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Code No. : 16538 AS

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (Mech. Engg.) VI-Semester Advanced Supplementary Examinations, August-2022

Machine Design

Time: 3 hours

Max. Marks: 60

Note: Answer all questions from Part-A and any FIVE from Part-B

Part-A (10× 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Write the empirical relation for neutral axis and centroidal axis for curved beam with circular cross section and show the sketch.	2	1	1	1
2.	State the design considerations of machine frames.	2	1	1	2
3.	How the surge in the helical springs can be eliminated?	2	2	2	1
4.	Define the following terms: Spring index, Free length.	2	1	2	1
5.	What is herringbone gear? Where they are used.	2	3	3	2
6.	Sketch the worm gear and show the forces acting on the gear.	2	2	3	1
7.	What is rated life of the rolling contact bearing?	2	1	4	1
8.	Give the applications and limitations of rolling contact bearings.	2	2	4	1
9.	Name various types of stresses induced in a connecting rod.	2	3	5	2
10.	Mention the functions of piston rings.	2	2	5	2
Part-B (5×8 = 40 Marks)					
11.	Design a crane hook with the load lifting capacity of the crane as 100kN. The weight of the hook and grabbing tongues is 20kN.	8	3	1	2
12. a)	Briefly discuss the importance of A.M. Wahl's factor in the design of helical springs.	3	2	2	1
b)	A semi Elliptic laminated spring is made of 5 mm thick steel plate 50 mm wide. The length between the supports is 665 mm and the band is 65 mm wide. The spring has two full length and five graduated leaves. A central load of 1600 N is applied. Determine (a) The maximum stress in each set of leaves for an initial condition of no stress in the leaves. (b) The maximum stress if initial stress is provided to cause equal stresses when loaded. (c) The deflection in part (a) and part (b).	5	3	2	2
13. a)	A bronze spur pinion rotating at 600 rpm drives a cast iron spur gear at a transmission ratio 4:1. The allowable static stresses for the bronze pinion and C.I gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength.	6	3	3	2
b)	State the possible failure of gear teeth and suggest remedies for them.	2	1	3	1

Contd... 2

14. a)	Design a journal bearing for a centrifugal pump from the following data: load on the journal = 20,000 N; speed of the journal = 900 rpm; type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg/ms, ambient temperature of oil = 15.5°C ; maximum bearing pressure for the pump = 1.5 N/mm ² . Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil to be limited to 100C. Heat dissipation coefficient = 1232 W/m ² /°C.	4	3	4	1
b)	A radial rolling contact bearing is to operate in the following work cycle: 1.Radial load of 1500 N at 150 rpm for 30% of time. 2. Radial load of 6750 N at 600 rpm for 10% of time. 3. Radial load of 2250 N at 300 rpm for 60% of time. The inner race rotates and loads are steady, Take Dynamic load capacity as 19600 N. Calculate the average life of the bearing.	4	2	4	2
15. a)	Design the cross section of the connecting rod of a petrol engine, from the following data: Diameter of piston = 90 mm. Length of the connecting rod = 300 mm. Maximum explosion pressure = 2.2 N/mm ² , Factor of safety = 5. The rod is of "I" Section, with width 4t and depth 5t where 't' the thickness of the web and flanges. Compare the values of 't' obtained in direct compression and buckling.	6	2	5	3
b)	State the design considerations of piston.	2	1	5	2
16. a)	The C- Clamp has a round cross – section of 40 mm with diameter 100 mm at the centre of curvature. Load is acting at a distance of 400 mm from the centre of curvature. Determine the load which will produce a maximum stress of 250 N/mm ² in the inner fibers	4	3	1	2
b)	A rail wagon of mass 20 tones is moving with a velocity of 2 m/sec. It is brought to rest by two buffers with springs of 300 mm diameter. The maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa. Design the spring for the buffers.	4	2	2	1
17.	Answer any <i>two</i> of the following:				
a)	Pair of helical gears is to transmit 15 K.W. The teeth are 200 stub in diametral plane and have a helix angle of 45° The pinion runs at 10000 rpm and has 80 mm pitch dia. The gear has 320 mm pitch dia. If the gears are made up of cast steel having allowable static strength of 100 N/mm ² , find module face width. Given surface endurance strength is 618 N/mm ²	4	3	3	2
b)	The thrust of a propeller shaft in a marine engine is taken up by a number of collars integrated with the shaft, which is 300 mm in diameter. The trust on the shaft is 200 KN and the speed of the shaft is 90 rpm. Assuming coefficient of friction as 0.05 and bearing pressure as 0.35 N/ mm ² determine (i) power lost in friction (ii) number of collars required (iii) thickness of the collars.	4	2	4	1
c)	Briefly Explain the design procedure of crank shaft.	4	2	5	1

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	30%
iii)	Blooms Taxonomy Level – 3 & 4	50%
