

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Summer Examination – 2023

Course: B. Tech.

Branch : MECH

Semester :IV

Subject Code & Name: BTMPE405ANumerical Methods in Engineering

Max Marks: 60

Date:22/07/23

Duration: 3 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

	(Level/CO)	Marks
Q.1 Solve Any Two of the following.		12
A) Write a note on	CO1	6
i) True error ii) True percent relative error		
iii) Approximate percent relative error		
B) The exponential function can be computed using	CO1	6
$e^x=1+x+x^2/2!+x^3/3!+\dots+x^n/n!$		
add terms one at a time to estimate $e^{(0.2)}$ After each new term is added, compute the true and approximate percent relative errors and make a table. Add terms until the absolute value of the approximate error estimate 'ea' falls below a pre specified error criterion 'εs' conforming to three significant figures.		
C) Write a note on	CO1	6
i) Truncation error and Taylor series ii) Machine epsilon, iii) Accuracy and Precision		
Q.2 Solve Any Two of the following.		12
A) The velocity v of a falling parachutist is given by	CO2	6
$v=gm/c(1-e^{-(c/m)t})$		
where $g = 9.8 \text{ m/s}^2$. For a parachutist with a drag coefficient $c = 15 \text{ kg/s}$, compute the mass 'm' so that the velocity is $v = 35 \text{ m/s}$ at $t = 9 \text{ s}$. Determine 'm' to a level of $\epsilon_s = 0.1\%$. Using Newton Raphson		
B) You are designing a spherical tank to hold water for a small village in a developing country. The volume of liquid it can hold can be computed as	CO2	6
$V=\pi h^2(3R-h)/3$, where $V = \text{volume [m}^3\text{]}$, $h = \text{depth of water in tank [m]}$,		

and R = the tank radius [m]. If $R = 3$ m, to what depth must the tank be filled so that it holds 30 m^3 Use Bisection method

- C) Write a note on i) Stopping criteria ii) Error propagation iii) Significant digits 6
- Q.3 Solve Any Two of the following. 12
- A) Given the system of equations CO3 6
- $$-3x_2 + 7x_3 = 2$$
- $$x_1 + 2x_2 - x_3 = 3$$
- $$5x_1 - 2x_2 = 2$$
- (a) Compute the determinant.
- (b) Use Cramer's rule to solve for the x 's.
- B) For the following set of simultaneous equations CO3 6
- $$100a + T = 519.72$$
- $$50a - T + R = 216.55$$
- $$25a - R = 108.27$$
- Solve for acceleration a and the tensions T and R
- C) The following system of equations was generated by applying the mesh current law to the circuit CO3 6
- $$60I_1 - 40I_2 = 200$$
- $$-40I_1 + 150I_2 - 100I_3 = 0$$
- $$-100I_2 + 130I_3 = 230$$
- Solve for I_1 , I_2 , and I_3 .
- Q.4 Solve Any Two of the following. 12
- A) Evaluate the following integral: CO4 6
- $$\int_0^{\pi/2} (8 + 4 \cos x) dx$$
- (a) analytically; (b) single application of the trapezoidal rule;
- (c) multiple-application trapezoidal rule, with $n = 2$ and 4 ; For each of the numerical estimates (b) through (c), determine the percent relative error based on (a)
- B) Suppose that the upward force of air resistance on a falling object is proportional to the square of the velocity. For this case, the velocity can be computed as CO4 6

$$v(t) = \sqrt{\frac{gm}{cd}} \tanh\left(\sqrt{\frac{gcd}{m}} t\right)$$

where c_d = a second-order drag coefficient. (a) If $g = 9.8 \text{ m/s}^2$, $m = 68.1 \text{ kg}$ and $c_d = 0.25 \text{ kg/m}$, use analytical integration to determine how far the object falls in 10 s. (b) Make the same evaluation, but evaluate the integral with the multiple-segment trapezoidal rule. Use a sufficiently high n that you get three significant digits of accuracy

- C) The following data was collected for the distance traveled versus time for a rocket: CO4 6

t, s	0	25	50	75	100	125
y, km	0	32	58	78	92	100

Use numerical differentiation to estimate the rocket's velocity and acceleration at each time

- Q. 5 Solve Any Two of the following. 12

- A) An object is suspended in a wind tunnel and the force measured for various levels of wind velocity. The results are tabulated below. CO5 6

v, m/s	10	20	30	40	50	60	70	80
F, N	25	70	380	550	610	1220	830	1450

Use least-squares regression to fit this data with (a) a straight line, (b) a power equation based on log transformations, and (c) a power model based on nonlinear regression. Display the results graphically

- B) Use least-squares regression to fit a straight line to CO5 6

x	1	2	3	4	5	6	7	8	9
y	1	1.5	2	3	4	5	8	10	13

- C) Explain the basic structure of a C program with suitable example. CO5 6

*** End ***

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(Level Marks
/CO)

Q. 1 Solve Any Two of the following.

12

A) Derive from the fundamental, the relation for the deformation of a body, when it is subjected to

R/CO-1

6

a) A tensile force

b) Its own weight.

