KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Food Engg.) 2017 Admission
V Semester Final Examination-December 2019

Meen 3107 **Machine Design (2+1)** **Marks:50**
Time: 2 hours

I **Fill in the blanks:** **(10x1=10)**

1. The maximum value of stress concentration factor around a circular hole in a plate is ____
2. Couplings are usually made of _____ material.
3. If the ratio of free length to mean coil diameter of a helical spring is greater than four, _____ failure mode also to be analyzed during design.

Define

4. A steel id designated as Fe E250. What is the meaning of this designation?
5. A thread is specified by M 16 X 1.5. What do you understand from this representation?
6. Which of the following properties is critical in the design of a component subjected to cyclic loading? (Yield strength, UTS, Fatigue strength, Hardness).

State True or False

7. In pure bending, shear stress is maximum.
8. Maximum principal stress theory of failure is used for the design of brittle materials.
9. Keys are loaded in shear; hence brittle materials are used for the design of keys.
10. Helical gear drives are used for rough operation.

II **Write Short notes on ANY FIVE of the following** **(5x2=10)**

1. What are the different phases of design? Explain.
2. Explain important mechanical properties of materials.
3. What is maximum shear stress theory of failure? What type of material can be designed using this theory?
4. Explain mean and alternating stresses.
5. Explain shock and fatigue factor in shaft design.
6. What are the stresses acting in a thin cylindrical shell?
7. Explain Wahl's stress factor in springs.

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

1. What is factor of safety? What are the factors to be considered in fixing factor of safety?
2. Differentiate between knuckle joint and cotter joint.
3. A cast iron cylinder head is fastened to a 0.5 m inside diameter cylinder by means of 8 bolts. Consider the bolt is extremely flexible as compared to the bolted parts. For an internal pressure of 1.4 MPa, what is the axial force on each bolt if the bolts were tightened just enough to prevent the joint opening under a pressure of 2.1 MPa.
4. A flange coupling is used to transmit 30 kW at 250 r.p.m. Find the standard bolt size if 6 bolts are mounted at 250 mm bolt circle diameter. The allowable shear stress may be taken as 35 MPa.

P T O

5. Explain the procedure for the design of a shaft subjected to combined bending and torsion.
6. What is the required thickness of 1.8 m diameter thin cylinder to withstand an internal pressure of 7 MPa if the allowable tangential stress is 150 MPa?
7. Explain static and dynamic load carrying capacity of rolling contact bearings.

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

1. A bearing for a compressor shaft is to carry a radial load of 2000 N and a thrust load of 1000 N. The service imposes a light shock with shock factor 1.5. The bearing is to be used for 8 hours per day and 6 days per week for 5 years. The speed of shaft is 1200 r.p.m. and its diameter is 50 mm. Assume that the inner ring is rotating. Select a suitable ball bearing.
2. A laminated semi elliptic leaf spring of truck is to carry a central load of 30 kN. The center-to-center distance between the spring eyes is 1.3 m. The spring has 12 leaves of which two are full length and have been pre-stressed so that all the leaves have the same stress after the full load have been applied. The leaves are held together at the center by a band of width 100 mm. The leaves are made of steel with ultimate strength 1500 MPa. Take a factor of safety of 3. Design the spring. Also calculate the initial nip, pre-load to close the nip and the maximum deflection.

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