

PARUL UNIVERSITY
FACULTY OF AGRICULTURE
B.Tech., Winter 2019 - 20 Examination

Semester: 3
Subject Code: 20103206
Subject Name: Machine Design

Date: 29/11/2019
Time: 10:00am to 12:00noon
Total Marks:50

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 **(05)**

A Fill in the blanks

1. The toughness of a material _____ when it is heated.
a. Increases b. decreases c. does not change
2. The stress in the bar when the load is applied suddenly is _____ as compared to the stress induced due to gradually applied load.
a. Same b. double c. three times d. four times
3. The yield point in static loading is _____ as compared to fatigue loading.
a. Higher b. lower c. same
4. The longitudinal stress is _____ of the circumferential stress.
a. One-half b. two-third c. three-fourth d. double
5. Shaft coupling used in machinery to
a. Introduce mechanical flexibility c. introduce protection against overload
b. Reduce the transmission of shock load d. all of these
6. A single strap butt joint is always in _____ shear.
a. Single b. double c. three-times d. four-times
7. A bolt is designed on the basis of _____ with a large factor safety.
a. Direct tensile stress c. direct compressive stress
b. direct bending stress d. direct shear stress
8. The stress in the threaded part of the bolt will be _____ as compared to the shank.
a. Same b. higher c. lower
9. A cotter joint is used to connect two _____ rods.
a. Co-axial b. perpendicular c. parallel d. non parallel-non perpendicular
10. A hollow shaft will transmit a _____ torque than a solid shaft of the same mass and same material.
a. Smaller b. greater c. equal

B Multiple Choice Questions.**(10)**

1. Which of the following property is desirable in parts subjected to shock and impact loads?
 - a. Strength
 - b. stiffness
 - c. brittleness
 - d. toughness
2. Which of the following property is essential for the spring material?
 - a. Stiffness
 - b. ductility
 - c. resilience
 - d. malleability
3. The ratio of the ultimate stress to the design stress is known as
 - a. Elastic limit
 - b. strain
 - c. factor of safety
 - d. bulk modulus
4. When a machine member is subjected to torsion, the torsional shear stress induced in the member is
 - a. Zero at both centroidal axis and outer surface of the member.
 - b. Maximum at both centroidal axis and outer surface of the member.
 - c. Zero at centroidal axis and maximum at the outer surface of the member
 - d. Maximum at centroidal axis and Zero at the outer surface of the member
5. Stress concentration is caused due to
 - a. Variations in a load acting on a member
 - b. Variations in a property of a materials in a member
 - c. Abrupt change of cross-section
 - d. All of these
6. A pressure vessel is said to be a thick shell, if the ratio of wall thickness to its diameter is
 - a. Equal to 1/10
 - b. less than 1/10
 - c. greater than 1/10
 - d. none of these
7. The Design of pressure vessel is based on
 - a. Longitudinal stress
 - b. hoop stress
 - c. both (a) and (b)
 - d. none of these
8. In the assembly of pulley, key and shaft
 - a. Pulley is made weakest
 - b. Key is made the strongest
 - c. Key is made weakest
 - d. all the three are design for equal strength
9. When an open coiled helical compression spring is subjected to an axial compressive load, the Stress induced in the wire is
 - a. Tensile stress
 - b. compressive stress
 - c. shear stress
 - d. bending stress
10. The included angle for the V-belt is usually
 - a. 10°-20°
 - b. 30°-40°
 - c. 40°-60°
 - d. 60°-80°
11. Screws used for power transmission should have
 - a. Low efficiency
 - b. high efficiency
 - c. very fine threads
 - d. strong teeth
12. The antifriction bearings
 - a. Have low starting and low running friction at moderate speeds
 - b. Have high initial cost
 - c. Can carry both radial and thrust loads
 - d. all of these

13. In levers, leverage is the ratio of
- Load lifted to the effort applied
 - Mechanical advantage to the velocity ratio
 - load arm to the effort arm
 - effort arm to the load arm
14. The contact ratio for gears is
- Zero
 - less than one
 - greater than one
 - none of these
15. A universal coupling is used to connect two shafts which are
- Which are perfectly aligned
 - Which are not in exact alignment
 - have lateral misalignment
 - whose axes intersect at a small angle
16. When the shaft is subjected to combined twisting moment (T) and combined bending moment (M), then the equivalent bending moment is equal to
- $\frac{1}{2}\sqrt{M^2 + T^2}$
 - $\sqrt{M^2 + T^2}$
 - $\frac{1}{2}(M + \sqrt{M^2 + T^2})$
 - $M + \sqrt{M^2 + T^2}$
17. Maximum shear stress theory is used for
- Brittle materials
 - ductile materials
 - plastic materials
 - non-ferrous materials
18. Two shafts will have equal strength, if
- Diameter of both shafts is same
 - Angle of twist of both shafts is same
 - material of both shafts is same
 - twisting moment of both shaft is same
19. When a load W is applied suddenly on a bar of cross-sectional area A, the stress induced in the Bar will be
- $\frac{W}{A}$
 - $\frac{W}{2A}$
 - $\frac{2W}{A}$
 - $\frac{3W}{A}$
20. The transverse welded fillet joints are designed for
- Tensile strength
 - compressive strength
 - bending strength
 - shear strength

Q.2

(A) Define the following **(05)**

- Machine design
- Modulus of elasticity
- Yield point
- 'Pitch' of the screw
- Stress concentration
- Curved beam
- Butt joint

(B) Answer the following (Any five out of seven questions) **(05)**

- Differentiate between Torque and Moment.
- A square key of side $d/4$ is to be fitted on a shaft of diameter d and in the hub of pulley. If the material of the key and shaft is same and the two are to be equally strong in shear, if the diameter of shaft is 50mm then what is the length of key?
- How the hollow shafts are beneficial over the solid shafts?
- Why are square threads preferable to V threads for power transmission?

5. State the different applications of the Knuckle joint.
6. Distinguish between fatigue failure and creep phenomenon
7. Write the classification of welded joints.

Q.3 Write Short notes (Any five out of six questions)

(10)

1. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to 1. Maximum principal stress theory; 2. Maximum shear stress theory.
2. What is stress concentration? What are the different methods to reduce it?
3. Why the Knuckle pin is Designed in such a way that it will fail before failure of fork and single eye?
4. Explain various failures of bolted joints.
5. State the difference between shaft, axle and spindle.
6. Write a note on belt drives.

Q.4 Long Questions (Any three out of four questions)

(15)

1. Explain stress strain diagram for ductile material.
2. Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.
3. A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design.
4. A mild steel rod of 12 mm diameter was tested for tensile strength with the gauge length of 60 mm. Following observations were recorded: Final length = 80 mm; Final diameter = 7 mm; Yield load = 3.4 kN and Ultimate load = 6.1 kN. Calculate: 1. yield stress, 2. ultimate tensile stress, 3. percentage reduction in area, and 4 percentage elongation.