



KERALA AGRICULTURAL UNIVERSITY  
B.Tech. (Food Engg. & Tech.) 2018 Admission

V Semester Final Examination-February 2021

Meen.3107

Machine Design (2+1)

Marks:50  
Time: 2hours

**I Choose the correct Answer**

(10x1=10)

- Steel containing up to 0.15% carbon is known as:  
(a) mild steel (b) dead mild steel  
(c) medium carbon steel (d) high carbon steel
- The material commonly used for crane hooks is:  
(a) cast iron (b) wrought iron  
(c) mild steel (d) aluminium
- The taper on cotter varies from:  
(a) 1 in 15 to 1 in 10 (b) 1 in 24 to 1 in 20  
(c) 1 in 32 to 1 in 24 (d) 1 in 48 to 1 in 24
- The length of cotter, in a sleeve and cotter joint, is taken as:  
(a) 1.5 d (b) 2.5 d  
(c) 3 d (d) 4 d
- A key made from a cylindrical disc having segmental cross-section, is known as:  
(a) feather key (b) gib head key  
(c) woodruff key (d) flat saddle key
- Oldham coupling is used to connect two shafts:  
(a) which are perfectly aligned (b) which are not in exact alignment  
(c) which have lateral misalignment (d) whose axes intersect at a small angle
- Two shafts will have equal strength, if:  
(a) diameter of both the shafts is same (b) angle of twist of both the shafts is same  
(c) material of both the shafts is same (d) twisting moment of both the shafts is same
- All the types of levers are subjected to:  
(a) twisting moment (b) bending moment  
(c) direct axial load (d) combined twisting and bending moment
- When the speed of belt increases,  
(a) the coefficient of friction between the belt and pulley increases (b) the coefficient of friction between the belt and pulley decreases  
(c) the power transmitted will decrease (d) the power transmitted will increase
- A sliding bearing which can support steady loads without any relative motion between the journal and the bearing is called:  
(a) zero film bearing (b) boundary lubricated bearing  
(c) hydrodynamic lubricated bearing (d) hydrostatic lubricated bearing

**II Write Short notes on ANY FIVE of the following**

(5x2=10)

- What are the different stages of designing machine elements?
- Which theories of failure are applicable for shaft design?
- What types of stresses are produced in a belt used for power transmission?
- How is the strength of a shaft affected by the key way?
- What do you mean by stiffness and rigidity of a shaft?

6. Draw stress-strain diagram for a ductile material.
7. What do you mean by a bolt of uniform strength?

**III Answer ANY FIVE of the following (5x4=20)**

1. What are different types of design? State the general design procedure used in design of machine element.
2. What are the considerations in the design of dimensions of formed and parallel key having rectangular cross-section?
3. 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.
4. Design a knuckle joint to connect two mild steel bars under a tensile load of 25 kN. The allowable stresses are 65 MPa in tension, 50 MPa in shear and 83 MPa in crushing.
5. Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used :  
Shear stress for shaft, bolt and key material = 40 MPa  
Crushing stress for bolt and key = 80 MPa  
Shear stress of cast iron = 8 MPa
6. Design the elliptical cross-section of a belt pulley arm near the hub for the following specifications:  
The mean pulley diameter is 300 mm and the numbers of pulley arms are 4. The elliptical section has major axis twice the minor axis length. The tight and slack side's tension in the belt are 600 N and 200 N respectively. Assume half number of arms transmit torque at any time and the load factor of 1.75 to account for dynamic effects on the pulley while transmitting torque. The permissible tensile stress for cast iron pulley material is 15 MPa. The pulley hub diameter is 60 mm.
7. Define 'mechanical property' of an engineering material. State any six mechanical properties, give their definitions and one example of the material possessing the properties.

**IV Write an essay on ANY ONE of the following (1x10=10)**

1. Beam strength of gear teeth.
2. Explain the design procedure of a rigid flange coupling and compare rigid with flexible coupling.

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