Model Question paper.

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Sub. Code: P08ME33

P.E.S COLLEGE OF ENGINEERING, MANDYA
Mechanical Engineering Department
An Autonomous Institution Under VTU, Belgaum
Model Question Paper
Third Semester B.E. Degree Examination
<u>MECHANICS OF MATERIALS</u>

Time: 3 hrs Max. Marks: 100

{Note: answer any FIVE full questions, selecting at least TWO from each part.}

Part-A

1 a. Define i) Poisson's Ratio ii) Bulk modulus iii) Factor of safety. (03)

b. Derive an expression for deformation of a tapering rectangular bar of widths 'b'$_1$ and 'b'$_2$ and thickness't' when it is subject to an axial force 'P'. (07)

c. For the component shown in fig. 1(c), determine the magnitude of force P, such that net deformation in the bar does not exceed 1 mm. E for steel is 200 GPa and that for Aluminum is 70 GPa. Big end diameter and small end diameter of the tapering bar are 40mm and 12.5mm respectively. (10)

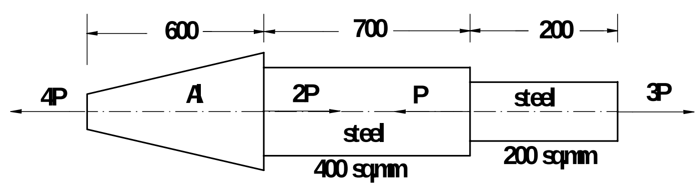

Fig.1(c)

2 a. Derive an expression for relationship between Young's modulus, modulus of Rigidity and Poisson's ratio. (10)

b. Two bars of the same length, one of steel, the other of brass, have their ends firmly united. The areas of cross-sections of the steel and brass bars are respectively 850 mm^2 and 1000 mm^2. Find the stresses in steel and brass when the temperature falls by 100°C. Take E_s = 200GPa, E_b = 80GPa, α_s = 0.000012/^{0}C and α_b = 0.000021/^{0}C. (10)

3 a. Define Principal Stresses and Principal Planes. (03)

b. Prove that the sum of normal stresses on any two mutually perpendicular planes is a constant in a general two dimensional stress system. (07)

c A plane element is subjected to stresses as shown in fig.3(c). Determine principal stresses maximum shear stress and their planes. Sketch the planes determined. (10)

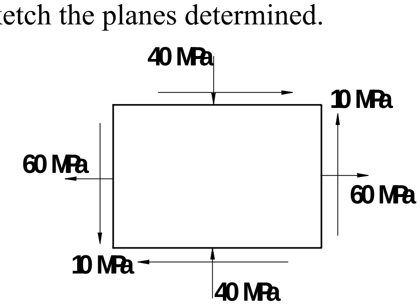

Fig. 3(c)

4 a. Derive an expression for circumferential and longitudinal stress for thin cylinder. (10)

b. A pipe of 400mm internal diameter and 100 thickness contains a fluid at a pressure of $80N/mm^2$. Find the maximum and minimum hoop stresses across the section. Also sketch radial and hoop stress distribution across the section. (10)

PART – B

5 a. What are the different types of beams? Explain briefly. (5)

b. For the beam shown in fig.5(b), draw shear force and Bending moment diagram. Locate the point of contra flexure if any. (15)

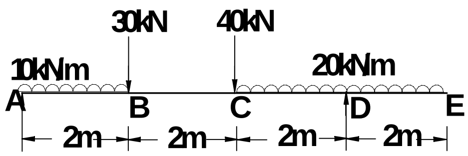

Fig. 5(b)

6 a. Derive an expression for relationship between bending stress and radius of curvature of a beam. (10)

b. A Cantilever of square section 200mm x 200mm, 2 meter long just fails in flexure when a load of 12kN is placed at its free end. A beam of same material and having a rectangular cross section 150mm wide and 300mm deep is simply supported over a span of 3m. Calculate the minimum central concentrated load required to break the beam. (10)

7 a Derive an expression $E = \frac{d^2 y}{dx^2} = M$ with usual notations. (10)

b Determine the deflection under the loads in the beam shown in fig.6 (b). Take flexural rigidity as EI through out. (10)

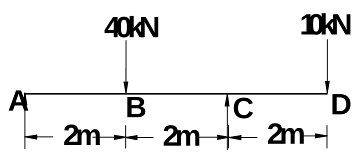

Fig. 6(b)

8 a. Define Slenderness Ratio and derive Euler's expression for buckling load for column with both ends hinged. (10)

b. A solid shaft rotating at 500 rpm transmits 30kW. Maximum torque is 20% more than mean torque. Allowable shear stress is 65MPa and modulus of rigidity is 81GPa. The angle of twist in the shaft should not exceed 1° in 1 meter length. Determine suitable diameter for the shaft. (10)

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P.E.S COLLEGE OF ENGINEERING, MANDYA
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Model Question Paper
Third Semester B.E. Degree examination, October 2009-10

