QUESTION BANK OF

MECHANICAL OPERATIONS IN MINE

3RD SEMESTER MINING

GOVERNMENT POLYTECHNIC JAJPUR

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LECT. IN MECHANICAL

GP JAJPUR

CHAPTER 1

STRENGTH OF MATERIALS AND POWER TRANSMISSION

SHORT QUESTIONS:

1. Define Elasticity
2. Define Hook's Law
3. Define Limit of Proportionality.
4. Define Young's Modulus
5. Define Factor of safety.
6. Define Lateral strain
7. Define Poisson's ratio.
8. Draw stress-strain curve.
9. What is stress and what is its unit?
10. Define bending moment and state its unit.
11. Define shear force and state its unit.
12. State types of beams. And types of loads.
13. Define bending formula.
14. State section modulus.
15. State torsion formula and its application.
16. State advantages of rope drive, belt drive and chain drive.
17. State function of fly wheel and governor.
18. What do you mean by torque converter.

LONG QUESTIONS

Q. 1. A steel rod 1 m long and 20 mm × 20 mm in cross-section is subjected to a tensile force of 40 KN. Determine the elongation of the rod, if modulus of elasticity for the rod material is 200 GPa.

Q. 2. A hollow cylinder 2 m long has an outside diameter of 50 mm and inside diameter of 30 mm. If the cylinder is carrying a load of 25 kN, find the stress in the cylinder. Also find the deformation of the cylinder, if the value of modulus of elasticity for the cylinder material is 100 GPa.

Q. 3. A load of 5 kN is to be raised with the help of a steel wire. Find the minimum diameter of the steel wire, if the stress is not to exceed 100 MPa.

Q. 4. In an experiment, a steel specimen of 13 mm diameter was found to elongate 0.2 mm in a 200 mm gauge length when it was subjected to a tensile force of 26.8 kN. If the specimen was tested within the elastic range, what is the value of Young's modulus for the steel specimen ?

Q. 5. A hollow steel tube 3.5 m long has external diameter of 120 mm. In order to determine the internal diameter, the tube was subjected to a tensile load of 400 kN and extension was measured to be 2 mm. If the modulus of elasticity for the

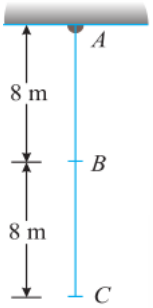
tube material is 200 GPa, determine the internal diameter of the tube.

Q. 6. Two wires, one of steel and the other of copper, are of the same length and are subjected to the same tension. If the diameter of the copper wire is 2 mm, find the diameter of the steel wire, if they are elongated by the same amount. Take E for steel as 200 GPa and that for copper as 100 GPa.

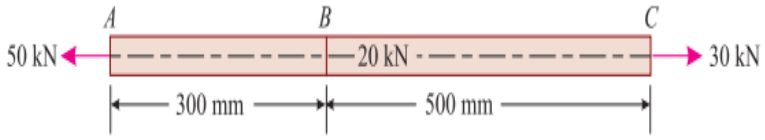
Q. 7. A copper alloy wire of 1.5 mm diameter and 30 m long is hanging freely from a tower. What will be its elongation due to self weight? Take specific weight of the copper and its modulus of elasticity as 89.2 kN/m^3 and 90 GPa respectively.

Q. 8. An alloy wire of 2 mm^2 cross-sectional area and 12 N weight hangs freely under its own weight. Find the maximum length of the wire, if its extension is not to exceed 0.6 mm. Take E for the wire material as 150 GPa.

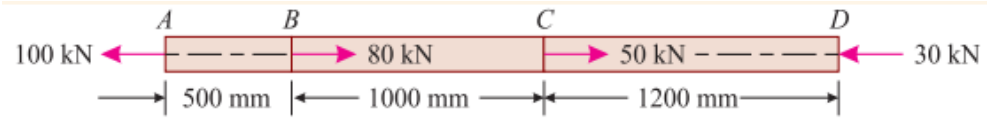
Q. 9. A steel wire ABC 16 m long having cross-sectional area of 4 mm^2 weighs 20 N as shown in figure. If the modulus of elasticity for the wire material is 200 GPa, find the deflections at C and B.



Q. 10. A steel bar of cross-sectional area 200 mm^2 is loaded as shown in Fig. Find the change in length of the bar. Take E as 200 GPa.

