PAPER ID-310556

Subject Code: NME501

Roll No: | | | | | | | | | | | | | |

B. TECH
(SEM-V) THEORY EXAMINATION 2020-21
MACHINE DESIGN-I

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a.	What is main reason for the use of alloy steel in machine parts?
b.	What do you understand by Mechanical Engineering design?
c.	State the factors which influences the endurance limit of a ductile material
d.	Define S-N Curve.
e.	Describe the effect of keyway on shaft strength briefly.
f.	State the advantage and limitation of hollow shaft
g.	Define splines.
h.	State advantages of flexible coupling
i.	Classify various types of spring
j.	Why efficiency of self-locking square threads is less than 50 %?

SECTION B

2. Attempt any *three* of the following: 10x3=30

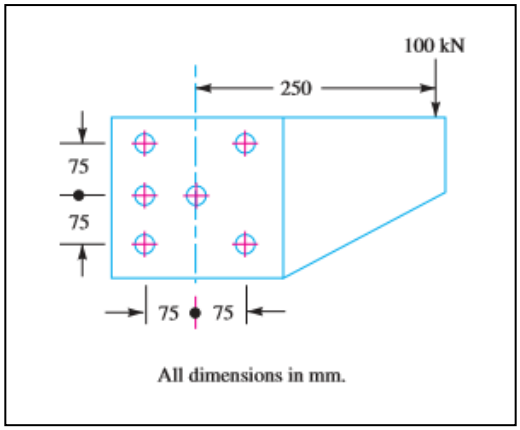
a.	What are the different stages in design of machine element, Explain it with example?
b.	A shaft, made of plain carbon steel $30C_8$ is subjected to a bending moment varying from -200 N-m to 500 N-m and a torque varying from 50 N-m to 175 N-m. The stress concentration factor is 1.85, notch sensitivity is 0.9 and reliability is 99.9%. if factor of safety is 2. Determine diameter of shaft.
c.	A shaft is subjected to a bending moment of 15 N-m and transmits 5 KW power at 500 r.p.m. The permissible shear stress and permissible tensile stress for the shaft are 40 N/mm^2 and 58 N/mm^2 respectively. Determine the diameter of the shaft
d.	Design the rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key and shaft material are 42 N/mm^2 and 72 N/mm^2 respectively
e.	A helical valve spring is subjected to a compressive load ranging from 90 KN when valve is closed to 140 N when valve is open. If the deflection of spring is limited 8 mm, deign the spring. Take G= 84 GPa

SECTION C

3. Attempt any *one* part of the following: 10x1=10

a.	A cylindrical shaft, made of steel having yield strength of 600 MPa, is subjected to a static load consisting of bending moment of 10 KN-m and torsional moment of 30 KN-m. Assuming factor of safety 2, find the required diameter of shaft using maximum shear stress theory Take E= 210 GPa and Poisson's ratio= 0.25
b.	A bolt, made of plain carbon steel (S_{yt}=300 N/mm^2 and Poisson's ratio=0.25), is subjected to tensile load of 25 KN and shear load of 10 KN. If the required factor of safety is 2.5. determine the diameter of bolt using: (i) The maximum principal stress theory (ii) The maximum shear stress theory

4. Attempt any *one* part of the following: 10x1=10

a.	A double riveted lap joint is to be used to carry a load of 350 KN. If the rivets are of 20 mm in diameter, design the joint using following allowable stresses
b.	A bracket is riveted to a column by 6 rivets of equal size as shown in figure. It carries a load of 100 KN at a distance of 250 mm from the column. If the maximum shear stress in rivet is limited to 63 MPa. Find the diameter of the rivet. 

5. Attempt any *one* part of the following: 10x1=10

a.	Compare the strength of a hollow shaft with that of solid shaft of same diameter and material of diameter ratio is 0.75.
b.	A mild steel shaft transmits 23 KW power at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearing 2.5 m apart. The allowable shear stress for the shaft is 42 MPa, while the maximum tensile and compressive stress is not exceeding 56 MPa. If the shaft is subjected to the gradually applied load, determine the diameter of the shaft. The shock and fatigue factor are K_b= 1.5 and K_t= 1.0

6. Attempt any *one* part of the following: 10x1=10

a.	A shaft of 100 mm diameter is used for transmitting 60 KW power at 300 r.p.m, if the allowable crushing stress for key is 175 N/mm^2. Design the taper key
b.	A flange coupling is used to connect two commercial shafts of diameter 50 mm. four bolts of same material as that of shaft are used in the coupling on a bolt circle of 240 mm diameter. The web thickness is 22 mm. determine the size of the bolts required and power transmitted at 2000 r.p.m

7. Attempt any *one* part of the following: 10x1=10

a.	The helical compression spring, made of cold drawn steel wire of ultimate tensile strength 1000 MPa, is subjected to a force of 500 N. The spring deflects by 20 mm under the force. The spring index is 6. If the permissible shear stress is 50 % of ultimate tensile strength and modulus of rigidity is 81 GPa Calculate (i) The wire diameter (ii) The mean coil diameter (iii) The number of effective coils (iv) The free length of spring
b.	Explain the procedure for design of screw jack.