

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Nov. 2016

B. Tech in Mechanical Engineering, Semester III

Roll No.....

ME 306: Strength of Materials

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1 Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. For a circular shaft of dia. D subjected to torque T , the maximum value of the shear stress is ; (a) $64 T/\pi d^3$ (b) $32 T/\pi d^3$ (c) $16 T/\pi d^3$ (d) $8 T/\pi d^3$
- ii. Factor of safety is defined as the ratio of
(a) Ultimate stress to Working stress (b) Working stress to Ultimate stress
(c) Breaking stress to Ultimate stress (d) Ultimate stress to breaking stress
- iii. If the young's modulus of elasticity of a material is twice its modulus of rigidity, then the Poisson's ratio of the material is
a)-1 b) -0.5 c) 0.5 d) 0
- iv. Failure of a material is called fatigue when it fails
(a) At the elastic limit (b) Below the elastic limit
(c) At the yield point (d) Below the yield point
- v. If the length of a simply supported beam carrying a concentrated load at the center is doubled, the deflection at the center will become
a) two times b) four times c) Eight times d) sixteen times
- vi. A shaft turns at 150 rpm under a torque of 1500 N-m. Power transmitted is
a) 15π kW b) 10π kW c) 7.5π kW d) 5π kW
- vii. Units of strain are
a) mm/m b) mm/mm c) m/mm d) no units
- viii. In a Mohr's circle, the radius gives the value of
a) Minimum shear stress b) Maximum normal stress
c) Maximum normal stress d) Maximum shear stress
- ix. The variation of shear force due to a uniformly distributed load is by
a) Cubic law b) Parabolic law c) Linear law d) Uniform law
- x. The equivalent length of a column fixed at one end with other free is
a) 1 b) 2l c) $l/1.414$ d) $l/2$

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- (i) What is the difference between crushing and buckling failures of a column?
- (ii) Differentiate between thin and thick shells.
- (iii) Define the principle of superposition.
- (iv) Enumerate various methods to determine slope and deflection at a point of a beam.

Q.3A	Find an expression for elongation of a bar of rectangular section due to its self weight.	05
Q.3B	What is Mohr's stress circle? How is it useful in the solution of stress-analysis problems?	05
Q.4A	A simply supported beam of 8 m length carries three point loads of 8 kN, 4kN and 10 kN at 2 m, 5 m and 6 m respectively from the left end. Draw the shear force and bending moment diagrams.	05
Q.4B	Describe types and uses of springs.	05
Q.5A	Derive the torsion equation and state the assumptions made.	05
Q.5B	A solid shaft is to transmit 337.5 kW at 120 RPM. If the shear stress is not to exceed 80 N/mm ² , find the diameter of the shaft. What percent saving in weight would be obtained if this shaft were replaced by a hollow one whose internal dia equals 0.6 of the external dia, the length, material and maximum stress being the same?	10
Q.6A	Define bending stresses, section modulus and moment of resistance.	05
Q.6B	A Cast iron test beam 20mmX20mm in section and 1 m long and supported at the ends fails when a central load of 640 N is applied. What UDL will break a cantilever of the same material 50 mm wide, 100 mm deep and 2 m long.	10
Q.7	A beam, simply supported at ends A and B is loaded with two point loads of 60 KN and 50 KN at distance 1m and 3m respectively from end A. Determine the position and magnitude of maximum deflection. Take $E=2 \times 10^5$ and $I = 8500 \text{ Cm}^4$	10
Q.8A	Find the Euler's crushing load for a hollow cylindrical cast iron column 200 mm external dia and 25 mm thick, if it is 6 m long and is hinged at both ends. Take $E=80 \text{ kN/mm}^2$. Compare this load with the crushing load as given by Rankine's formula using constants $f_c = 550 \text{ N/mm}^2$ and $a=1/1600$.	10
Q.8B	Derive an expression for the crippling load of a long column when both ends are hinged	10
OR		
Q.8B	Derive an expression for the crippling load of a long column when both ends are hinged	10

----- BEST OF LUCK -----