

Mech

College of Engineering, Pune
End Semester Examination- Nov-Dec-2012

Course- B. Tech.
Branch- Mechanical
Semester- V

ME-301: Machine Design-I

Date: 26/11/2012

Time: 14.00Hrs to 17.00Hrs

Duration: 3Hrs

Max. Marks: 50

Instructions:

1. All Questions are compulsory.
2. Neat Diagram must be drawn wherever necessary.
3. Figures to the right indicate full marks
4. Use of programmable calculator is not permitted.
5. Assume suitable data, if necessary.

Q.1	A	What do you mean by design synthesis and design analysis?	03
	B	How many basic series are used? How will you denote them?	03
	C	Explain the ergonomic considerations in design of machine element.	03
Q.2	A	Derive the equation for the stresses due to torsional moment in a shaft and mention the assumptions made for the same.	04
	B	Explain the theories of elastic failure and also give its significance in Machine Design.	04
Q.3	A	What is recirculating ball screw? Give its applications.	03
	B	The lead screw of a lathe has Acme threads of 50 mm outer diameter and 8 mm pitch. The screw exert axial load of 2.5kN to drive the tool carriage. The thrust is carried on a collar which has outer diameter of 110mm and inner diameter of 55mm. If the lead screw is rotates at 30 rpm , Determine i) Power required to drive the screw. ii) the efficiency of the lead screw. Assume coefficient of friction for the screw and the collar are 0.15 and 0.12 respectively.	05
		OR	
Q.3		Two copper plates of thickness 30 mm each are joined by a steel bolt of size M14, class 9.8, with $S_{ut}=650$ MPa. Initial preload on bolt = $0.75 \times A_t$, where A_t is tensile stress area of bolt. The washer thickness is 3mm. Take $E_{copper} = 105$ kN/ mm ² and $E_{steel} = 207$ kN/ mm ² and A_t for M14 bolt = 115 mm ² . Determine : i) Additional load on bolt due to external load on assembly. ii) Bolt stiffness iii) Combined stiffness of plates iv) How much external load can be safely applied on the assembly of plates and bolts.	08

Q. 4	A	What are the methods of improving lateral rigidity of shafts?	03
	B	A line shaft supported in bearings with span of 1000 mm. The two pulleys A & B with dia. 200 mm and 400 mm respectively are also mounted on the shaft. The distance of Pulley A from left hand bearing is 500 mm whereas Pulley B is overhang at 250 mm from right hand bearing. Power is supplied to the shaft by means of vertical belt on pulley A and further transmitted to the other device by pulley B with horizontal belt arrangement. The limiting value of tension in the belts is 2.8 kN and the ratio of belt tension on tight side to slack side for both belts is 2.8 :1. The shaft is made of plain carbon steel 40C8($S_{ut} = 650\text{N/mm}^2$ and $S_{yt} = 380\text{N/mm}^2$). The pulleys are keyed to the shaft. Determine the diameter of the shaft according to ASME code if, $k_b = 1.5$ and $k_t = 1.0$. Draw the sketch for the arrangement.	06
Q.5	A	Explain the significance of nipping of leaf springs in an automobile.	03
	B	In an automotive plate clutch, six helical compression springs are arranged in parallel, provides the axial thrust of 1500N. The springs are compressed by 10 mm to provide this thrust force. The springs are identical and the spring index is 6. The springs are made of cold-drawn steel wires with ultimate tensile strength of 1200N/mm^2 . The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength. The modulus of rigidity of spring material is 81370N/mm^2 . A gap of 1 mm between adjacent coils when the springs are subjected to the maximum force. . If the springs have square and ground ends then Calculate i) Wire diameter ii) Mean coil diameter iii) Number of active coils iv) Total no. of coils v) Solid length vi) Free length vii) Required spring rate and viii) Actual spring rate.	06
Q.6	A	What are primary and secondary shear stresses in eccentrically loaded welded joint?	02
	B	Derive the equation for torsional shear stress (τ) in the weld is given by, $\tau = M_t / (2\pi tr^2)$ Where M_t -Torsional moment in the shaft r- radius of shaft t- one of the dimension of the weld	05