

College of Engineering, Pune
End Semester Examination- Nov-Dec-2013

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

ME-305: Machine Design-I

Date:

Duration: 3Hrs

Time:

Max. Marks: 60

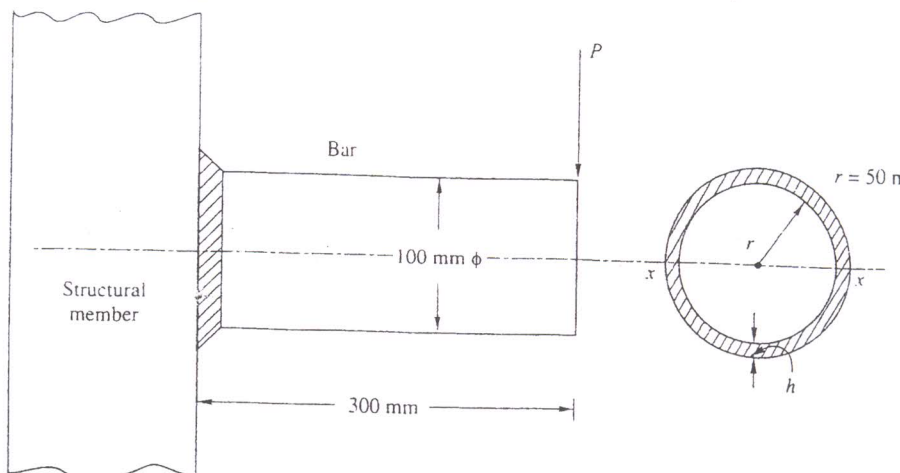
Instructions:

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 Engineering Design or Mechanical Design ?	03
	B	Explain the Weighted Point Method, give its significance.	04
	C	Why is factor of safety very small in the design of components used for aeroplane and aircraft industries?	03
Q.2	A	A short hollow cylindrical column of 200 mm inner diameter and 300 mm outer diameter, carries a vertical eccentric load of 500 kN, in one of the diametral planes; the eccentricity being 100 mm. Determine the maximum intensity of the stress induced and state its nature. What is the maximum permissible eccentricity of the above load, if the stress induced throughout the cross-section is to be compressive in nature?	05
	B	A cast iron cylinder has outside and inside diameters of 200 mm and 125 mm, if the ultimate tensile strength of the cast iron is 150 MN/m^2 , find the according to each of the following theories, the internal pressure which would cause rupture. a) Maximum principal stress theory b) Maximum strain theory and c) Maximum strain energy theory. Assume no longitudinal stress in the cylinder, poisson's ratio = 0.25	05
Q.3	A	What do you understand by property class of bolts?	02
	B	What is the condition of irreversibility in a power screw?	02
	C	The cutter of a broaching machine is pulled by a square thread screw of 50 mm external diameter and 10 mm pitch. The operating nut takes a load of 50 kN of a flact surface of 85 mm external diameter and 55 mm internal diameter; coefficient of friction is 0.15 for all contact surfaces. Determine i) Power required to rotate the operating nut ii) the efficiency of the screw. When the cutting speed is 15 m/min..	06

		OR	
Q.3	A	What is the difference between coarse, normal and fine series of pitches of treads of power screws?	02
	B	Why is the efficiency of Acme threads less than the efficiency of square threads?	02
	C	The cylinder head of an air compressor is held in place by steel studs. The cylinder bore is 400 mm, and the maximum air pressure is 0.75 N/mm^2 . The head to cylinder contact surfaces are ground together so that no packaging is necessary. Determine the number and size of studs to be used, assuming suitable value for the permissible stress of the bolt material.	06
Q.4	A	Kennedy keys of 12 mm x 12 mm are used to connect a shaft of 50 mm diameter, transmitting 40 kW at 360 rpm. The keys are made of 40C8 steel with $\sigma_{yt} = \sigma_{yc} = 380 \text{ N/mm}^2$. Taking a factor of safety of 3, determine the required length of the keys.	03
	B	A shaft is required to transmit 15 kW at 200 rpm. It is supported on two bearings, 0.6m apart and two spur gears are keyed on it. A 18 teeth, 14.5° involute, 5 mm module pinion is located at 120 mm to the right of the right bearing, and delivers power to a gear, directly below the shaft. A 72 teeth, 14.5° , 5 mm module gear is located at 150 mm to the right of the left bearing, and receives power from a gear, directly above it. Determine the shaft diameter, assuming permissible normal stress as 80 MPa.	07
		OR	
	B	A shaft supported by two bearing placed 1m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of the left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a said shaft, allowing working stress of 60 MPa in tension and 40 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley. Draw the sketch for the arrangement.	07
Q.5	A	A helical compression spring is made of hard drawn wire of 18 SWG. The outer diameter of the spring is 12.5 mm. Estimate: a) torsional yield strength of the material b) static load corresponding to yield strength c) deflection due to this static load, if the no. of total turns are 13.5, d) solid length of the spring and e) possibility of buckling if ends are squared?	05
	B	Determine the cross section of the leaves of a carriage spring of semi-elliptic shape, used as a suspension of a truck. There are two full-length leaves (including the master leaf) and eight graduated leaves. Spring eyes are located at 1180 mm. Take factor of safety as 2. Maximum load on	05

spring may be taken as 40 kN of the material of the spring i.e. 1400 MPa.

Q.6	A	What are primary and secondary shear stresses in eccentrically loaded welded joint?	04
	B	<p>A solid circular bar of 100 mm diameter is welded to a structural member as shown in fig. by a fillet weld all around the bar. Determine the leg dimension of the fillet weld, if $P = 16\text{kN}$ and permissible shear stress in weld is 90 N/mm^2.</p> 	06

