



KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Agrl. Engg.) 2023 & Previous Admissions
III Semester Final Examination – January 2025

Fpme.2104

Machine Design (2+0)

Marks: 50
Time: 2 hours

I State True or False (10x1=10)

1. An aluminium member is design on the basis of elastic limit stress.
2. The spindles of bench vices are usually provided with knuckle threads.
3. The average shear stress in the hollow shaft is smaller than the average shear stress in the solid shaft.
4. A leaf spring in automobiles is used to store strain energy.
5. The ratio of number of teeth to the pitch circle diameter in millimeter is called circular pitch.

Fill in the blanks

6. The yield point in a static loading isas compared to fatigue loading.
7. In the butt welded joint, the size of weld isthe throat of weld.
8. The taper on cotter varies from
9. A chain drive transmitspower as compared to belt drive.
10. In a boundary-lubricated bearing, there is aof lubricant between the journal and the bearing.

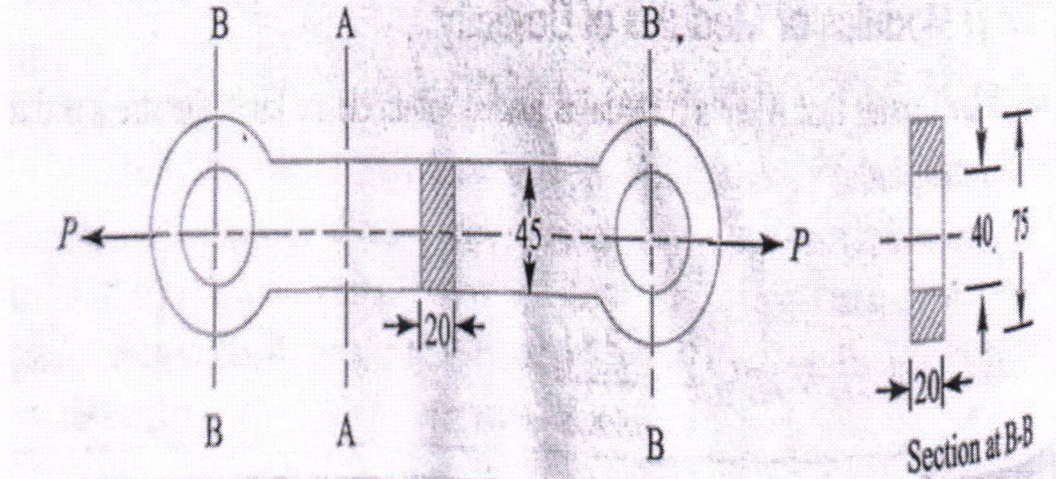
II Write short notes on ANY FIVE of the following (5x2=10)

1. What are the first and second critical speed of shaft?
2. What is saddle key? Why is saddle key suitable for light duty?
3. What is creep in belts? What is pitch width of V- belt?
4. What are the steps involved in design of machine element?
5. What are the types of stresses induced in power screw? Why are square threads preferred to V threads in power screws?
6. What is stud? Why hexagonal head is preferred for cap screw instead of square head?
7. What is the material of the rollers in antifriction bearings? Why taper roller bearing takes thrust and radial load?

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

1. A plate 100 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plate are subjected to a load of 50 kN. Find the length of the weld so that the maximum stress does not exceed 56 MPa. Consider the joint first under static loading and then under fatigue loading.
2. What is the difference between failure due to static load and fatigue failure? What are methods of reducing stress concentration?

3. A cast iron link, as shown in Fig .1 is required to transmit a steady tensile load of 45 kN. Find the tensile stress induced in the link material at section A-A and B-B.



4. A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN. for 10 percent of time, 2kN. for 20 percent of time, 1 kN. for 30 percent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 percent reliability, calculate dynamic load rating of the ball bearing.
5. Explain in detail the effects of nickel, copper, chromium, and molybdenum as alloying elements in cast iron.
6. A bronze spur pinion rotating at 600 r.p.m. drive a cast iron spur gear at transmission ratio of 4:1. The allowable static stresses for the bronze pinion and cast-iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 200full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength.
7. In the design of power screws, on what factors does the thread bearing pressure depend? Explain.

IV

Write an essay on ANY ONE of the following

(1x10=10)

- Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN . The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6.
- Design a sleeve and cotter joint to resist a tensile load of 60 kN . All parts of the joint are made of the same material with the following allowable stresses:
 $\sigma_t = 60 \text{ MPa}$; $\tau = 70 \text{ MPa}$; and $\sigma_c = 125 \text{ MPa}$.
