

JK Lakshmipat University, Jaipur

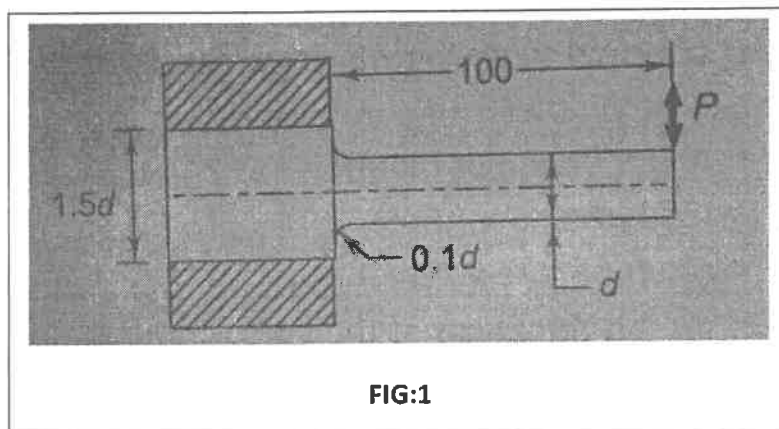
Institute of Engineering and Technology
End Sem Examination, (Session 2018-19)
B. Tech. in Mechanical Engineering, Semester VI

Subject Name: Design of Machine Element- II
Subject Code: ME604
Exam Type: Closed Book (Data Book Allowed)

Max. Marks: 60
Time Duration: 3 Hrs
Weightage: 30%

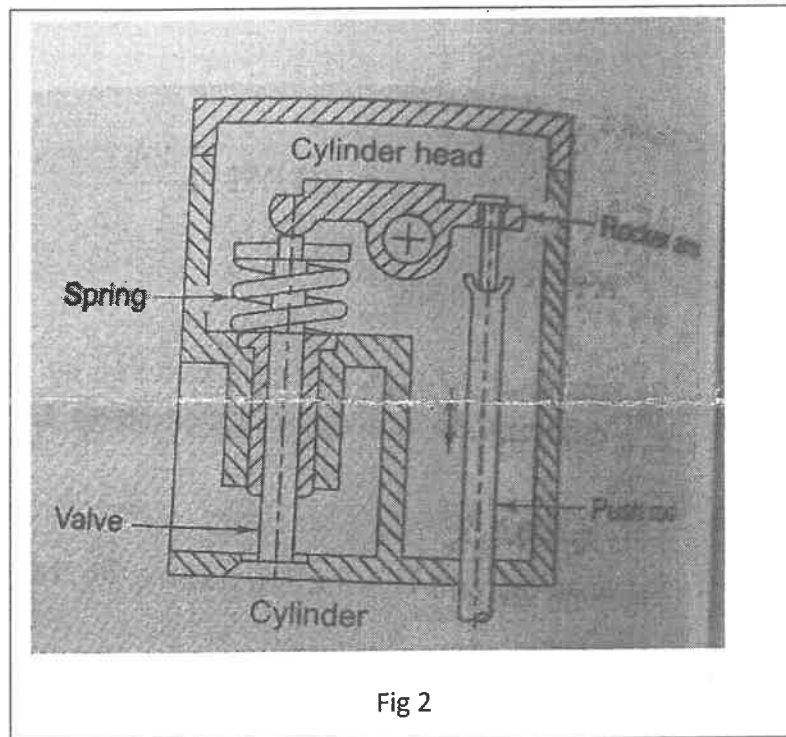
- Note:** 1. All questions are compulsory.
2. Do not write anything other than your roll number on question paper.
3. Assume suitable data wherever required and mention it clearly.

- Design a shaft required to transmit 100 KW at 300 RPM the supported length of shaft is 3 meter, it carries two pulley each weighing 1500 N supported at a distance of 1 meter from the ends respectively. Assume the safe value of stress (Marks: 5) LO1
- A cantilever beam made of steel FE 540 ($S_{ut} = 540 \text{ N/mm}^2$ and $S_{yt} = 320 \text{ N/mm}^2$) and subjected to a completely reversed load P of 5KN as shown in fig 1, the beam is machined and reliability is 50%. The factor of safety is 2 and the notch sensitivity factor is 0.9 calculate the endurance limit at the fillet section. (Marks: 5) LO1



- Design a spring for a direct reading spring balance consist of a helical tension spring, which is attached to a rigid support at one end and carries weight at the other free end. The pointer attached to a free end moves on a scale and indicate the weight. The length of scale is 75 mm, the maximum capacity of the balance is to measure the weight of 500N. the spring index is 6. The spring is made of oil hardened and tempered steel wire with S_{ut} of 1400 N/mm^2 . The permissible shear stress of spring is 50% of the ultimate tensile strength. ($G=81370 \text{ N/mm}^2$). (Marks: 5) LO2
- Compare the hydrostatic journal bearing with hydrodynamic journal bearing on the basis of its operating conditions, performance and uses. (Marks: 5) LO2
- Design a full hydrodynamic bearing used for an electric motor having radial load 1200N, journal speed 1400rpm, journal diameter 50mm, surface roughness (cla) for journal and bearing are 1 and 2 micron respectively, and static load on the bearing is 350N. The minimum oil film thickness should be five times the sum of surface roughness of bearing surfaces, select the suitable oil for lubrication assuming the operating temperature as 65°C . (Marks: 10) LO2
- A pair of parallel helical gear consists of 24 teeth pinion rotating at 5000rpm, and supply 2.5 KW power to a gear. The speed reduction is 4:1 the normal pressure angle and helix angle are 20° , and 23° respectively. Both gear are made of hardened steel ($S_{ut} = 750 \text{ N/mm}^2$) and heat treated to the surface hardness of 300BHN. The face width is 40 and normal module is 4mm. Service factor and FOS is 1.5 and 2 respectively. Assume the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. (Marks: 10) LO2

7. Diesel engine valve is shown in Fig. 2, the diameter of the valve is 40mm, and the suction pressure in the cylinder 0.03 N/mm^2 . The mass of the valve is 75g. the maximum valve lift is 10mm. The stiffness of the spring for the valve is 10 N/mm . C can be assumed as 8. The permissible shear stress in the spring wire is recommended as 30% of the ultimate tensile strength. Neglecting the effect of the inertia force, design the spring for static consideration and determine the FOS against fluctuating stress. (Marks: 10) LO2



8. A system involves four identical ball bearings each subjected to radial load of 2500 N. the reliability of the system, that is one out of four bearing failing during the lifetime of five million revolutions, is 82%. Determine the dynamic load carrying capacity of the bearing, so as to select it from the manufacturer catalogue based on 90% reliability. (Marks: 10) LO3

Or

A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm^2 . The corrected endurance limit stress for the machine components is 270 N/mm^2 . The ultimate tensile strength and yield strength of material are 600 and 450 N/mm^2 . Find the fos using Gerber theory, Soderberg line, and Goodman line. Also calculate the Fos for static load. (Marks: 10) LO3