failing of bearing.
6. Name some common terms used in the design of plain bearings and explain any two.
7. Write short note on bearing characteristic number and sommerfield number.
8. Give the applications of bearing.
9. Give the difference between rating life and average life in bearing.
10. Which factors are affecting during the design of sliding contact bearings?
11. List out the various features for sliding contact bearing.
12. Differentiate between sliding contact and rolling contact bearing.
13. Explain the antifriction bearing with neat sketch.
14. The deep grove bearing runs at 550 rpm and subjected to radial load of 3.5 KN.
15. Determine the required dynamic capacity of bearing for the expected life of 10000 hours.
16. State the functions of bearing in Industries.
17. What is the bearing length to journal diameter (L/d) ratio for long and short bearing?
18. Draw a neat sketch of sliding contact bearing.
19. Give the classification of bearing.
20. Explain the working of sliding contact bearing with neat sketch.
21. From the following details available for the journal bearings of centrifugal pump, determine bearing load, bearing characteristics number and coefficient of friction.
    a. Length of journal = 100 mm,
    b. Bearing pressure = 1.4 $N/mm^2$, Journal speed = 900 rpm,
    c. Room temperature = $35^0$ C, Operating temperature of oil = $75^0$ C, Journal diameter = 50 mm,
    d. Absolute viscosity of oil = 11 C.P. (0.011 kg/ms), Correction factor for side leakage K= 0.002, Heat dissipation constant, K = 0.4 $^0C$ $m^2/W$.

22. A ball bearing required to operate for 5 years at 8 hours per day at 100 rpm. If the equivalent load on the bearing is 6 KN. Find the basic dynamic capacity of bearing. Take 300 working days in a year.
23. Define the clearance in the design of plain bearing.
24. List out the factors in design of sliding contact bearings.
25. Give a relationship between coefficient of friction and bearing characteristic number with an equation.
26. Explain the different bearing characteristics for sliding contact bearing.
27. Enlist the applications and limitations of rolling contact bearings.
28. The basic load rating for the selected bearing is 50 KN. If the expected bearing life is 6000 hours, calculate the permissible equivalent load for the bearing at 500 rpm.
29. Define the following terms related to the sliding contact bearing: (a) Average bearing pressure, (b) Viscosity and (c) Coefficient of friction.
30. Explain the bearing characteristic number in brief.
31. What do you mean by antifriction bearing? And list out the elements of antifriction bearing.
32. Draw neat sketch of cage or separator and give the fuction of it.
33. Explain the following terms related to the design of sliding contact bearing: (a) Heat generated (b) Heat dissipation.
34. A plain bearing has been designed for which shell diameter is 75 mm
35. and length is 125 mm. The bearing is subjected to external load of 20 KN and journal rotates at 1000 rpm. Bearing temperature is $70^0$ C and room temperature is $30^0$C. The lubricating oil used has a viscosity of 0.01 kg/ms at $110^0$C. Determine the average bearing pressure, coefficient of friction and heat generated. Take d/c = 1000.
36. Give the difference between sliding contact bearing and rolling contact bearing.
37. A deep grove ball bearing having SKF 6309 number is rotating at 1500 rpm. The bearing is subjected to radial load of 8500 N and thrust load 5500 N. The inner race of the bearing rotates with the shaft. Determine the rating life and average life of the bearing. The dynamic capacity of the bearing is 41500 N and the bearing is in continuous service. Take X = 56.0 and Y = 3.1.
38. What are meant by 30 BC 03 and 25 BA 02 for rolling contact bearing?
39. Write down the advantages of antifriction bearing.
40. List out the commonly used bearing materials.
41. Write down the steps for the design procedure of journal bearing.
42. Explain the construction of antifriction bearing with neat sketch.
43. A deep grove ball bearing is subjected to radial load of 10000 N and thrust load of 4000 N. The inner ring of bearing rotates at 1000 rpm. For the average life of 5000 hours, determine the basic dynamic

44. capacity of the bearing. Take X = 0.56, Y = 1.2 and K = 3.
45. Explain the static load and equivalent dynamic load for the antifriction bearings.
46. Draw a neat sketch of rolling contact bearing.
47. Define: Rating life ($L_{10}$) and Average life ($L_{50}$).
48. State the equation for showing the relation against basic dynamic capacity, equivalent load and rating life of a rolling contact bearing.
49. Explain the bearing failures in detail.
50. Enlist different properties of bearing materials and explain any three in detail.
51. The deep grove bearing runs at 500 rpm and subjected to radial load of 3 KN. Determine the required dynamic capacity of bearing for the expected life of 10000 hours.
52. State the different types of rolling contact bearing and draw neat sketch of any three.