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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program	: B. Tech Mechanical	Semester – V
Subject (Course)	: Machine Design -1	Max. Marks : 100
Course Code	: MHEG 368	Duration : 3 Hrs
No. of page/s	: 03	

Design Data Hand Book by K. Mahadevan, K. Balaveera Reddy is allowed.
ASSUME ANY DATA WHICH IS NOT GIVEN

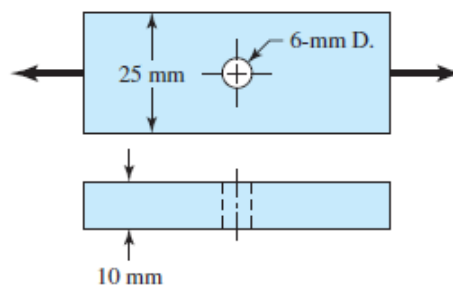
NOTE: ALL QUESTIONS ARE COMPULSORY

SECTION A

- Q1. A manufacturer is required to produce a set of nails with lengths roughly between 15 and 300 mm. using R5 series determine the size of the nails. **5**
- Q2. Explain failure to be considered for design of keys with diagrams. **5**
- Q3. Explain the design of nut and screw of a screw jack with diagram. **10**

SECTION B

- Q4. The cold-drawn steel bar shown in the figure is subjected to a completely reversed axial load fluctuating between 28 kN in compression to 28 kN in tension. Estimate the number of cycles to failure considering material of 30C8. Assume notch sensitivity factor of 0.8 and expected reliability of 90%. **15**



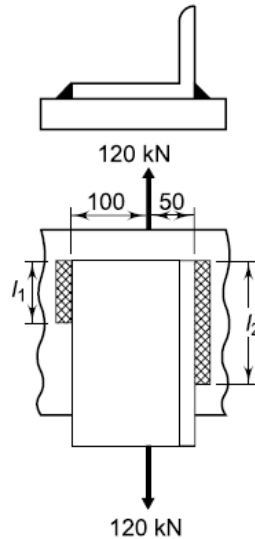
- Q5. A coil spring is used for the front suspension of an automobile. The spring has a stiffness of 90 N/mm. The material used is oil tempered chrome vanadium steel for which the permissible shear stress may be taken as 500 MPa. The load on the spring causes a total deflection of 8.5 mm. Design the spring. **15**

OR

A spring of a truck has 10 leaves of graduated length. The spring supports are 1.06 m apart and central band has a width of 87.5 mm. The load on central band is 5000 N, and permissible stresses are 500 MPa. Determine the width and

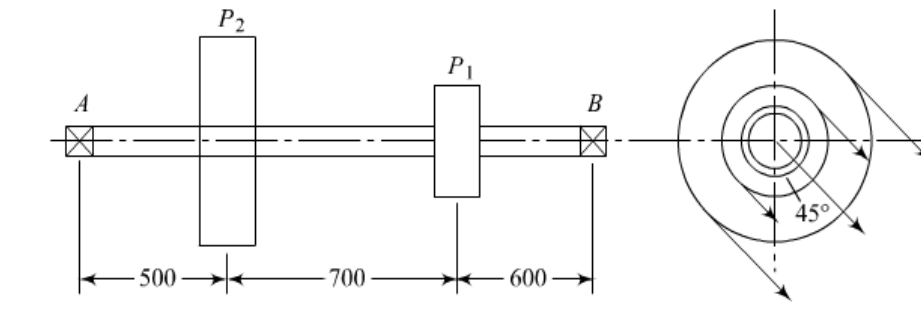
thickness of the steel spring material and deflection when loaded. The spring should have a ratio of total depth to width of 2.5.

- Q6.** A bracket, as shown in figure below, is welded to a plate. The welds have the same size, and the permissible force per mm of the weld-length is 1 kN. Calculate the lengths l_1 and l_2 . **10**



SECTION C

- Q7.** Design a line shaft transmitting power to two machine tools. The power received by the shaft is 30kW at 300 rpm. The power absorbed by pulley P_1 is 12 kW and the remaining power is absorbed by pulley P_2 . The diameter of pulley P_1 is 300 mm and its mass is 40 kg. The diameter and mass of pulley P_2 are 600 mm and 75 kg respectively. Assume the belt tension ratio of 2 for both pulleys, design the shaft as per ASME code. **20**



OR

- Design a rigid flange coupling to connect pump shaft with motor of 50 KW running at 1440 rpm. Assume appropriate material.
- Explain design procedure of a muff coupling.

- Q8.** It is required to select a flat belt drive for a fan running at 360 rpm which is driven by a 10 kW, 1440 rpm motor. The belt drive is open-type and space is available for a centre distance of 2 m approximately. Suggest preferred diameters for motor and fan pulleys and give complete specifications of belting. (Additional data for reference is given below)

Table 13.2 Arc of contact factor (F_d)

α_s (Deg.)	120	130	140	150	160	170	180	190	200
F_d	1.33	1.26	1.19	1.13	1.08	1.04	1.00	0.97	0.94

HI-SPEED	0.0118 kW per mm width per ply
FORT	0.0147 kW per mm width per ply

3-Ply	25	40	50	63	76					
4-Ply	40	44	50	63	76	90	100	112	125	152
5-Ply	76	100	112	125	152					
6-Ply	112	125	152	180	200					