BASIC THRMODYNAMICS

Time: 3 hrs **Max. Marks: 100**

Instructions: 1. Answer any FIVE full questions, choosing at least two from part A and two from part B
2. Use of thermodynamics data hand book permitted

Part-A

1. a. Distinguish between the following with example
   i). Open and Closed system
   ii). Extensive and Intensive property
   iii). Path function and Point function
   iv). Macroscopic and Microscopic point of view (06)
   b. State and explain Zeroth law of thermodynamics (06)
   c. The Mercury column of mercury in glass thermometer reads 75mm & 525mm when the thermometer is at ice point and steam point respectively. The temperature't' varies linearly with 'x'. Now assume that the length of the mercury column 'x' and temperature't^{*}' are related as $t^{*} = ax^{2} + b$. Evaluate the temperature on this scale when the temperature is 100^{o}F on the Fahrenheit scale. (08)

2. a. Obtain an expression for displacement work (06)
   b. Explain the comparison between heat transfer & work transfer and show that work is a path function (06)
   c. A spherical balloon having a radius of 30cm contains air at a pressure of 1.5 bar. The radius increases to 40 cm due to heating and during the process the pressure is inversely proportional to diameter. Calculate the magnitude and direction of work (08)

3. a. State precisely the First law of thermodynamics for a closed system undergoing a process & hence prove that Internal energy is a property of the system (10)
   b. A centrifugal pump delivers 60 kg of water per second. The inlet and outlet pressure are 10 kPa and 400 kPa respectively. The suction is 2 m below and delivery is 8 m above the centre line of the pump. The suction and delivery pipe diameter are 20 cm and 10 cm respectively. Determine the capacity of the electric motor to run the pump. (10)

4. a. Sketch and explain P-V & P-T diagram for pure substances. (06)
   b. Sketch and explain Separating & Throttling calorimeter. (06)
   c. The pressure cooker contains 1.75 kg of steam at a pressure of 500 kPa and 0.89 dry. Determine the quantity of heat which must be rejected so that the quantity of steam becomes 0.55dry. (08)

Part-B

5. a. Define Reversible & irreversible process & mention the factors whit render a process irreversible (06)

   b. Show that $(COP)_{HP} = 1 + (COP)_{Ref}$ (06)

   c. A Carnot engine operates between the temperature of 250^oC and 40^oC. Its efficiency will be improved with an increase of the source temperature to 300^oC holding the rise in temperature at 40^oC. Determine the sink temperature reduction necessary to effect the same improvement in efficiency holding the source temperature at 250^oC. (08)

6. a. State and prove the Clausius inequality and show that entropy is a property of the system. (10)

   b. 300 kJ/hr of heat is supplied at a constant fixed temperature of $270\,^oC$ to a heat engine. The heat rejection takes place at $8.5\,^oC$. The following results were obtained. i. 215 kJ/hr are rejected. ii. 150 kJ/hr are rejected. iii. 75 kJ/hr are rejected. Identify which of the results is reversible, irreversible or impossible. (10)

7. a. Define available energy & unavailable energy. (06)

   b. Write a short note on Helmoltz & Gibb's function. (06)

   c. 5kg of air at 555 K & 4 bar is enclosed in a system. Determine the availability of system, if the surrounding temperature & pressure is 290 K & 1 bar respectively. If the air is cooled at constant pressure to atmospheric temperature determine the availability & effectiveness. (08)

8. a. State and explain Dalton's law of partial pressure. (06)

   b. State and explain Amagat's law of partial volume. (06)

   c. 2 kg of air undergoes a polytropic process from 330 K and 0.15 m3 to 550 K and 0.02 m3. determine i) work transfer, ii) heat transfer, iii) change in enthalpy and iv) change in entropy. (08)

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P.E.S COLLEGE OF ENGINEERING, MANDYA
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Model Question Paper
Fourth semester B. E Degree Examination

MECHANICAL MEASUREMENTS AND METROLOGY

Time: 3 hrs **Max. Marks: 100**

Note: Answer any FIVE full questions, selecting at least TWO questions from each Part – A and Part – B.

Part – A

1.	a	Define Metrology and state its objectives.	(06 Marks)
	b	Define line and end standards, Give the sub division of standard.	(08 Marks)
	c	Give details of M112 set, and build the following dimensions; 49.3115 68.208	(06 Marks)
2.	a	With a sketch brief the 'Hole basis' and 'shaft basis' system of fits.	(06 Marks)
	b	Differentiate between interchangeability and selective assembly.	(08 Marks)
	c	State and explain Taylor's principle of gauge design.	(08 Marks)
3.	a	What is comparator? Explain any one type of mechanical comparator	(10 Marks)
	b	Explain with sketch, how sine bar can be used to measure a taper angle.	(10 Marks)
4.	a	Write a note on interferometry.	(04 Marks)
	b	Define 'effective diameter' and 'best size wire', Derive an expression to determine the best size wire diameter	(08 Marks)
	c	Explain with sketch the principle and working of an auto collimator	(08 Marks)

