Register No.: 

# 924

## October 2017

*Time – Three hours*
*(Maximum Marks: 75)*

*[N.B: (1) Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory. Answer any FOUR questions from the remaining in each PART – A and PART – B.*

*(2) Answer division (a) or division (b) of each question in PART-C.*

*(3) Each question carries 2 marks in PART – A, 3 marks in Part – B and 10 marks in PART – C. ]*

### PART – A

1. State triangular law of forces.
2. Define angle of friction.
3. Define creep.
4. Define Poisson's ratio.
5. State perpendicular axis theorem.
6. Write torsion equation.
7. Define neutral axis.
8. Write sign conventions for shear force and bending moment.

### PART – B

9. Explain external and internal forces.
10. Explain cone of friction.
11. Explain bulk modulus.
12. Derive the moment of inertia for rectangular area.
13. State the relationship between load, force and bending moment at a section.
14. Write the assumptions mode on theory of simple bending.
15. Derive polar modulus for (i) Solid shaft (ii) Hollow shaft.
16. State the difference between open and closely coiled helical spring.



[Turn over...

PART – C

17. (a) Five forces are acting on a particle. The magnitude of the forces are 300N, 600N, 700N, 900N and 'P'. Their respective angles with horizontal are 0°, 60°, 135°, 210° and 270°. If the vertical component of all the forces is –1000N, find the value of 'P'. Also calculate the magnitude and direction of the resultant, assuming that the first force acts towards the point, while all the remaining forces act away from the point.

*(Or)*

(b) The magnitude of the resultant of two concurrent forces including an angle of 90° between them is $\sqrt{13}kN$. When the included angle between the forces is 60°, the magnitude of their resultant is $\sqrt{19}kN$. Find the magnitudes of the two forces.

18. (a) Explain the stress-strain diagram for a mild steel specimen with its salient point parameters.

*(Or)*

(b) A bar of steel 28mm diameter and 250mm long is subjected to an axial load of 80kN. It is found that the diameter has contracted by 1/240mm. If the modulus of rigidity is $0.8 \times 10^5 N/mm^2$, calculate (1) Poisson ratio (2) Bulk modulus and (3) Young's modulus.

19. (a) An I-section has the top flange 100mm x 15mm, web 150mm x 20mm and the bottom flange 180mm x 30mm. Calculate $I_{xx}$, $I_{yy}$, and also radius of gyration about the centroid axes.

*(Or)*

(b) A cylinder shell 3m long 500mm in diameter is made up of 20mm thick plate. If the cylinder shell is subjected to an internal pressure of 5N/mm², find the resulting hoop stress, longitudinal stress, change in length and change in volume. Take E=2x10$^5$N/mm² and 1/m=0.3.

20. (a) A beam is freely supported over a span of 8m. It carries point load of 3kN at 2m from the left hand support and an udl of 2kN/m run from the centre to the right hand support. Construct SFD and BMD.





*(Or)*

(b) A cast iron water main 450mm bore and 20mm thick is supported at intervals of 6m. Assuming each span as simply supported, find the maximum stress in the metal when (i) pipe is running full and (ii) the pipe is empty. Specific weight of cast iron is 70kN/m³ and specific weight of water is 9.81kN/m³.

21. (a) Hollow circular shaft of 25mm outside diameter and 20mm inside diameter is subjected to a torque of 50Nm. Find the shear stress induced at the outside and inside layer of shaft.

*(Or)*

(b) A truck weighing 30kN and moving at 5km/hr has to be brought to rest by buffer. Find how many springs each of 18 coils will be required to the energy of motion during a compression of 200mm. The spring is made of 25mm diameter steel rod coiled to a mean diameter of 240mm. Take N=0.84x10$^5$N/mm²

---