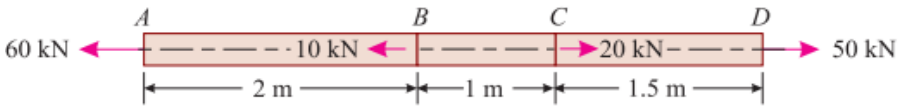


Q. 11. A brass bar, having cross-sectional area of 500 mm2 is subjected to axial forces as shown in Fig.

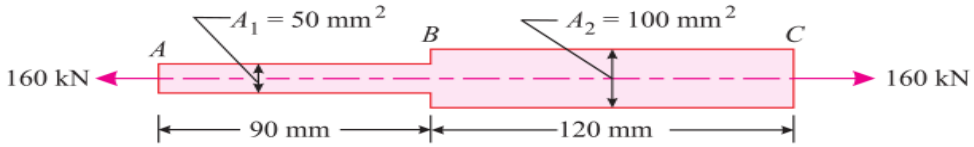


Find the total elongation of the bar. Take E = 80 GPa.

Q. 12. A steel rod ABCD 4.5 m long and 25 mm in diameter is subjected to the forces as shown in Fig. If the value of Young's modulus for the steel is 200 GPa, determine its deformation.

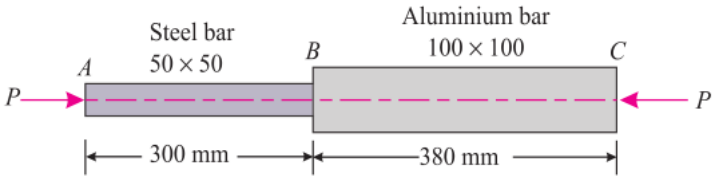


Q. 13. An automobile component shown in Fig. is subjected to a tensile load of 160 kN.



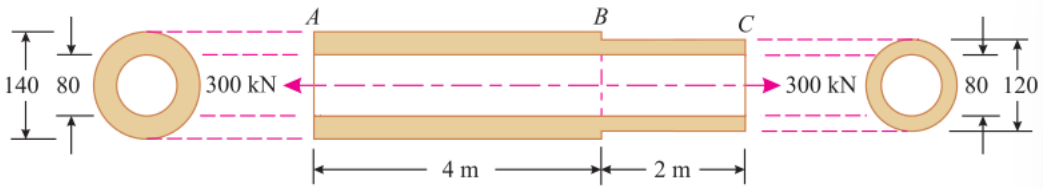
Determine the total elongation of the component, if its modules of elasticity is 200 GPa.

Q. 14. A member formed by connecting a steel bar to an aluminium bar is shown in fig.



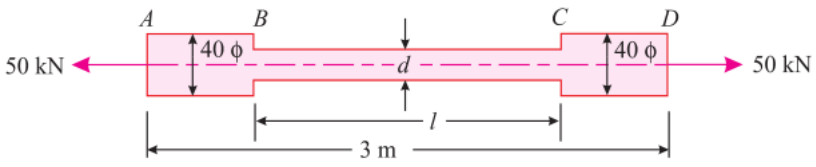
Assuming that the bars are prevented from buckling sidewise, calculate the magnitude of force P, that will cause the total length of the member to decrease by 0.25 mm. The values of elastic modulus for steel and aluminium are 210 GPa and 70 GPa respectively.

Q. 15. A 6 m long hollow bar of circular section has 140 mm diameter for a length of 4 m, while it has 120 mm diameter for a length of 2 m. The bore diameter is 80 mm throughout as shown in Fig.



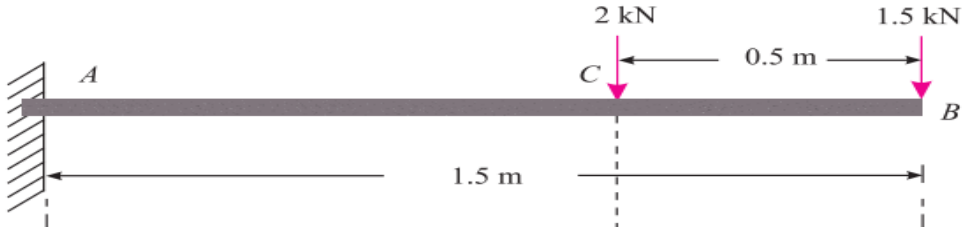
Find the elongation of the bar, when it is subjected to an axial tensile force of 300 kN. Take modulus of elasticity for the bar material as 200 GPa.