Part - B

5.	a	Explain the terms with sketches: i) Linearity ii) Hysteresis.	(10 Marks)
	b	Classify errors, what are the sources of errors in measurement.	(10 Marks)
6.	a	With the help of neat sketch, explain the working of cathode ray oscilloscope.	(10 Marks)
	b	Write a note on: i) Input circuitry ii) Ballast circuit.	(10 Marks)
7.	a	With a neat sketch explain the working of Hydraulic dynamometer.	(10 Marks)
	b	Explain with a neat sketch explain the Bridgman gauge for pressure measurement.	(10 Marks)
8.	a	State and explain the laws of thermocouple.	(04 Marks)
	b	With a neat sketch, explain the principle and working of optical pyrometer.	(08 Marks)
	c	Explain the principle and working of unbonded and bonded electrical strai gauges.	(08 Marks)

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P.E.S COLLEGE OF ENGINEERING, MANDYA
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Model Question Paper
Fourth semester B. E Degree Examination

Fluid Mechanics

Time: 3 hrs **Max. Marks: 100**

Note: Answer any FIVE full questions Selecting at least two questions from each part.

PART-A

1. a Give reasons for the following:
The meniscus of water is concave upwards while the meniscus of mereury is convex upwards.
Viscosity of llqulds decrease on heating whereas viscosity of gases increase on heating.
Rain drops and tiny dew drops are spherical in shape. (06 Marks)

b A vertical gap 2.2cm wide of infinite extent contains a fluid of viscosity 2.0NS/m^2 and specific gravity 0.9. a metallic plate 1.2mX1.2mX0.2cm is to be lifted up with a constant velocity of 0.15m/sec, through the gap. If the plate is in the middle of the gap, find the force required. The weight of the plate is 40 N. (10 Marks)

c Two liters of petrol weighs 14N. Calculate specific weight, mass density, specific volume and specific graving of petrol. (04 Marks)

2. a Obtain an expression for the pressure and depth of center of pressure in case of an inclined immersed surface. (10 Marks)

b A U-tube manometer is used to measure the pressure of water in a pipe the which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U-tube is 10 cm and the free surface of mercury is in level with the center of the pipe, if the pressure of water in pipe line is reduced to 9810 N / m^2. Calculate the new difference in level of mercury. Sketch the arrangements in both the cases. (10 Marks)

3. a Distinguish between: i) steady and unsteady flow ii) Uniform and non uniform flow. (04 Marks)

b Derive the continuity equation in 3 dimensions for a steady incompressible flow. (06 Marks)

c The stream function for a two-dimentional flow is given by φ= 3xy. Calculate the velocity at point A (3, 4). Also find the velocity potential function ϕ. (10 Marks)

4. a Explain the terms: i) Geometric similarity ii) Kinematic similarity iii) Dimensional homogeneity. (06 Marks)

b Define i) FROUDE Number ii) WEBER Number iii) Euler Number iv) Mach Number.

(04 Marks)

c The resisting force R of supersonic plane during flight can be considered as dependent upon the lenigh of the aircraft l, velocity V, air viscosity μ, air density $\rho$and bulk modulus of air K. Express the functional relationship between these variables and the resisting force by using buckingham's π theorem. (10 Marks)

PART-B

5. a State the principal of working of a venturimeter and obtain an expression for the actual discharge through the venturimeter. (08 Marks)

b A pipe line carrying oil of specific gravity 0.87 changes in diameter from 200mm diameter at a position A to 500mm diameter at a position B which is 4 meters at a higher level. If the pressure at A and B are 9.81 N/cm^2 and 5.886N/cm^2 respectively and the discharge is 200 litres/ sec, determine the loss of head and direction of flow. (10 Marks)

c State the working principle of pitot tube. (02 Marks)

6. a Define upper critical and lower critical Reynold's Number. (02 Marks)

b Show that for laminar flow through a circular pipe $V_{min.} = \frac{1}{2}V_{max}$. (10 Marks)

c A fluid of viscosity 0.7N sec/m^2 and specific gravity 1.3 flowing through a circular pipe of diameter 100mm. the maximum shear stress at the pipe wall is given as 196.2 N/m^2. Find i) the pressure gradient ii) the average velocity and iii) Reynold's number. (08 Marks)

7. a Distinguish between
Drag and Lift
Friction Drag and pressure drag. (08 Marks)

b define the terms
Displacement thickness
Momentum thickness (04 Marks)

c A flat plate 1.5 x 1.5 m moves at 50 km/hour in stationary air of density 1.5 kg/m^3. If the coefficients of drag and lift are 0.75 respectively, determine
Lift force
Drag force
Resultant fore
Power required to keep the plate in motion. (08 Marks)

8. a Derive Darcy Weisbach equation and deduce Chezy's equation. (08 Marks)

b In a pipe of diameter 400mm and length 100 mm water is flowing at a velocity of 3.5 m/sec. find the head loss due friction using i) darcy- weisbach formula ii) chezy's- formula for which c=55 (08 Marks)

c Write a short note on CFD software packages. (04 Marks)