C

B.Tech. Degree VI Semester Regular/Supplementary Examination in Marine Engineering June 2024

19-208-0606 MACHINE DESIGN
(2019 Scheme)

Time: 3 Hours   Maximum Marks: 60

(Assume any missing data suitably)
(Use of standard machine design data book is permitted)

Course Outcome
On successful completion of the course, the students will be able to:

CO1: Understand the basic procedure in machine design, the standards used and the design for different load conditions.

CO2: Gain knowledge regarding fits and tolerances and design of fasteners, welded and riveted joints.

CO3: Do the design of transmission elements like shaft, belt and chain.

CO4: Design clutches bearings and brakes.
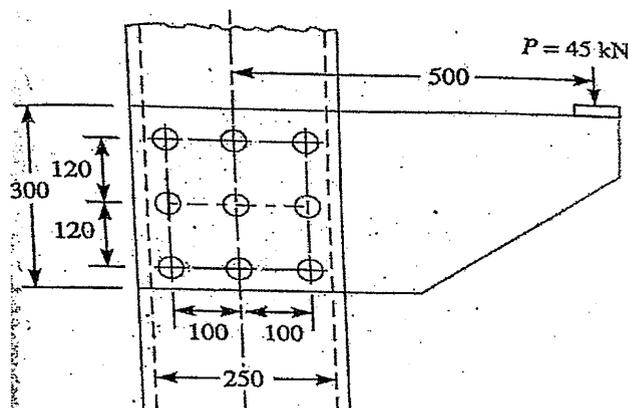
CO5: Design spur gear, bevel gear and helical gear.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 –Analyze, L5 – Evaluate, L6 – Create

PI – Programme Indicators

(Answer *ALL* questions)   (5 × 15 = 75)

			Marks	BL	CO	PI
I.	(a)	Explain theories of failure.	10	L1	1	1.4.1
	(b)	Write a note on general procedure in machine design.	5	L1	1	1.4.1
		OR				
II.	(a)	Explain the manufacturing design considerations in casting.	10	L1	1	1.4.1
	(b)	With help of simple sketches, explain the methods to reduce stress concentration.	5	L1	1	1.4.1
III.		A simply supported beam has a concentrated load at the center, which fluctuates from a value of P to 4 P. The span of the beam is 500 mm, and its cross-section is circular with a diameter of 60 mm. Taking for the beam material an ultimate stress of 700 MPa, yield stress of 500 MPa, an endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9.	15	L3	2	1.4.1
		OR				
IV.		The bracket, as shown in figure below, is to carry a load of 45 kN. Determine the size of the rivet if the shear stress is not to exceed 40 MPa. Assume all rivets are of the same size. (All dimensions in mm).	15	L3	2	1.4.1

			Marks	BL	CO	PI

V. (a) Prove that for a belt drive, when the power transmitted is maximum, $1/3^{rd}$ of the maximum tension is absorbed as centrifugal tension.   **5   L2   3   3.1.1**

(b) A mild steel shaft transmits 20 kW at 200 rpm. It carries a central load of 900 N and is simply supported between the bearings 2.5 m apart. Determine the size of the shaft if the allowable shear stress is 42 MPa and the tensile or compressive stress is not to exceed 56 MPa. What size of the shaft will be required, if it is subjected to gradually applied loads?   **10   L3   3   3.1.1**

OR

VI. A 800 rpm, 25 kW squirrel cage induction motor is to drive a reciprocating pump at 200 rpm. The pump is to run at full load for 24 hours a day. Select a suitable roller chain drive, if the center distance is 930 mm.   **15   L3   3   3.2.1**

VII. A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 kW at 1250 rpm. The outer diameter of the contact surfaces is to be 300 mm. The coefficient of friction is 0.4.   **15   L3   4   1.4.1**

     (i) Assuming a uniform pressure of 0.17 N/mm^2, determine the inner diameter of the friction surfaces.

     (ii) Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of pressure when uniform wear conditions have been reached.

OR

VIII. (a) Select a single row deep groove ball bearing with the operating cycle listed below, which will have a life of 15000 rpm. Assume radial and axial load factors to be 1.0 and 1.5 respectively and the inner race to be rotating.   **10   L3   4   1.4.1**

Fraction of cycle	Type of load	Radial load (N)	Thrust load (N)	Speed (rpm)	Service factor
1/10	Heavy shocks	2000	1200	400	3
1/10	Light shocks	1500	1000	500	1.5
1/5	Moderate shocks	1000	1500	600	2
3/5	No shocks	1200	2000	800	1

(b) Explain bearing characteristics number and bearing modulus for journal bearings.   **5   L3   4   1.4.1**

IX. (a) Prove that the common normal at the point of contact between a pair of teeth must always pass through the pitch point.   **6   L2   5   1.4.1**

(b) Briefly explain any two causes of gear tooth failure.   **4   L2   5   1.4.1**

(c) Briefly explain any two methods to avoid interference.   **5   L2   5   1.4.1**

OR

X. Design a 20° involve worm and gear to transmit 10 kW with worm rotating at 1400 rpm and to obtain a speed reduction of 12:1. The distance between the shafts is 225 mm.   **15   L3   5   4.1.3**

Blooms's Taxonomy Level
L1 – 20%, L2 – 13.33%, L3 – 66.67%.

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