Q. 16. An alloy circular bar ABCD 3 m long is subjected to a tensile force of 50 KN as shown in figure.

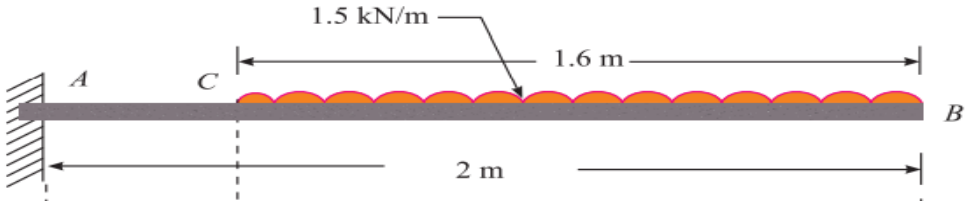


If the stress in the middle portion BC is not to exceed 150 MPa, then what should be its diameter? Also find the length of the middle portion, if the total extension of the bar should not exceed by 3 mm. Take E as 100 GPa.

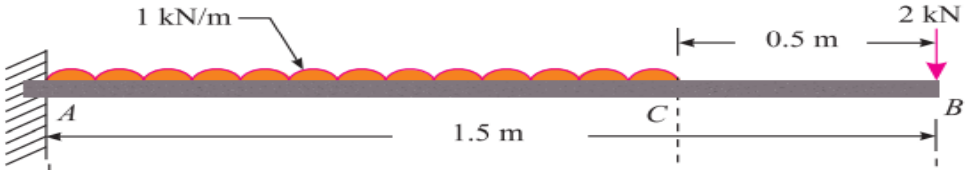
Q. 17. Draw shear force and bending moment diagram.



Q. 18. Draw shear force and bending moment diagram.



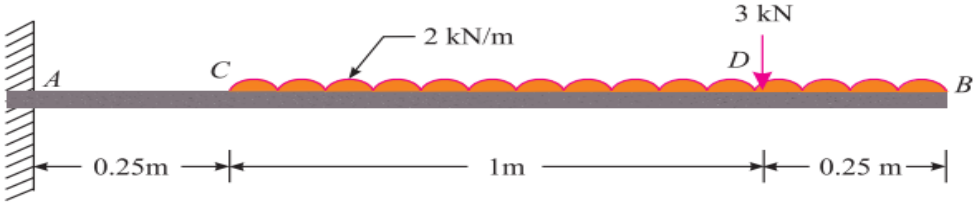
Q. 19. Draw shear force and bending moment diagram.



Q. 20.

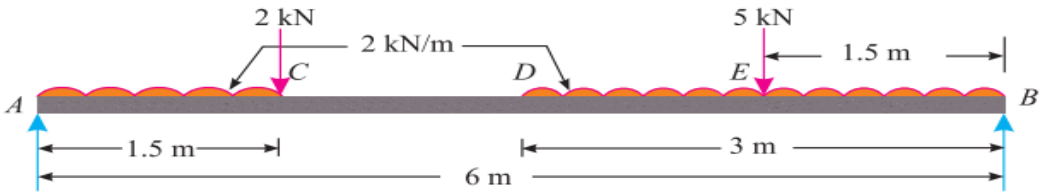
A cantilever beam 1.5 m long carries point loads of 1 kN, 2 kN and 3 kN at 0.5 m, 1.0 m and 1.5 m from the fixed end respectively. Draw the shear force and bending moment diagrams for the beam.

Q. 21. Draw shear force and bending moment diagram.

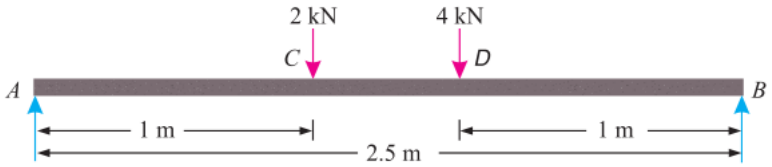


A simply supported beam of 3 m span carries two loads of 5 kN each at 1 m and 2 m from the left hand support. Draw the shear force and bending moment diagrams for the beam.

Q. 22. Draw shear force and bending moment diagram.

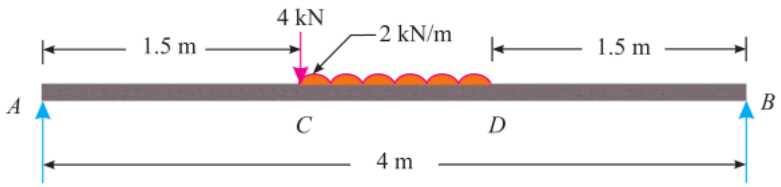


Q. 23. A simply supported beam AB of span 2.5 m is carrying two point loads as shown in figure.



Draw the shear force and bending moment diagrams for the beam.

