B.TECH SEM – V (2007 COURSE) (MECHANICAL ENGG.) :
SUMMER - 2018
SUBJECT: MACHINE DESIGN - I

Day : **Tuesday** | Time : **10.00 AM TO 02.00 PM**
Date : **22/05/2018** | **S-2018-2680** | Max. Marks : 80

N.B.:

1) **Q. No. 1**and **Q. No. 5** are **COMPULSORY**. Out of remaining attempt **ANY TWO** questions from each section.
2) Figures to the right indicate full marks.
3) Answers to both the sections should be written in separate answer books.
4) Use of non-programmable calculator is allowed.
5) Draw neat and labeled diagram wherever necessary.
6) Assume suitable data, if necessary.

SECTION - I

Q. 1 **a)** Explain the basic procedure involved in a design of any machine component. **(05)**

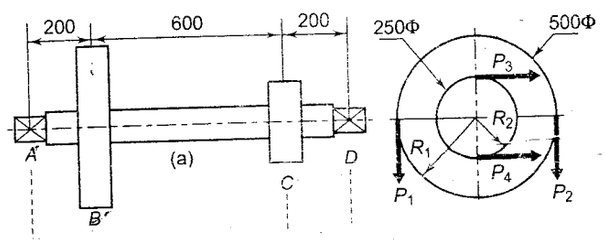
b) Compare flexible coupling with rigid coupling state applications of both. **(04)**

c) Draw the labeled sketch of recirculating ball screw. **(05)**

Q. 2 **a)** What is the difference between modulus of elasticity and modules of rigidity? **(04)**

b) A knuckle joint is completely made of plain carbon steel 40 C8 (S_{yt} = 380 N/mm^2) and subjected to an axial pull of 80 kN. Design the joint with a factor of safety of 4. Assume the compressive strength of material to be 20 % more than tensile strength. **(09)**

Q. 3 The layout of transmission shaft carrying two pulleys B and C and supported on bearings A and D as shown in Fig. Power is supplied to the shaft by means of vertical belt on pulley B, that is then transmitted to pulley C carrying a horizontal belt. The maximum tension in belt on pulleyB is 2.5 kN. The angle of wrap for both the pulleys is 180^0 and the coefficient of friction 0.24. The shaft is made of plain carbon steel is 30 C 8 (S_{yt} = 400 N/mm^2) and the factor of safety is 3. Determine the shaft diameter on strength basis. **(13)**



Q. 4 **a)** In a machine tool application, the tool holder is pulled by means of an operating nut powered by a screw. The nut exerts a force of 600N to drive the tool holder which travels at a speed of 6 m/min. The screw has a single start acme threads of 48 mm nominal diameter and 8 mm pitch. The mean radius of collar is 40 mm. If the coefficients of thread as well as collar friction is 0.2. Determine : **(09)**

i) The power required to drive the screw

ii) The efficiency of system

b) What is the difference between self locking screw and over hauling screw? **(04)**

P. T. O.

SECTION – II

Q. 5 **a)** What is surging of springs? **(05)**

b) Explain soderberg diagram for evaluating fluctuating stresses with suitable formulae. **(05)**

c) State the advantages and limitations of welded joints. **(04)**

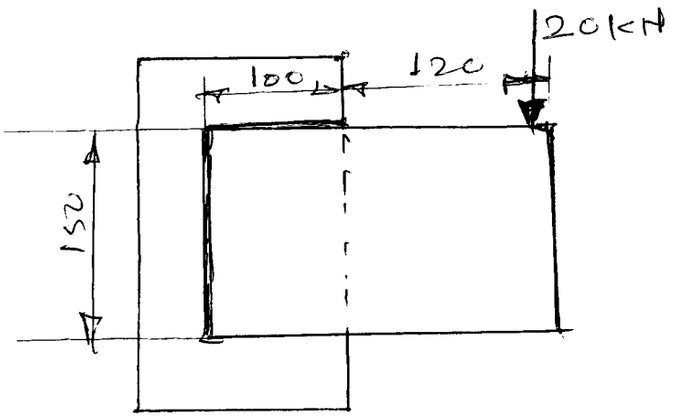
Q. 6 It is desired to design valve spring of IC engine for the following details. **(13)**

a) Spring load = 80 N when valve is closed.
b) Spring load = 100 N when valve is open.
c) Space constraints for the fitment of spring are
Inside guide bush diameter = 24 mm
Outside recess diameter = 36 mm
d) Valve lift = 5 mm
e) Spring steel has following properties
maximum permissible shear
stress = 350 MPa.
Modulus of rigidity = $8.4 \times 10^4\ N/mm^2$
f) Spring ends are sequenced and ground

design:

i) Wire diameter
ii) Spring Index
iii) Total No. of coils
iv) Solid length of spring
v) Free length of spring
vi) Pitch of the coil when additional 15 % of working deflection is used to avoid complete closing of coils

Q. 7 Fig. shows a welded joint subjected to an eccentric load of 20 kN. The welding in only on one side. If the permissible shear stress for the weld material is 80 MPa determine the weld size. **(13)**



Q. 8 **a)** The mechanical component is subjected to the following bending stress cycles: **(08)**

$\pm\ 400\ N/mm^2$ for 60 % of time

$\pm\ 500\ N/mm^2$ for 10 % of time

$\pm\ 250\ N/mm^2$ for remaining time

The component is made of plain carbon steel 50 C 4 (S_{ut} = 600 N/mm^2). If the endurance limit of the component is 280 N/mm^2. Determine its life.

b) What are the different methods of reducing stress concentration? **(05)**

* * * * *