Seat No: - _____

Ganpat University
B. Tech. Sem. IV Mechanical Engineering
CBCS Regular Examination May/June - 2013
2ME402 Fundamentals of Machine Design & Drafting

[Time: 3 Hour] [Total marks: 70]

Instructions:
(1) Attempt all questions.
(2) Figure to the **right** indicate full marks.
(3) Assume suitable data if necessary.
(4) Only scientific calculator is allowed.

SECTION-I

Que.1
(A) Explain the various steps of machine design process. [03]
(B) Why the efficiency of self-locking square threaded screw is less than 50%? [03]
(C) In a machine tool application, the tool holder is pulled by means of an operating nut mounted on a screw. The tool holder travels at a speed of 5 m/mim. The screw has single start square threads of 48 mm nominal diameter and 8 mm pitch. The operating nut exerted a force of 500 N to drive the tool holder. The mean radius of the friction collar is 40 mm. the coefficient of friction at thread and collar surface is 0.15. Calculate: (i) Power required to drive the screw (ii) The efficiency of the mechanism. [06]

OR

Que.1
(A) Classify the different types of load & Explain each in brief. [03]
(B) What is meant by ductility, malleability and plasticity? [03]
(C) A triple threaded power screw is used to lifting the load of 10 kN. The nominal diameter is 70 mm and the pitch is 10 mm. The threads are Acme type ($2\beta=29°$) and the coefficient of friction at the screw thread is 0.15. [06]
Neglecting collar friction calculate: (i) the torque required to raise the load, (ii) the torque required to raise the load, (iii) the efficiency of the screw for lifting load.

Que.2
(A) Differentiate: Sunk key and Saddle key. [02]
(B) Explain the various type of failure in the knuckle joint. [03]
(C) Two rods, made of plain carbon steel 40C8 (S_{yt}= 380N/mm^2) are to be connected by means of a cotter joint. The diameter of each rod is 50 mm and the cotter is made from a steel plate of 15 mm thickness. Calculate the dimensions of the socket end making following assumptions: (i) the yield strength in compression is twice of the tensile yield strength and (ii) the yield strength in shear is 50% of the tensile yield strength. The factor of safety is 6. [06]

OR

Que.2
(A) What is coupling? What are the requirements of good coupling? [02]
(B) Derive strength equations of flat key based on shear and compression types of failure. [03]
(C) Design a muff coupling to transmit 30 kW at 100 rpm. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are 6. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3. Take width of key = Shaft diameter/4 and thickness of key = Shaft diameter/6. [06]

Que.3 Attempt any two. [12]
(A) What is stress concentration? Discuss the method to relive the stress concentration with neat sketches.
(B) Explain bush pin flexible coupling and Oldham coupling.

(C) A belt pulley is mounted on a shaft midway between two supporting bearings that are 1 m apart. The shaft receives 30 kW power at 700 rpm through a coupling which is located to the left of left hand bearing. The shaft transmits to the pulley which is 500 mm in diameter. The angle warp of the belt on the pulley is 180° and belt tensions act vertically downward. The ratio of belt tension is 2.5. The shaft made of steel FeE300 (S_{yt}=300 N/mm^2) and the factor of safety is 3. Determine the diameter of shaft on the basis of maximum shear stress.

SECTION – II

Que.4

(A) Explain the following terms related to lever. **[04]**
(i) Mechanical advantage (ii) Leverage (iii) Arm of lever.

(B) A lever loaded safety valve is 70 mm in diameter and is to be designed for a boiler to blow off at pressure of 1 N/mm^2 gauge. Design a suitable mild steel lever of rectangular cross section. For mild steel: Permissible tensile stress = 70 MPa, Shear stress = 50 MPa, Bearing pressure intensity = 25 N/mm^2. The pin is also made of mild steel. The distance from the fulcrum to the weight of the lever is 880 mm and the distance between the fulcrum and pin connecting the valve spindle links to the lever is 80 mm. **[08]**

OR

Que.4

(A) Explain the failures of a riveted joint. **[04]**

(B) Two plates of 10 mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the riveted diameter, riveted pitch, strap thickness and efficiency of the joint. Take the working stresses in tension and shearing as 80 MPa and 60 MPa respectively. **[08]**

Que.5

(A) What do you understand by a column or strut? Explain various end condition of a column. **[02]**

(B) Give the equations of Euler's formula. Explain limitations of Euler's formula. **[03]**

(C) A connecting rod of length (L) may be considered as a strut with the end free to turn on the crank pin and gudgeon pin. In the direction of the axes of these pins, however it may be considered as having fixed ends. Assuming that Euler's formula is applicable, determine the ratio of the side of the rectangular cross section so that the connecting rod is equally strong in both plane of buckling. **[06]**

OR

Que.5

(A) What are the different types of springs and their used? **[02]**

(B) What is buckling of helical spring? How is it taken care off in designing springs? **[03]**

(C) Design a helical compression spring for a maximum load 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for a spring wire is 420 MPa and modulus of rigidity is 84 kN/mm^2. **[06]**

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

Que.6 Explain any two. **[12]**

(A) Explain circle, arc, rectangle and polygon commands for Auto CAD drawing. With suitable example also explain use of mirror command.

(B) Discuss briefly the stresses induced in a spring wire of a helical compression spring subjected to axial loading.

(C) A bell crank lever is to be designed to raise a load of 5 kN at the short arm end. The arm lengths are 150 mm and 500 mm. The permissible stresses for lever and pin materials in shear and tension are 60 MPa and 90 MPa respectively. The bearing pressure on the pin is to be limited to 12 MPa. Assume the lever cross section as t x 4t and fulcrum pin length as 1.25 times pin diameter.

END OF PAPER