Q. 25. A simply supported beam of 4 m span is carrying loads as shown in Figure.



Draw shear force and bending moment diagrams for the beam.

Q. 26. Describe the construction and working of hydraulic coupling.

Q. 27. Describe the construction and working of magnetic coupling.

Q. 28. Find the velocity ratio of simple gear train.

Q. 29. Find the velocity ratio of compound gear train.

Q. 30. Differentiate between fly wheel and governor.

Q. 31. Describe the construction and working of watt governor.

Q. 32. Describe the construction and working of porter governor.

Q. 33. Describe the construction and working of proel governor.

CHAPTER 2 ELEMENTS OF HYDRAULICS

Q. 1 . Define density and state its S I unit.

Q. 2. Define weight density and its unit.

Q.3. Define specific gravity.

Q. 4. Define pressure of a fluid and pressure head.

Q. 5. Define viscosity.

Q. 6. Define Newtons law of viscosity.

Q. 7. What is surface tension and its unit ?

Q. 8. What is capillarity ?

Q.9. Define continuity equation.

Q. 10. Define gauge pressure.

Q. 11. Define Atmospheric pressure.

Q.12. Define Absolute pressure.

Q. 13. Define Vaccum pressure.

LONG TYPE QUESTIONS

Q.1. What are the gauge pressure and absolute pressure at a point 3 m below the free surface of a liquid having a density of 1.53×10^3 kg/m^3, If the atmospheric pressure is equivalent to 750mm of mercury? If the specific gravity of mercury is 13.6 and density of water is 1000 kg/m^3.

Q.2. The right limb of a simple U-tube manometer containing Mercury is open to the atmosphere. While the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12 cm below the level of Hg in the right limb. Find the pressure of fluid in the pipe, If the difference in the mercury level in the two limbs is 20 cm.

Q.3. A simple U- tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vaccum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vaccum pressure in pipe, If the difference of Mercury level in the two limbs is 40 cm and the height of fluid in the left limb from the centre of pipe is 15 cm below.

Q. 4. The diameter of a pipe at the section 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe, If the velocity of water flowing through the pipe at section 1 is 5 m/s. Determine also the velocity at section 2.

Q. 5. A 30 cm diameter pipe, conveying water branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s. Find the discharge in this pipe. Also determine the velocity in 15 cm pipe, If the average velocity in 20 cm diameter pipe is 2 m/s.

Q. 6. Water is flowing through a pipe having diameter 20 cm and 10 cm at section 1 and section 2 respectively. The rate of flow through pipe is 35 lit./s. Section- 1 is 6 m above datum and section- 2 is 4 m above datum. If the pressure in section- 1 is 39.24 N/cm^2. Find the intensity of pressure at section- 2 ?

Q. 7. A pipe of diameter 400 mm carries water at a velocity of 25 m/s, the pressure at point A and B are given as 29.43 N/cm^2 and 22.563 N/cm^2 respectively. While the datum head at A and B are 28 m and 30 m. Find the loss of head at A and B.

Q. 8. Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head, If the rate of flow through pipe is 40 lit./s.

Q. 9. A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and throat is 20 cm of mercury. Determine the rate of flow. Take C_d = 0.98

Q. 10. An oil of specific gravity 0.8 is flowing through a venturimeter having inlet dia. 20 cm and throat dia. 10 cm. The oil mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take C_d = 0.98.

Q. 11. A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60 lit./s . Find the oil-mercury differential manometer. Take C_d = 0.98

Q. 12. A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and the vaccum pressure at the throat is 30 cm of Mercury. Find the discharge of water through venturimeter. Take C_d = 0.98.

Q. 13. The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2, while the vaccum pressure head at the throat is 37 cm of Hg. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of C_d for the venturimeter.

Q. 14. The head of water over an orifice of diameter 40 mm is 10 m. Find actual discharge and actual velocity of the jet at vena-contracta. Take C_d = 0.6 and C_V = 0.98.

Q. 15. The head of water over the centre of an orifice of diameter 20 mm is 1 m. The actual discharge through the orifice is 0.85 lit./s. Find the co-efficient of discharge.

