Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – June 2024
Programme Name: B. Tech (Marine Engineering)
Semester: IV
Subject Code: UG11T4401
Subject Name: Strength of Materials

Date: 28.05.2024	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. A sudden increase or decrease in shear force diagram between any two points indicates that there
   a) No loading between the two points
   b) U.D.L. between the two points
   c) Point loads between the two points
   d) None of these

2. Bending moment at supports in case of simply supported beams is always
   a) Less than unity
   b) More than unity
   c) Zero
   d) None of these

3. The product of ..... is known as flexural rigidity.
   a) EL
   b) EG
   c) EI
   d) EC

4. The intensity of bending stress at any point in a beam varies directly with
   a) length of beam
   b) area of cross-section of beam
   c) distance of point from the neutral axis
   d) polar moment of inertia

5. In an I-beam the maximum bending stress occurs at the
   a) Section where shear stress is maximum
   b) Neutral axis
   c) Joint of wedge and the flange
   d) Outermost fiber

6. The slope and deflection at the center of a simple beam carrying a central point load are
   a) Zero and zero
   b) Zero and maximum
   c) Maximum and minimum
   d) Maximum and zero

7. The Fixed beam is also called as
   a) Propped beams
   b) Pulled-up beam
   c) Encaster beam
   d) Stacked beams

8. In comparison with a simply supported beam of same span and load, a continuous beam has
   a) Less maximum bending moment
   b) Same bending moment
   c) Higher maximum bending moment
   d) Twice bending moment

9. A column that fails due to direct stress is called
   a) Long column
   b) Medium column
   c) Short column
   d) None of these

10. The Rankine formula holds good for
   a) Long column
   b) Short column
   c) Both short and long column
   d) Medium column

Section B

Five Questions of 02 Marks each

11. Define shear force and bending moment
12. Define 2nd Area moment theorem.
13. What is the use of Castigliano's first theorem?
14. What are the advantages and disadvantages of fixed beam over a simply supported beam?
15. What is the effective length of a column in terms of actual length at one end fixed and the other end free?

Section – C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. Draw the SF and BM diagrams for the beam loaded as shown in Fig. Also, find the value of maximum bending moment.

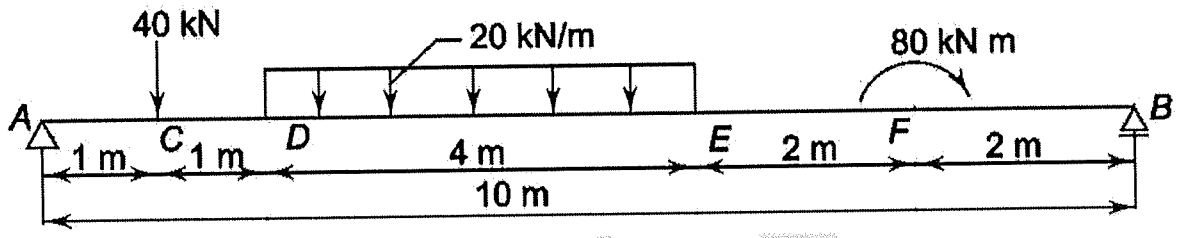

Figure 1

17. A beam made of Cast Iron having a section of 50 mm external diameter and 25 mm internal diameter is supported at two points 4 m apart. The beam carries a concentrated load of 100 N at its centre. Find the maximum bending stress induced in the beam.

(10 marks)

18. Determine the Euler critical load for the column section shown in figure-2, if its length is 3m and (a) If its ends are hinged and (b) if its ends are fixed. E = 200 GPa. All dimensions are in mm.

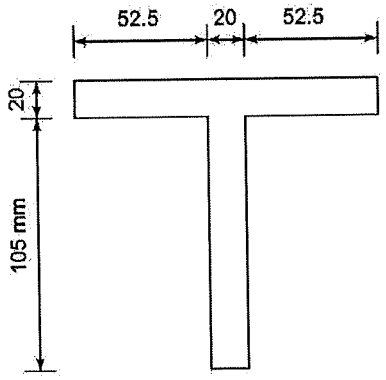

Figure 2

(10 marks)

19. (a) Using moment area method, find slope and deflection at the free end of cantilever having uniform EI and subjected to point load W at the free end.

(b) Determine the maximum slope and maximum deflection for a cantilever beam of length 'L' subjected to moment load 'M' at the free end.

(5 + 5 marks)

20. Find the deflection at the free end of a cantilever carrying a concentrated load at the free end. Assume uniform flexural rigidity, apply Castigliano's theorem.

(10 marks)

21. (a) A cantilever beam carrying a point load '*P*' and moment '*M*' as shown in figure 3 Find slope and deflection at free end B, using Area-moment method. *EI* is constant.

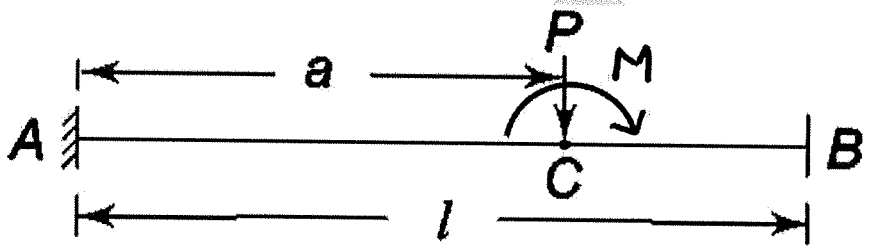

Figure 3

(b) A circular shaft is subjected to a BM of 20 kN-m and a torque of 12 kN-m at a section. Find equivalent BM and equivalent Torque.

(7 + 3 marks)

22. A 1.5m long column has a circular cross section of 50 cm diameter. One of the ends of the column is fixed in direction and position and the other end is free.

Take factor of safety as 3, calculate the safe load using.

i) Rankine-Gordon formula, take yield stress=560 MN/m^2, and $\alpha = 1/1600$

ii) Euler's formula, Young's modulus for C.I.=120 GN/m^2.

(10 marks)