

**5TH SEM./ DIP. IN MECH./ MECH(MAINT)/ MECH(PROD)/ MECH(SAND)/
MECHANICAL/ MECH(IND. INT) / 2022(W)**

Th2 Design of Machine Elements

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks
DATA BOOKS ALLOWED

1. Answer **All** questions 2 x 10
 - a. What is meant by Spring Rate and Pitch?
 - b. Define the term: Factor of Safety.
 - c. What is Modulus of Rigidity?
 - d. What are the different types of keys?
 - e. What is rivet? State its uses.
 - f. Define welding and types of welding process.
 - g. What is the pressure vessel?
 - h. What is spring? Classify spring into its various types.
 - i. State the formula for stress in helical spring of a circular wire.
 - j. State four general considerations in Machine design.

2. Answer **Any Six** Questions 6 x 5
 - a. What is the function of shaft coupling? Describe requirements of a good shaft coupling.
 - b. Explain the failures of a riveted joint.
 - c. Describe the mechanical properties of the material.
 - d. Two plates of 10mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet diameter, rivet pitch, strap thickness of the joint. Take the working stresses intension and shearing as 8MPa and 60MPa respectively.
 - e. A line shaft rotating at 200 rpm is to transmit 20kW. The shaft may be assumed to be made of mild steel with an allowable shear stress of 42MPa. Determine the diameter of the shaft neglecting the bending moment on the shaft.
 - f. Briefly explain the advantages and disadvantages of Welded Joints over Riveted Joints.
 - g. State the application of Saddle keys, Tangent keys, Round keys, Splines keys and Woodruff keys with neat sketches.

- 3 Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40kW at 350 rpm. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40MPa and 80MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15MPa. 10
- 4 Design a close coiled helical compression spring for a service load ranging from 2250N to 2750N. The axial deflection of the spring for the load range is 6mm. Assume a spring index of 5. The permissible shear stress intensity is 420MPa and modulus of rigidity $G=84\text{kN/mm}^2$. Neglect the effect of shear concentration. Draw a fully dimensioned sketch of the spring showing details of the finish of the end coils. 10
- 5 Write down the general Procedure followed in Machine Design. 10
- 6 A plate 100mm wide and 12.5mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50kN. Find the length of the weld so that the maximum stress does not exceed 56MPa. Consider the joint first under static loading and then under fatigue loading. 10
- 7 Design the rectangular key for a shaft of 50mm diameter. The shearing and crushing stresses for the key material are 42MPa and 70MPa. 10