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October 2017

Time – Three hours
(Maximum Marks: 75)

[N.B: (1) Answer all questions choosing either (a) or (b) of each question.
(2) All question carry 15 marks.
(3) P.S.G. Data book is permitted.]

Marks

I. (A) (i) Define factor of safety for ductile and brittle materials.   5+10
   (ii) A hydraulic press exerts a total load of 3.5MN. The load is carried by two steel rods supporting the upper head of the press. If the safe stress is 85MPa and E=210kN/m², find (1)diameter of the rods (2)extension in each rod in a length of 2.5m.

(Or)

(B) Design a sleeve and cotter joint to transmit a tensile load of 60kN, assuming that all the parts are made of the same materials. The permissible stresses are 60N/mm² in tension, 125N/mm² in bearing and 70N/mm² in shear.   15

II (A) A mild steel shaft transmits 20kW at 200rpm. It carries a central load of 1000N and is simply supported between the bearings 2m apart. Determine the size of the shaft, if the allowable shear stress is 42MPa and the maximum tensile or compressive stress is not to exceed 56MPa. What size of the shaft is required if it is subjected to applied load gradually?   15

(Or)

(B) Design a protective type flange coupling to connect two shafts to transmit 7.5kW at 720rpm. The permissible shear stress for the shaft, bolts and key materials is 33N/mm², permissible crushing strength for bolt and key material is 60N/mm² and permissible shear stress for cast-iron is 15N/mm².

III (A) Select a flat belt from manufacturer's catalogue to transmit power of 15kW at 1200rpm. The speed of the driven pulley is 450rpm. Maximum centre distance between the shafts is 2m. Assume steady load.

[Turn over...

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Marks

(Or)

(B) Design V-belt drive to the following specifications.   15
        Power to be transmitted   =75kW
        Speed of driving wheel   =1440rpm
        Speed of driven wheel   =400rpm
        Diameter of driving wheel =300mm
        Centre distance   =2500mm
        Small pulley factor 'k_d'   =1.14
        Service factor 'k_s'   =1.3
        Correction factor for length 'k_l' =1.07

IV (A) (i) How bearings are classified?   5+10
      (ii) A 150mm diameter shaft supporting a load of 10kN has a speed of 1500rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diametral clearance of the bearing is 0.15mm and the absolute viscosity of the oil at the operating temperature is 0.011kg/m-s. Find the power wasted in friction.

(Or)

(B) A journal bearing is proposed for a centrifugal pump. The diameter of the journal is 150mm and the load on it is 40kN and its speed is 900rpm. Design and give the complete calculations for the bearing.

V (A) (i) State the different types of lever and their application in engineering practice.   5+10
      (ii) A hand lever is mounted on a shaft. The maximum force of 150N is applied by the worker. The distance between the centre of the shaft to the point of load is 1m. Determine the diameter of the solid shaft, if the permissible shear stress is limited to 20N/mm². Determine the section of the lever near the boss, if the permissible stress is limited to 85N/mm². Assume rectangular cross-section with sides in the ratio 1:2.

(Or)

(B) A pinion runs at 600rpm drives a gear at a speed ratio of 4:1. Allowable static stress of pinion and gear material is 85N/mm². Pinion has 16 teeth of module 8mm. Teeth are 20° FD system. Face width is 90mm. Find the power transmitted.   15

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