B) A steel bar of 600 mm² cross sectional area is carrying loads as shown in fig. No. 1

U/CO-1

6

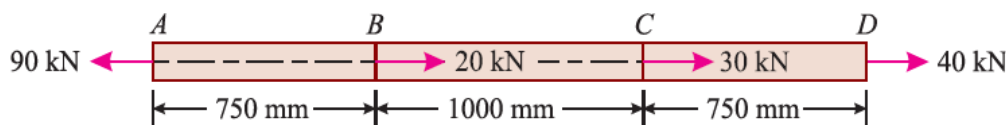


Fig. No. 1

C) An element in strained body is subjected to a tensile stress of 150 MPa and shear stress of 50 Mpa tending to rotate the element in and anticlockwise direction. Find (i) the magnitude of the normal and shear stresses on a section inclined at 40° with the tensile stress and (ii) The magnitude and direction of maximum shear stress that can exist on the element.

A/CO-1

6

Q.2 Solve Any Two of the following.

12

A) A vertical round steel rod, 1.82 m long is securely held at its upper end and a weight sliding freely on the rod falls on to a stop at the lower end of the rod. When the weight falls from a height of 30 mm the maximum stress is reached in the rod is estimated to be 157 N/mm². Determine the stress if the load had been gradually applied and also the maximum stress if the load has fallen from a height of 45 mm. take $E = 2 \times 10^5$ N/mm².

U/CO-2

6

B) Derive the equation for Strain energy for

R/CO-2

6

i) Gradually applied load

ii) Suddenly Applied load.

- C) A rectangular strut 200 mm wide and 150 mm thick carries a load of 60 kN at an eccentricity of 20 mm in a plane bisecting the thickness. Find the maximum and minimum intensities of stress in the section. Also draw stress distribution diagram. A/CO-3 6

Q. 3 Solve Any Two of the following. 12

- A) State the assumptions made in the theory of pure bending. R/CO-4 6
- B) An I sections with rectangular ends, has the following dimensions: Flanges 150 mm x 20 mm, web 300 mm x 10 mm. Find the maximum shearing stress developed in the beam for a shear force of 50 kN. U/CO-4 6
- C) A solid steel shaft has to transmit 100 kW at 160 r.p.m. taking allowable shear stress as 70 Mpa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. A/CO-4 6

Q.4 Solve Any Two of the following. 12

- A) State and explain the relation between R/CO-5 6
- i) The load and Shear force
- ii) The Shear force and Bending moment.
- B) A simply supported beam of span 3 m carries two-point loads of 5 kN each at 1 m and 2 m from the left-hand support. Draw shear force and bending moment diagrams for the beam. U/CO-5 6
- C) The intensity of loading on a simply supported beam of 6 m span increases gradually from 800 N/m run at one end to 2000 N/m run at another end as shown in fig. No. 2. Find the position and amount of maximum bending moment. Also draw the shear force and bending moment diagram. A/CO-5 6

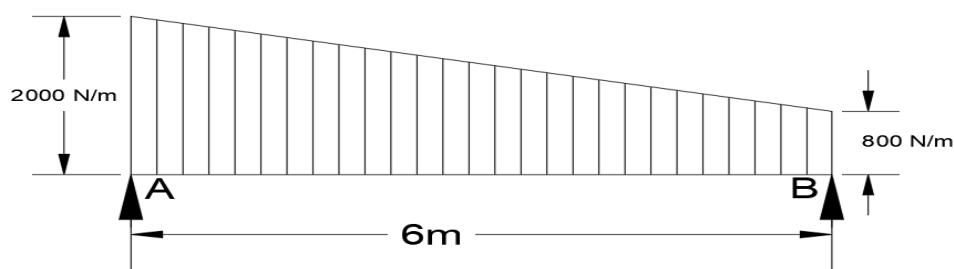


Fig. No. 2

Q. 5 Solve Any Two of the following. 12

- A) Derive the equation for the slope and deflection for the beam subjected to pure bending. R/CO-6 6

- B) A simply supported beam AB of Span 5 m is carrying a point load of 30 kN U/CO-6 6
at a distance 3.75 m from the left end A. Calculate the slopes at A and B and
deflection under the load. Take $EI = 26 \times 10^7 \text{ N-mm}^2$.
- C) Determine slope and deflection at the free end and at point C, 2 m from A/CO-6 6
fixed end A for the cantilever beam shown in fig. No. 3 using moment area
method.

