QPC: RD19BTECH029 AR 19 Reg. No | | | | | | | | | | |

# GIET UNIVERSITY, GUNUPUR – 765022

B. Tech ( Third Semester – Regular) Examinations, December – 2020

## BPCCV 3020 – MECHANICS OF MATERIALS

## (CIVIL ENGINEERING )

Time: 2 hrs Maximum: 50 Marks

**The figures in the right hand margin indicate marks.**

**PART – A: (Multiple Choice Questions)(1 x 10 =10 Marks)**

Q.1. Answer ***ALL*** questions [CO#] [PO#]

a. The ability of material to absorb a large amount of energy is [CO1] [PO1]

(i) Hardness (ii)Ductility

(iii) Toughness (iv) Resilience

b. The material of a rubber balloon has a poisson's ratio of 0.5. if uniform pressure is applied to blow the balloon, the volumetric strain of the material will be [CO1] [PO2]

(i) 0.50 (ii) 0.25

(iii)0.20 (iv)zero

c. A beam has a solid circular cross-section having diameter d. if a section of the beam is subject to a shear force F, the maximum shear stress in the cross-section is given by [CO1] [PO3]

(i) $4F/3\pi d^2$ (ii) $16F/3\pi d^2$

(iii) $8F/3\pi d^2$ (iv) $3F/16\pi d^2$

d. A rectangular beam is to be cut from a circular log of wood of diameter D. the ratio of the two sides (width to depth ) of the rectangle for strongest section in bending should be [CO2] [PO1]

(i) $\sqrt{2}$ (ii) 3/2

(iii) $1/\sqrt{2}$ (iv) 3/4

e. In a shaft subjected to pure twist, the shear stress at any section is maximum at [CO2] [PO1]

(i) Centre of section (ii) Mid radius

(iii) Surface (iv) ¾ radius from centre

f. An element is subjected is to two mutually perpendicular unlike, but equal stresses of 'p'. The radius of Mohr's circle will be [CO2] [PO4]

(i) zero (ii) p/2

(iii) p (iv) 2p

g. The plane of maximum shear stress has normal stress that is [CO2] [PO1]

(i) maximum (ii) minimum

(iii) zero (iv) none of the above

h. A cast iron pipe of 1m dia is required to withstand a 200 m head of water. If the limiting tensile stress of the pipe material is 20 MPa, then the thickness of the pipe will be [CO3] [PO3]

(i) 25mm (ii) 50mm

(iii) 75mm (iv) 100mm

i. The falling of a very long column is essentially by [CO3] [PO1]

(i) crushing (ii) buckling

(iii) both (i) and (ii) (iv) none

j. A steel column, pinned at both ends, has a buckling load of 200kN. If the column is restrained against lateral movement at its mid height, its buckling load will be [CO3] [PO2]

(i) 200kN (ii) 283kN

(iii) 400kN (iv) 800kN

## PART – B: (Short Answer Questions) (2 x 5 = 10 Marks)

Q.2. Answer ***ALL*** questions [CO#] [PO#]

a. What is modulus of elasticity, bulk modulus, and rigidity modulus? [CO1] [PO1]

d. Write any four assumptions in the theory of simple bending [CO2] [PO1]

e. Draw qualitative shear stress distribution for an I and T section. [CO2] [PO3]

h. What is meant the radius of Mohr's circle refer to? [CO3] [PO1]

i. State any four assumptions made in thin cylinders theory. [CO4] [PO1]

## PART – C: (Long Answer Questions) (6 x 5 = 30 Marks)

Answer ***ANY FIVE*** questions Marks [CO#] [PO#]

3. In a steel member, at a point the major principal stress is 180MN/m$^2$ and the minor principal stresses are compressive. If the tensile yield point of the steel is 225MN/m$^2$, find the value of the minor principal stress at which yielding will commence, according to each of the following criteria of failure. (6) [CO1] [PO2]

    i. Maximum total strain energy
    ii. Maximum shear strain energy. Take poisson's ratio = 0.26.

4. According to the theory of maximum shear stress, determine the diameter of bolt which is subjected to an axial pull of 9.6kN together with a transverse shear force of 4.8kN. Elastic limit intension is 270N/mm$^2$, factor of safety=3 and poisson's ratio=0.3. (6) [CO1] [PO3]

5. The cross section of T beam is as follows: Flange thickness = 50mm; width of the flange = 200mm; thickness of the web = 50mm; depth of the web = 200mm; If a vertical shear force of 100kN is acting at a particular section of the beam draw the shear stress distribution across the section. (6) [CO2] [PO4]

6. A shaft required to transmit 300kW power at 80 rpm. The maximum torque may be 1.4 times the mean torque. The shear stress in the shaft should not exceed 60 MN/m$^2$and the twist 1$^O$ per 2metre length. Determine the diameter required if (6) [CO2] [PO3]

    i. The shaft is solid
    ii. The shaft is hollow with internal diameter 0.6 the external diameter. Take modulus of rigidity = 100 GN/m$^2$

7. The principal stress in the wall of a container are 40 MN/m$^2$ and 80 MN/m$^2$. Determine the normal, shear and resultant stresses in magnitude and direction in a plane, the normal of which makes an angle of 30$^o$ with the direction of maximum principal stress. (6) [CO3] [PO1]

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| 8. | Derive relations for normal and shear stresses acting on an inclined plane at a point in a stained material subjected to two mutually perpendicular direct stresses. | (6) | [CO3] | [PO1] |
| 9. | A cylindrical shell 3 m long which is closed at the end has an internal diameter of 1m and wall thickness of 15 mm. Calculate the circumferential and longitudinal stress induced and also change in the dimensions of the shell. If it is subjected to an internal pressure of 1.5 $MN/m^2$.Take E=200$GN/m^2$, 1/m= 0.3 | (6) | [CO3] | [PO4] |
| 10. | Calculate the increase in volume of a spherical shell 1m in diameter and 1cm thick when it is subjected to an internal pressure of 1.6 $MN/m^2$. Take E = 200 $GN/m^2$, and 1/m = 0.3. | (6) | [CO3] | [PO4] |

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