SV - 85

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Seat No.	

T.E. (Mechanical) (Part -III) (Semester - V) (Revised) Examination, April - 2018

MACHINE DESIGN-I

Sub. Code: 66244

Day and Date : Friday, 27 - 04 - 2018 **Total Marks : 100**

Time :10.00 a.m. to 1.00 p.m.

Instructions :

1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Make suitable assumptions wherever required and state them clearly.**
4) **Use of non-programmable calculator is permitted.**
5) **Draw neat diagrams wherever necessary.**

Q1) Solve any Three: **[18]**

a) Discuss the guidelines for the selection of quantitative values of 'factor of safety'.

b) Suggest with justification the suitable material for the following:

i) Large Flywheel

ii) Helical spring

iii) Dairy Equipment

c) Discuss the design of a bell-crank lever.

d) Discuss different types of stresses in bolt design.

Q2) a) A knuckle joint used to connect two mild steel rods has to transmit a tensile load of 200 kN. Given: yield point strength of the material in tension 200 N/mm^2 and factor of safety = 2. Allowable stress in compression is two times the allowable stress in tension, and allowable stress in shear as 0.707 times that in tension. Design the knuckle joint. **[8]**

P.T.O.

b) A steel plate is subjected to a force of 6 kN and fixed to the channel by means of three identical bolts as shown in figure 2b. The bolts are made of plain carbon steel 30C8(S_{yt} =400N/mm^2, factor of safety = 3) Determine the nominal diameter of bolts. **[8]**

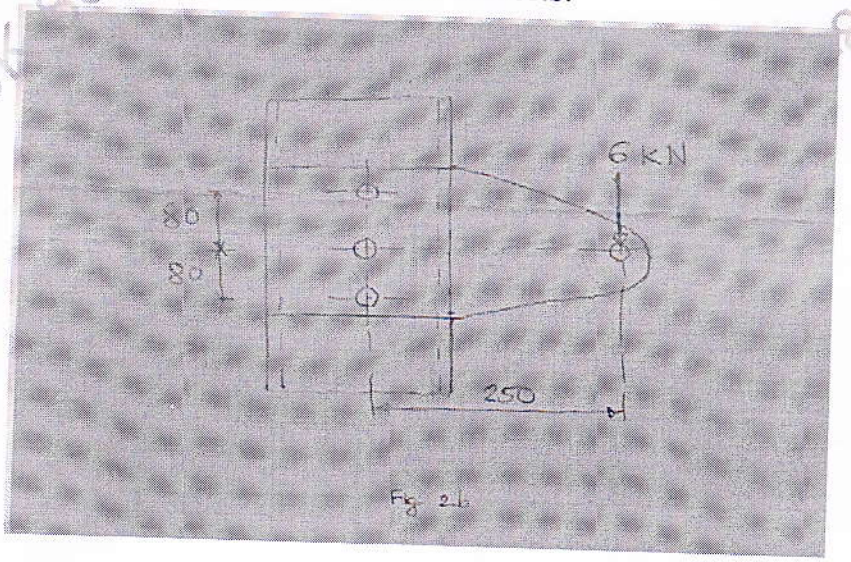

Fig 2b

OR

c) Figure 2c shows a bracket is welded to the vertical plate by means of two fillet welds. Determine the size of welds if the permissible shear stress is limited to 72 N/mm^2. **[8]**

