



KERALA AGRICULTURAL UNIVERSITY  
B. Tech. (Agrl. Engg.) 2019 Admission

III Semester Final Examination – February 2021

Fpme 2104

Machine Design (2+0)

Marks: 50  
Time: 2 hours

- I Fill in the blanks (10x1=10)**
1. Ability of material to absorb energy when deformed elastically is known as \_\_\_\_\_.
  2. Resistance developed by surface of any material is known as \_\_\_\_\_.
  3. Oxygen to acetylene ratio in the case of oxidizing flame is \_\_\_\_\_.
  4. Woodruff key permits \_\_\_\_\_ movement between shaft and the hub.
  5. \_\_\_\_\_ gear can be used for power transmission in intersecting shafts.
- State True or False**
6. Deformation that occurs due to stress over a period of time is known as creep.
  7. The principle of wedge action is used in cotter joint.
  8. A coupling is a mechanical device that temporarily joins two rotating shafts to each other.
  9. The teeth of the helical gears are cut parallel to the shaft axis.
  10. In order to have a good grip on the pulley, the V-belt should touch the bottom of the groove in the pulley.
- II Write short notes on ANY FIVE of the following (5x2=10)**
1. A 50 mm diameter solid shaft is welded to a flat plate by 10 mm fillet weld. Find the maximum torque that the welded joint can sustain if the maximum shear stress intensity in the weld material is not to exceed 80 MPa.
  2. How welded joint differs from riveted joint?
  3. Briefly explain about leaf springs.
  4. A line shaft rotating at 200 rpm is to transmit 20 kW. The shaft may be assumed to be made of mild steel with an allowable shear stress of 42 MPa. Determine the diameter of the shaft, neglecting the bending moment on the shaft.
  5. Briefly explain about the function of a key.
  6. When do we prefer a V-belt to a flat-belt?
  7. What do you mean by backlash in gears?
- III Answer ANY FIVE of the following (5x4=20)**
1. Discuss about maximum principal stress theory.
  2. Differentiate between a cotter joint and a knuckle joint.
  3. Differentiate crown gear and miter gear.
  4. Define the term bearing characteristics number.
  5. A 45 mm diameter shaft is made of steel with yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2.
  6. A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm<sup>2</sup>, find the axial load which the spring can carry and the deflection per active turn.
  7. Design and make a neat dimensional sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW 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 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.

**IV**

**Write an essay on ANY ONE of the following**

**(1x10=10)**

1. A gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and rpm of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth have 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and the material combination factor for the wear as 1.4.
2. A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10,000 N-m. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and an ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft.

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