Q. 16. A jet of water, issuing from a sharp-edged vertical orifice under a constant head of 10 cm, at a certain point, has the horizontal and vertical co-ordinates measured from the vena-contracta as 20 cm and 10.5 cm respectively. Find the value of C_v, also find the value of C_C and C_d = 0.60.

Q. 17. The head of water over an orifice of diameter 100 mm is 10 m. The water is coming out from orifice is collected in a circular tank of diameter 1.5 m in 25 sec. Also

the co-ordinates of a point on the jet, measured from vena-contracta are 4.3 m horizontal and 0.5 m vertical. Find the co-efficients, C_c, C_v and C_d.

Q. 18. Water discharge at the rate of 98.2 lit/s through a 120 mm diameter, vertical sharp edged orifice placed under a constant head of 10 m. A point on the jet measured from the vena-contracta of the jet has co-ordinates 4.5 m horizontal and 0.54 vertical. Find the co-efficients C_c, C_v and C_d of the orifice.

Q. 19. Find the discharge through a rectangular orifice of 2 m wide and 1.5 m deep fitted to a water tank. The water level in the tank is 3 m above the top edge of the orifice. Take C_d = 0.62.

Q. 20. A rectangular orifice, 1.5 m wide and 1 m deep is discharging water from a tank, if the water level in the tank is 3 above the top edge of the orifice. Find the discharge through the orifice. Take the co-efficient of discharge for the orifice = 0.6.

21. A rectangular orifice, 0.9 m wide and 1.2 m deep is discharging water from a vessel. The top edge of the orifice is 0.6 m below the water surface in the vessel. Calculate the discharge through the orifice, if the co-efficient of discharge for the orifice = 0.6 and percentage of error if the orifice is treated as a small orifice.

22. Determine the height of a rectangular notch/weir of length 6 m to be built across rectangular channel. The maximum depth of water on the upstream side of the notch is 1.8 m and discharge is 2000 lit/s. Take C_d = 0.6 and neglect the end contraction.

Q. 23. Find the discharge of water flowing over a rectangular notch of 2 m length when the constant head over the notch is 300 mm. Take C_d =0.60.

Q. 24. The head of water over a rectangular notch is 900 mm. The discharge is 300 lit/s. Find the length of the notch, when C_d =0.60.

25. Find the discharge over a triangular notch of angle 60^0, when the head over the V-notch is 0.3 m. Assume C_d = 0.6.

26. Water flows over a rectangular weir 1m wide at a depth of 150 mm and afterward passes through a triangular right-angled weir. Taking C_d for the rectangular and triangular weir as 0.62 and 0.59 respectively, find the depth over the triangular weir.

27. Find the head loss due to the friction in pipe of diameter of 300 mm and length 50 m through which water is flowing at a velocity of 3 m/s using Darcy webach formula and Chezy's formula . Find the head loss where Chezy's constant C = 60 and γ of water is 0.01 stoke.

CHAPTER 3 COMPRESSED AIR

2 MARK QUESTIONS

1. Classify compressor.
2. State various methods of transmission of compressed air.
3. State two advantages of use of compressed air in mines.

LONG QUESTIONS

1. Explain the working principle of reciprocating compressor.
2. Explain the working principle of vane type compressor.
3. State the advantages of use of compressed air in mines.

CHAPTER- 4 INTERNAL COMBUSTION ENGINE

2 MARK QUESTION:

1. Write the processes of otto cycle.
2. Write the processes of diesel cycle.
3. What is the formula of efficiency in otto cycle and diesel cycles.
4. Write down the parts of 4 stroke petrol engine.
5. Write down the parts of 4 stroke diesel engine.
6. What is TDC and BDC.
7. Define swept volume.
8. Draw P-V and T-S diagram of otto cycle.
9. Draw P-V and T-S diagram of diesel cycle.
10. Define BHP and IHP.

5 MARK QUESTION:

1. What are the different parts and their functions of 4 stroke petrol engine ?
2. Differentiate between petrol engine and diesel engine.
3. What are the uses of I.C engine in mining field.

10 MARK QUESTION:

1. Derive the efficiency of otto cycle.
2. Derive the efficiency of diesel cycle.
3. Write the working of 2 stroke diesel engine with neat sketch.
4. Write the working of 4 stroke diesel engine with neat sketch.
5. Write the working of 2 stroke petrol engine with neat sketch.
6. Write the working of 4 stroke diesel engine with neat sketch.