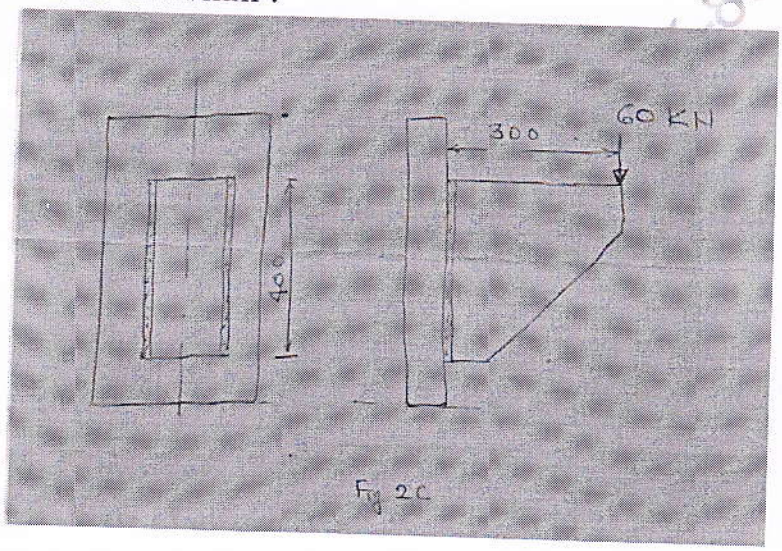

Fig 2c

Q3) a) What are various types of keys? Compare stresses in woodruff key with flat key? **[6]**

b) The propeller shaft is required to transmit 45 kW power at 500 rpm. It is a hollow shaft made of plain carbon steel and the permissible shear stress is 84 N/mm^2. Calculate the inside and outside diameters of the shaft for **[10]**

i) Ratio of an inside diameter 0.6 times the outside diameter.

ii) Ratio of an inside diameter 0.65 times the outside diameter.

Determine the % saving in material by modifying the ratio.

OR

b) Design a bushed-pin type flexible coupling for connecting a motor shaft to a compressor, with the following service conditions:

Power to be transmitted = 50kW

Speed of motor shaft = 1000r.p.m

Diameter of motor and compressor shaft = 55mm

Bearing pressure on the rubber bush = 0.7 N/mm^2

Allowable stress in the pins = 60 Mpa

Allowable shear stress in the keys and shafts = 45 Mpa

Allowable crushing stress in the keys = 60 MPa

Allowable shear stress in the flange material = 15 Mpa

Q4) a) Explain with neat sketches, the stresses induced in helical spring of circular cross section. **[6]**

b) Design helical compression spring for a maximum load of 1000 N for deflection of 25 mm using the valve having spring index of 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm^2. Assume squared and ground ends. **[10]**

Assume Whal's Stress factor $K=\frac{4C-1}{4C-4}+\frac{0.615}{C}$

Where C - spring index

SWG	1	2	3	4	5
Diam. mm	7.620	7.010	6.401	5.893	5.385

Q5) a) Discuss Various forms of threads used for power transmission giving their relative merits and limitations. **[6]**

OR

a) Derive an expression for maximum efficiency for square threaded screw.

b) The cutter of machine is pulled by square threaded screw of 55 mm external diameter and pitch of 10 mm. The operating nut takes the axial load of 400 N on a flat surface of 60 mm and 90 mm internal and external diameter respectively. If the coefficient of friction is 0.15 for all contact surfaces on nut. Determine power required to rotate operating nut when cutting speed is 6m/min. Also find efficiency of the screw. **[12]**

Q6) a) Explain the step by step procedure for selection of V belt from Manufacturer's Catalogue. **[6]**

b) It is required to select flat belt drive to connect two transmission shafts rotating at 800 rpm and 400 rpm respectively. The centre to centre distance between the shafts is approximately 3m and the belt drive is open type. The power transmitted by the belt is 30 kW. The load correction factor is 1.3. The belt should operate at velocity between 17.80 m/s to 22.90 m/s. The power transmitting capacity of the belt per mm width per ply at 180° arc of contact and at a belt velocity of 5.08 m/s is 0.0147 kW. Select preferred pulley diameters and specify the belt. Refer the tables given below. **[10]**

Arc of Contact Factor (F_d)

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

Standard Widths of these belts in mm

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					

For flat pulleys: Series of preferred values of pitch diameters (in mm) are as follows

Pitch diameter (mm):	125	132	140	150	160	170	180	190
200	212	224	236	250	265	280	300	315
355	375	400	425	450	475	500	530	560
600	630	670	710	750	800	900	1000	

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