Course Name: Machine Component Design -I

Course Outcomes (CO):

At the end of this course, the students will be able to:

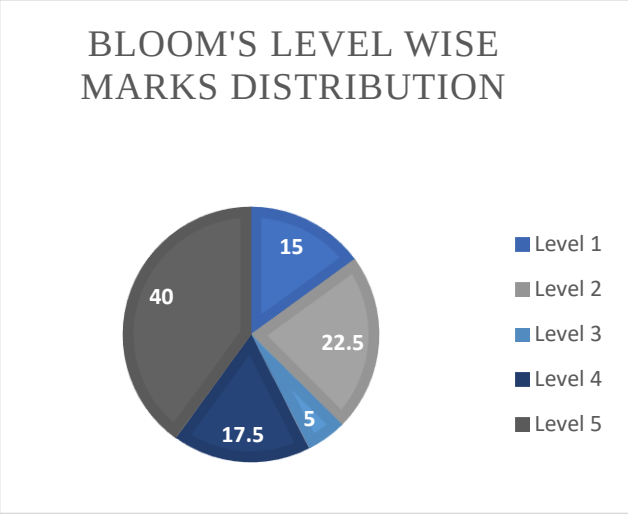
1. Illustrate the fundamental of stress analysis, theories of failure and material science in the design of machine components.
2. Analyze the principle of solid mechanics to design machine member under variable loading.
3. Analyze the shaft design based on strength, rigidity and design various types of coupling based on application.
4. Compare and analyze the design parameters of Springs & Joints on various loading applications.
5. Illustrate the different types of product design and development.

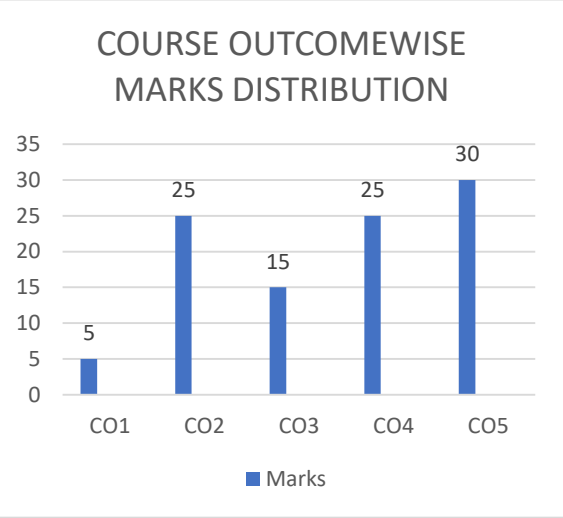
Model Question Paper
Total Duration (H:M): 3:00
Course: Machine Component Design -I
Maximum Marks :100

Note: (1) *Use of design data book is permitted*
(2) *For Unit- I, Unit II, Unit III, Unit-1V, Unit-V, Attempt all questions.*

Q.No	Questions	Marks	CO	BL
1a)	Define S- N Diagram and Endurance limit.	2.5	CO1	L1
1b)	The load of a bolt consists of an axial pull of 10 KN together with a transverse shear force of 5 KN. Find the diameter of the bolt required using maximum shear stress theory.	2.5	CO2	L4
1c)	Discuss the various design considerations affecting the design of machine element.	2.5	CO2	L2
1d)	Explain any three theories of failure.	2.5	CO1	L1
2a)	A rod of linkage mechanism made of steel 40Cr1 (Ultimate Tensile Strength= 550N/mm^2) is subjected to a completely reversed axial load of 100 KN. The rod is machined on lathe and the expected reliability is 95%. There are no stress concentrations. Determine the diameter of rod using a factor of safety of two for an infinite life condition.	5	CO2	L5
2b)	Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to tensile load that has a maximum value of 250 KN and minimum value 100 KN. The properties	5	CO2	L5

	of the plate are as follows: Endurance limit stress =225 Mpa, Yield point stress= 300 Mpa, Factor of safety =1.5			
3a)	List the types of stresses induced in shaft.	5	CO3	L1
3b)	Discuss the design procedure of shaft subjected to twisting moment only.?	5	CO3	L2
3c)	A hollow shaft of 40 mm outer diameter and 25 mm inner diameter is subjected to twisting moment of 120 KN and bending moment of 80 N-m. Calculate maximum compressive and shear stress.	5	CO3	L3
3d)	A solid shaft is transmitting 1 MW at 240 rpm. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20 %. Take the maximum allowable shear stress is 60 Mpa.	5	CO2	L4
4a)	Define the terminology used in helical compression springs.	5	CO4	L1
4b)	Design a helical compression spring to sustain an axial load of 3 KN. The deflection is 60 mm. The spring indexed is 6. The shear stress is not to exceed 300 MPa. Rigidity of Modulus for spring material is 81 GPa.	10	CO5	L5
4c)	Explain the significance of Wahl's factor.	5	CO2	L2
5a)	A single dry plate clutch is to be designed to transmit 7.5 KW at 900 rpm. Find the diameter of the shaft, mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width is 4; Outer and inner radii of the clutch plate and dimensions of the spring, assuming that that number of springs are 6 and spring indexed is 6. The allowable shear stress for the spring wire may be taken as 420 MPa.	10	CO4	L4
5c)	Design a cone clutch with leather facing and cast-iron mating surface to transmit 20 KW at 750 rpm. The mean diameter is limited to 260 mm and the slope of the face is to be 15^0. The clutch is to work under oily condition.	10	CO5	L5
6a)	A journal bearing of steam turbine is required to support a radial load of 120 Kgf. The shaft diameter of the bearing is 60 mm. The speed of rotation is 1800 rpm. Design the bearing. Design should clearly indicate the requirement of artificial cooling.	10	CO5	L5
6b)	Explain the bearing and its use. Draw the figure of radial and thrust bearing. Explain hydrodynamic bearing. Write the note in detail on McKee's investigation with suitable sketch.	10	CO4	L2





BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 –Evaluating, 6 - Creating)

CO – Course Outcomes PO – Program Outcomes; PI Code – Performance Indicator Code