P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

Nov-Dec 2021

SECV2102 Advanced Solid Mechanics

07.12.2021, Tuesday **Time: 09:00 a.m. To 11:30 a.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1 Answer the following (Any five) **[05]**

(i) What is neutral axis?

(ii) Define pure bending

(iii) The maximum shear stress is at the N.A. for a circular section is given by _____.

(a) $q_{max} = 1.2\ q_{avg}$

(b) $q_{max} = 1.5\ q_{avg}$

(c) $q_{max} = 1.7\ q_{avg}$

(d) $q_{max} = 2.0\ q_{avg}$

(iv) In case of triangular section, the sear stress is not maximum at the N.A. The shear stress is maximum at a height of _____.

(v) What is eccentricity?

(vi) Define core or kernel of a section.

Q - 2 (a) A beam is simply supported and caries a uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 N/mm^2 and moment of inertia of the section is 7 x 10^8 mm^4, find the span of the beam. **[05]**

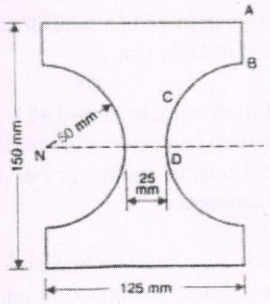
Q - 2 (b) A rectangular beam 250mm wide and 320 mm deep is subjected to a maximum shear force of 50kN, determine? **[05]**

1. Average shear stress,
2. Maximum shear stress, and
3. Shear stress at a distance of 20 mm above the neutral axis.

OR

Q - 2 (a) A rectangular beam 200mm deep and 400mm wide is simply supported over a span of 5m. What uniformly distributed load per meter the beam may carry, if the bending stress is not to exceed 140 N/mm 2 . **[05]**

Q - 2 (b) Fig. shows a section, which is subjected to a shear force of 100Kn. Determine the shear stress distribution also. **[05]**



Q - 3 (a)	Derive Bending Equation for a Beam.	**[05]**
Q - 3 (b)	A short column of external diameter 40 cm and internal diameter 20 cm carries an eccentric load of 80 kN. Find the greatest eccentricity which the load can have without producing tension on the cross-section.	**[05]**

OR

Q - 3 (a)	Derive Shear Stress equation for a triangular section.	**[05]**
Q - 3 (b)	A masonry pier of 3m x 4m supports a load of 40 kN 1m from smaller and 1m larger side find stresses developed at each corner of the pier.	**[05]**
Q - 4	Attempt any one.	**[05]**
(i)	Derive an equation of Kernel for hollow circular section.	
(ii)	Draw a neat sketch of Kernel of a hollow rectangular section of outer cross section 300 mm x 200 mm and inner cross section 150 x 100 mm.	

SECTION – II

Q - 1	Answer the Following: (Any five)	**[05]**
(i)	List out the various important dams.	
(ii)	A dam is constructed to store _____and retaining wall is constructed to retain _____.	
(iii)	What is strut?	
(iv)	The maximum axial compressive load which a column can take without failure by lateral deflection is called_____ (a) critical load (b) buckling load (c) crippling load (d) any one of the above	
(v)	The power transmitted by a shaft is given by_____.	
(vi)	Write equation for polar moment of inertia for solid shaft.	
Q - 2 (a)	A masonry dam of rectangular section 20 m high and 10 m wide, has water up to a height of 16 m on its one side. Find: (1) Pressure force due to water on one meter length of the dam. (2) Position of centre of pressure. Take the weight density of masonry = 19.62 kN/m^3 and of water = 9.81 kN/m^3.	**[05]**
Q - 2 (b)	a. A solid round bar 3 m long and 5 cm in diameter is used as a strut with both ends hinged. Determine the crippling load. Take E = 2.0 X 10^5 N/mm^2.	**[05]**

OR

Q - 2 (a)	A masonry dam whose width at bottom as 3 m, width at top as 1 m and height of dam as 4m. The dam retains the water to the full depth of dam as 4m. The coefficient of friction between the base of the dam and the earth underneath is 0.7. Check if the wall is safe from sliding. Take the wight of dam material as 18 kN/m^3. Consider length of dam as 1m.	**[05]**
Q - 2 (b)	a. A hollow mild steel tube 6 m long 4 cm internal diameter and6 mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. E = 2.0 X 10^5 N/mm^2.	**[05]**
Q - 3 (a)	A solid shaft of 150 mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced to the shaft is 45 N/mm^2.	**[05]**
Q - 3 (b)	Find the maximum shear stress induced in a solid circular shaft of diameter 15 cm when the shaft transmits 150 kW power at 180 r.p.m.	**[05]**

OR

Q - 3 (a)	The sharing stress is a solid shaft is not to exceed 40 N/mm^2 when the torque transmitted is 20000 N.m. Determine the minimum diameter of the shaft.	**[05]**
Q - 3 (b)	A solid cylindrical shaft is to transmit 300 kW power at 100 r.p.m. If the shear stress is not exceed 80 N/mm^2, find its diameter.	**[05]**
Q - 4	Attempt any one.	**[05]**
(i)	A 1.5 m long column has a circular cross section of 5 cm diameter. One of the ends of the column is fixed in direction and position and other end is free. Taking factor of safety as 3,	

calculate the safe load using Rankine's formula. Take yield stress f_c = 560 N/mm^2 and α = 1/1600 for pinned ends.

(ii) A trapezoidal dam with a vertical water face is 3m wide at the top and 16 m wide at the base, and is 30 m high. Determine the maximum depth of water so that no tension develops in the dam. Take the weight of masonry as 20 kN/m^3 and of water as 10 kN/m^3. Length of dam as consider 1m.

****