QUESTION PAPER CODE- 54015

University Institute of Engineering & Technology

(Recognised Under Section 2(f) and 12B of UGC)

Kurukshetra University, Kurukshetra

Roll No. -

THEORY EXAMINATION – May 2019		TIME – 3 Hrs.
B.TECH - Mechanical	SEMESTER - IV	M.M. - 75

PAPER– ME-206	SUBJECT– Mechanics of Solids-II

Note: All questions in Part-A and Part-B are compulsory. Attempt any four questions from Part-C selecting at least one from each unit.

PART-A (15 Marks)

Q. No. – 1 Answer the following questions. 15x1=15

(i)	A rectangular block of size 200mm x100mm x 50mm is subjected to ashear stress of 500 kg/cm^2. If the modulus of rigidity of the material is 1x10^6, kg/cm2, the strain energy stored will be _____
(ii)	If two springs of stiffness k_1 and $k_2$are connected in series, thestiffness of the combined spring is _____
(iii)	All the failure theories give nearly the same result. a) When one of the principal stresses at a point is large in comparison to the other b) When shear stresses act c) When both the principal stresses are numerically equal d) For all situations of stress.
(iv)	In a hollow circular rotating disc of inner radius r_1 and outer radius r_2, the radial stress is maximum at r = _____
(v)	Write the expression for position of neutral axis in case of beams with large initial curvature.
(vi)	Two closed coil springs are made from the same small diameter wire, one wound on 2.5 cm diameter core and the other on 1.25 diameter core. If each spring had n coils, then the ratio of their spring constants should be _____
(vii)	Two shafts of solid circular cross-section are identical except for their diameters $d_1$and d_2. Under the same torque, the ratio of strain energy stored in each shaft (U_1/ U_2) will conform to the _____.
(viii)	For a T-section, shear centre is located at a) Centre of the vertical web b) Centroid of horizontal flange c) At the Centroid of the section d) None of the above
(ix)	The distribution of stress along a section of a curved bar subjected to a bending moment tending to increase its curvature is a) Linear b) Uniform c) Parabolic d) Hyperbolic

(x)	A thin cylindrical shell with D/t ratio equal to 40 subjected to an internal pressure of 2 N/mm^2. The yield point stress of the material is 210 N/mm^2. Using the maximum shear stress theory for designing the thin shell, The Factor of safety is _____.
(xi)	In a thick cylinder of inner radius R_1, wall thickness t, an internal pressure p producesmaximum hoop tension 1.25 p. The magnitude of wall thickness will be _____
(xii)	What is the expression for position of neutral axis in case of bending of curved bars?
(xiii)	A thin walled cylindrical vessel of wall thickness, t and diameter d is fittedwith gas to a gauge pressure of p. The maximum shear stress on the vessel wall will be _____
(xiv)	If a thick cylindrical shell is subjected to internal pressure, then hoop stress,radial stress and longitudinal stress at a point in the thickness will be: a) Tensile, compressive and compressive respectively b) All compressive c) All tensile d) Tensile, compressive and tensile respectively
(xv)	Define the Proof Load in case of laminated Spring.

PART-B (20 Marks)

	UNIT-I	
2	A mild steel shaft of 50 mm diameter is subjected to a beading moment of 1.5kNm and torque T. If the yield point of steel in tension is 210 MPa, find themaximum value of the torque without causing yielding of the shaft materialaccording to (i) Maximum principal stress theory (ii) Maximum shear stress theory.	5
	UNIT-II	
3	A thin cylinder of 100 mm internal diameter and 5 mm thickness is subjectedto an internal pressure of 10 MPa and a torque of 2000 Nm. Calculate themagnitudes of the principal stresses	5
	UNIT-III	
4	A close coiled helical spring is to have a stiffness of 0.9 kg/cm in compression and-with a-maximum load of 4·5 kg and a maximum shearing stress of 1200 kg/cm3• Thesolid length of the spring (i.e. coils touching) is 4·5 cm. Find the wire diameter, mean coil diameter and number of coils. G=400 tonnes/cm^2.	5
	UNIT-IV	
5	A steel disc of a turbine is to be designed so that the radial and circumferential stresses are to be the same and constant throughout and equal to 80 N/mm^2,when running at 3500 rpm. If the axial thickness at the centre is 1.5 cm, what is the thicknessat a radius of 50 cm? Density for steel= 0.0078 kg/cm^3, g=981 cm/sec^2	5

PART-C (40 Marks)

	UNIT-I	
6	Derive the expression for stress induced in a body when the load is applied with impact. A crane chain whose sectional area is 6.25 cm^2 carries a load of 10 kN. As it is being lowered at a uniform rate of 40 m per minute, the chain gets jammed suddenly, at which the time the length of the chain unwound is 10 m. Estimate the stress induced in the chain due to the sudden stoppage. Neglect the weight of the chain. Take E = $2.1x10^5$ N/mm^2	10

7	In a steel member, at a point the major principal stress is 180 MN/m^2 and the minor principal Stress is compressive. If the tensile yield point of the steel is 225 MN/m^2, find the value of the Minor principal stress at which the yielding will commence, according to each of the following criteria of failure. i) Maximum shear stress theory ii) Maximum total strain energy theory iii) Maximum shear strain energy theory iv) Maximum principal stress theory	10
	UNIT-II	
8	A copper tube 30 mm bore and 3 mm thick is plugged at its ends. It is just filled with water at atmosphere pressure. If an axial compressive load of 8 kN is applied to the plugs, find by how much the water pressure will increase? The plugs are assumed to be rigid and fixed to the tube. Take: E = 100 GN/m^2, Bulk modulus = 2.2 GN/m^2; Poissson's ratio = 0.33	**10**
9	A thick walled steel cylindrical shell of internal diameter 150 mm and external diameter 500mm is subjected to fluid pressure of 100 MPa. Calculate the principal stress at a point on theinside surface of the cylinder and calculate the increase in inside diameter due to fluid pressure. Assume E = 200 kN/mm^2 and poisson's ratio = 0.3.	**10**
	UNIT-III	
10	Determine the intensities of principal stresses in a flat steel disc of uniform thickness having a diameter of 1m and rotating at 2400 rpm. Take density as 7850 kg/m^3 and Poisson's ratio as 1/3. Also calculate the stresses if the disc has a central hole of 0.2 m diameter.	**10**
11	A laminated carriage spring made of 10 steel plates is 1.2 m long. The maximum central load is 400 kg. If the maximum allowable stress in steel is 2400 kg/cm^2 and the maximum deflection is 5 cm, find the thickness and width of the plates. *E = 210 GN/m^2*	10
	UNIT-IV	
12	A crane hook having a trapezoidal horizontal cross- section is 50 mm wide at inside and 25 mm wide at outside. The thickness of section is 50 mm. The crane hook carries a vertical load of 10 kN whose line of action is 38 mm from the inside edge of the section. The centre of curvature is 50 mm from the inside edge. Estimate the extreme intensities of stress in the section.	**10**
13	a) Explain in brief how stresses in beams due to unsymmetrical bending is considered. b) Discuss in brief the method of locating shear centre.	**05** **05**