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B.E/B.TECH (Full-time) END SEMESTER EXAMINATIONS, APRIL/MAY 2019

MANUFACTURING ENGINEERING, INDUSTRIAL ENGINEERING AND MATERIALS SCIENCE ENGINEERING

FIFTH SEMESTER

ME 8553 - MACHINE DESIGN

(REGULATIONS 2012)

Note: Use of approved Data Book is permitted. Assume appropriate design data whenever required.

Time: 3 Hours

Max. Marks: 100

Answer All Questions

PART-A (10 x 2 = 20 Marks)

1. Differentiate between allowance and tolerance.
2. State maximum distortion energy theory.
3. When is a rigid coupling used? State its types.
4. What are the types of roller bearings?
5. Bring out the differences between the functions of a governor and a flywheel.
6. What type of stresses are induced in a crankshaft?
7. List two advantages and two disadvantages of V-belt drive over flat belt drive.
8. Mention some applications where wire ropes are utilized.
9. What is normal pitch in helical gears?
10. What is kinematic layout of a gear box?

Part-B (5 x 16 = 80 Marks)

11. A wall bracket with a rectangular cross-section is shown in Fig. 11. The depth of the cross-section is twice of the width. The force P acting on the bracket at 60° to the vertical is 5 kN. The material of the bracket is grey cast iron FG-200 and the factor of safety is 3.5. Determine the dimensions of the cross-section of the bracket. Assume maximum principal stress theory of failure.

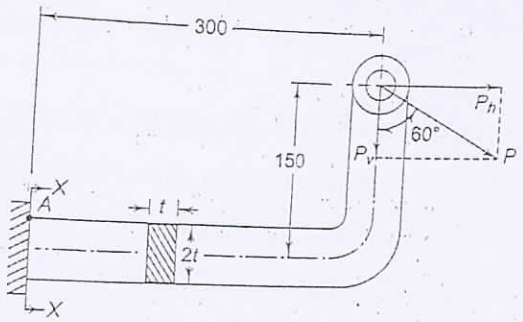

Fig. 11

12(a) A bracket is welded to the vertical plate by means of two fillet welds as shown in Fig. 12a. Determine the size of the welds, if the permissible shear stress is limited to 70 N/mm^2.

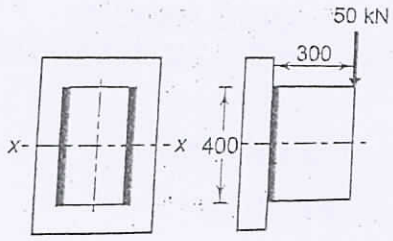

Fig. 12a

[OR]

12(b) It is required to design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.5 kW power at 180 rpm to the output shaft through the coupling. The service factor for the application is 1.5 i.e., the design torque is 1.5 times of rated torque. Select suitable materials for various parts of the coupling, design the coupling and specify the dimensions of its components,.

13(a) Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm^2.

Take Wahl's factor, $K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$, where C = Spring index

[OR]

13(b) A punching press pierces 35 holes per minute in a plate using 10 kN-m of energy per hole during each revolution. Each piercing takes 40 per cent of the time needed to make one revolution. The punch receives power through a gear reduction unit which in turn is fed by a motor driven belt pulley 800 mm diameter and turning at 210 rpm. Find the power of the electric motor if overall efficiency of the transmission unit is 80 per cent. Design a cast iron flywheel to be used with the punching machine for a coefficient of steadiness of 5, if the space considerations limit the maximum diameter to 1.3 m.

Allowable shear stress in the shaft material = 50 MPa

Allowable tensile stress for cast iron = 4 MPa

Density of cast iron = 7200 kg/m^3

14(a) Design a rubber belt to drive a dynamo generating 20 kW at 2250 r.p.m. and fitted with a pulley 200 mm diameter. Assume dynamo efficiency to be 85%.

Allowable stress for belt = 2.1 MPa

Density of rubber = 1000 kg/m^3

Angle of contact for dynamo pulley = 165°

Coefficient of friction between belt and pulley = 0.3

[OR]

14(b) Design a chain drive to actuate a compressor from 15 kW electric motor running at 1000 r.p.m., the compressor speed being 350 r.p.m. The minimum centre distance is 500 mm. The compressor operates 16 hours per day. The chain tension may be adjusted by shifting the motor on slides.

15(a) Design a pair of spur gears to transmit 20 kW at a pinion speed of 1400 rpm. The transmission ratio is 4. Assume suitable materials and stresses.

[OR]

15(b) Design the layout of a 12 speed gear box for a lathe. The minimum and maximum speeds are 100 and 1200 rpm respectively. The power is 5 kW from a 1440 rpm induction motor. Construct the speed diagram using a standard step ratio. Also calculate the number of teeth on all the gears and sketch the arrangement of the gear box.

ALL THE BEST