BT MRE-VI(R/S)-06-23-2347 Reg. No. | | | | | | | | |

A

B.Tech. Degree VI Semester Regular/Supplementary Examination in Marine Engineering June 2023

19-208-0606 MACHINE DESIGN

(2019 Scheme)

Time: 3 Hours Maximum Marks: 60

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 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

(Assume any missing data suitably)
(Use of standard Machine Design Data Book is permitted)

(5 × 15 = 75)

			Marks	BL	CO	PI
I.	(a)	Explain the effect of impurities on steel (any four).	7	L2	1	1.3.1
	(b)	State any four mechanical properties and one example of the material possessing the properties.	8	L2	1	2.1.2
		OR				
II.	(a)	What is meant by endurance strength of a material? How do the size and surface condition of a component and type of load affect such strength?	7	L2	1	1.2.1
	(b)	Explain methods to reduce stress concentration.	8	L2	1	2.1.2
III.		Design a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 50 MPa ; shear stress = 35 MPa and crushing stress = 90 MPa.	15	L3	2	2.2.3
		OR				
IV.		Design a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 rpm. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.	15	L3	2	2.2.3

(P.T.O.)

			Marks	BL	CO	PI
V.	(a)	Differentiate between shaft and axle.	5	L1	3	2.1.2
	(b)	Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 rpm. The angle of lap of the belt is 180° and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa.	10	L3	3	2.4.2
		OR				
VI.	(a)	Explain different types of belt drives	5	L1	3	2.1.2
	(b)	Two pulleys, one 450 mm diameter and the other 200 mm diameter, on parallel shafts 1.95 m apart are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25?	10	L3	3	2.4.2
VII.		Design a journal bearing for a centrifugal pump from the following data : Load on the journal = 20 kN; Speed of the journal = 900 rpm.; Type of oil used is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg / m-s; Ambient temperature of oil = 15.5°C; Maximum bearing pressure for the pump = 1.5 N / mm^2. Also calculate mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 $W/m^2/°C$.	15	L4	4	2.4.2
		OR				
VIII..		Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load.	15	L4	4	2.4.2
IX.		A pair of helical gears are to transmit 15 kW. The teeth are 20° stub in diametric plane and have a helix angle of 45°. The pinion runs at 10000 rpm and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; (given σ_{es} = 618 MPa). Determine: (i) suitable module (ii) face width from static strength considerations (iii) check the gears for wear	15	L4	5	2.2.3
		OR				
X.		A pair of straight teeth spur gears is to transmit 20 kW when the pinion rotates at 300 rpm. The velocity ratio is 1:3. The allowable static stresses for the pinion and gear materials are 120 MPa and 100 MPa respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine: (i) Module (ii) Face width (iii) Pitch circle diameters of both the pinion and the gear from the standpoint of strength only.	15	L4	5	2.2.3

Bloom's Taxonomy Levels

L1 – 6.6%, L2 – 20%, L3 – 33.3%, l4 – 40%.

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