VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD
Accredited by NAAC with A++ Grade
B.E. (Mech. Engg.) VI-Semester Main & Backlog Examinations, June-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.	Determine the eccentricity between the centroidal and neutral axes of a curved beam with rectangular cross section. Depth of the cross section is 450 mm and width 350 mm. Position of the centroidal axis is axis of loading is 500 mm.	2	2	1	2
2.	Differentiate between straight beam and curved beam.	2	1	1	1
3.	Mention the applications of springs.	2	1	2	1
4.	Determine the maximum shear stress in helical compression spring subjected to an axial load of 620 N. Mean coil diameter for the spring made od 6 mm diameter wire is 63 mm. Take Wahl correction factor into consideration.	2	2	2	2
5.	Pinion of a bevel gear train with a velocity ratio of 1.538 has 30 teeth. Determine the formative number of teeth for the pinion.	2	2	3	1
6.	State the advantages of worm gears.	2	1	3	1
7.	A deep grove ball bearing runs at 1000 rpm for 8 hours per day and 300 days in a year. What is the life in million revolutions at 90% reliability and what the dynamic load capacity if the radial load is 5 KN?	2	2	4	2
8.	A journal bearing is subjected to radial load of 30 KN and length and diameter of the journal bearing are 75 mm each. What is the pressure on the bearing, if the speed of the journal is 3600 rpm and radial clearance is 0.15 mm? For viscosity of 45 $centi\ poise$, determine the Somerfield number.	2	3	4	2
9.	State the types of crank shafts. Suggests its manufacturing methods.	2	1	5	1
10.	Why 'I' section is generally preferred cross section for connecting rod?	2	2	5	1

Part-B (5 × 8 = 40 Marks)

11.	Frame of a C-clamp is a curved beam of cross section T. Distance of inside surface from the centre of screw is 150 mm and 60 KN is the maximum axial thrust along the center line of the clamp. If the overall depth of the T cross section $8t$, flange width is $6t$ and thickness of both flange and web is t, draw the cross section showing the line of action of load. Determine the thickness t, if tensile stress in the critical section should be limited to $210\ \frac{N}{mm^2}$ and factor of safety is 1.8. Also determine the eccentricity of the cross section.	8	2	1	3

12. a)	A helical compression spring is subjected to radial load 50kN and spring index is 6. It is made of hardened steel with allowable shear stress is 380MPa. The maximum deflection is 30mm when maximum load is acting. Assume both ends are squared and ground and its modulus of rigidity is 81370 MPa. Design the helical springs	5	1	2	3
b)	Explain the importance of nipping in leaf spring.	3	1	2	1
13.	Two helical gears are used in a speed reducer that is to be driven by an internal combustion engine. The rated power of the speed reducer is $75\ kW$ at a pinion speed of $1200\frac{rev}{min}$. The speed ratio is 3. Assume medium shock conditions and $24\ hr$ operation. (a) Determine the module, Face width, number of teeth in each gear if pinion material is C-30 forged steel with $\sigma_b = 175\ MPa$ and BHN as 150. The teeth are 20^0 full depth in the normal plane.	8	3	3	3
14. a)	Length of a full journal bearing is $0.15\ m$, while its diameter is $0.10\ m$. Radial load on bearing is $22.7\ kN$ and Speed of Journal is $250\ rpm$. Radial clearance is $0.042\ mm$. It is desired to limit the minimum oil film thickness to $0.02\ mm$. Determine a suitable value for the viscosity of the lubricant and the power loss due to friction.	4	1	4	3
b)	A spherical roller bearing is subjected a radial load of 12kN, its dynamic load bearing capacity is 30 kN. Find the rated life and median life of the bearing. Find the life in hours if the bearing is operation at 1000 RPM. Find the life in million revolutions for 99% reliability	4	3	4	3
15. a)	Design a cast iron piston for a single acting four stroke engine if the cylinder bore is $100mm$, Stroke length is $120\ mm$ and maximum gas pressure is limited to $7N/mm^2$. Take brake mean effective pressure as $0.6\ N/mm^2$, Fuel consumption to be 0.229 Kg/KWhr and Speed of the engine as 2400 rpm. Take allowable tensile stress for C.I. as $42\ N/mm^2$. HCV of fuel is $41850KJ/Kg$ and C is 0.06.	5	2	5	3
b)	What is whipping stress? Where do you come across? Explain with a neat diagram.	3	1	5	2
16. a)	A C-frame withstands an axial load of W and allowable tensile stress in beam is $60\ MPa$. Determine the eccentricity between neutral and centroidal axes of trapezoidal cross section of this curved beam if two widths of the cross section are $90\ mm$ and $30\ mm$. Depth of the section is $120\ mm$ and in side surface is $90\ mm$ from line of action of load. Determine maximum load that can be applied on the beam.	4	2	1	3
b)	In a helical compression spring the spring index is 6. Determine the shear stress factor and Wahl correction factor.	4	1	2	1

17.		Answer any *two* of the following:				
	a)	A bronze spur pinion has 18 teeth and drives a cast steel gear. The gear ratio is 4 and the speed of pinion is 560 rpm. Teeth of spur gears are of 200 full depth involute profile and module is 5 mm. Taking face width as 25 mm, determine the maximum power that can be transmitted from the stand point of strength. Static strength for bronze is 80 MPa and that 4for cast steel is 100 MPa.	4	2	3	2
	b)	Select a suitable deep grove ball bearing to resist 8 KN radial load and 5 KN thrust load when rotating at 1500 rpm. Assume that inner race rotates and load is steady. Life expected is 500 Hours. Service is continuous. Determine the equivalent dynamic load. What is the required rating life of the bearing?	4	2	4	2
	c)	In a single cylinder IC engine length of connecting rod and stroke length are respectively 300 mm and 125 mm. Engine speed is 1800 rpm and maximum pressure on piston head is 3.5 MPa. Cylinder bore is 100 *mm*. Cross section of the connecting rod is circular of diameter d. Determine the cross section of the connecting rod if yield stress in compression is 330 MPa and factor of safety is 6. Neglect whipping effect.	4	3	5	2

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

i)	Blooms Taxonomy Level – 1	30
ii)	Blooms Taxonomy Level – 2	30
iii)	Blooms Taxonomy Level – 3 & 4	40

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