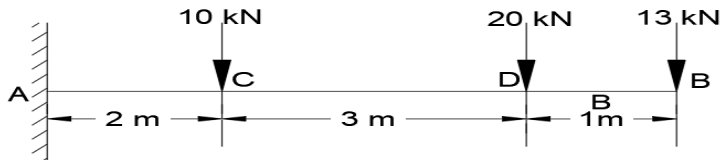


Fig. No. 3

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

Course: B. Tech. Branch: Multiple Branches Semester : IV

Subject Code & Name: (BTHM403) Basic Human Rights

Max Marks: 60

Date: 20/08/2022

Duration: 3.45 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

	(Level/CO)	Marks
Q.1 Solve any One of the following		
A) Write short notes on: i) Liberty ii) Equality iii) Fraternity	L2/CO2	12
B) Write short notes on: i) Civil society ii) State iii) Industrialism and the present social system	L2/CO2	12
Q.2 Solve any Two of the following		
A) What is the contribution of the French Revolution to the human rights movement?	L3/CO1	6
B) Explain the following concepts: i) Interrelationship between religion and culture ii) Communal riots and social harmony	L3/CO1	6
C) Elaborate the following terms: i) Unemployment ii) Rural poverty	L3/CO1	6
Q.3 Solve any Two of the following		
A) Throw light on the rights of migrant workers.	L5/CO5	6
B) How will you focus on the rights of mentally and physically challenged people? Elaborate.	L5/CO5	6
C) 'Freedom is the soul of democracy'. Justify.	L5/CO5	6
Q.4 Solve the following		
A) Elaborate the contribution of NGOs in India to help people get their rights in regard with: a) Water b) Forest c) Land	L4/CO4	12
Q.5 Solve any Two of the following		
A) Illustrate the fundamental rights in the Constitution of India?	L2/CO3	6
B) What duties are suggested by the Constitution of India? Explain.	L2/CO3	6
C) What is UDHR, what are its provisions in India?	L2/CO3	6

***** End *****

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

Course: B. Tech. Branch : Mechanical Engineering Semester :VI

Subject Code & Name: BTMC401 Manufacturing Processes I

Max Marks: 60

Date: 13/08/2022

Duration: 3.45 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Assume suitable data wherever necessary and mention it clearly.

	(Level/CO)	Marks
Q.1 Answer Any Two of the following.		
A) Explain the following types of casting processes	CO1	6
I] Expendable-pattern casting (Lost Foam)		
II] Shell-mold casting		
B) What is the function of chills in the casting processes? Why the chaplets are used in casting?	CO1	6
C) What is 'Fluidity Index'? Name the property of the mold that provides "ability to give way and allow casting to shrink without cracking the casting". Define the casting defect 'Misrun'.	CO1	6
Q.2 Explain any two of the following with neat diagrams.		
A) Two-high or three-high rolling mills.	CO2	6
B) Cluster mill.	CO2	6
C) Impression-die forging.	CO2	6
Q.3 Answer Any Two of the following.		
A) Explain the Process of Impact Extrusion giving suitable example.	CO3	6
B) Explain types of shearing dies.	CO3	6
C) Show the following types of discontinuities in fusion welds.	CO4	6
i] Underfill		
ii] Inclusions		
iii] Overlap		
iv] Undercut		
v] Incomplete penetration		
Q.4 Answer Any Two of the following.		
A) Explain the following types of welding processes	CO4	6
I] Thermit Welding		
II] Friction Stir Welding		
B) What are different types of lathes?	CO5	6
C) What is gun drilling and how drill life is measured?	CO5	6
Q.5 Write short notes on Any Two of the following.		
A) Broaching.	CO6	6
B) End milling	CO6	6
C) Gear finishing processes.	CO6	6

***** End *****

Instructions to the Students:

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4. Assume suitable data wherever necessary and mention it clearly.

(Level/CO) Marks

Q. 1 Solve the following.

- A) Fig. 1 shows part of an opposed piston engine mechanism. The velocity of the piston E for the given instant is 780 mm/s. the crank OA rotates at a uniform speed in a clockwise direction and makes an angle of 45° to vertical as shown in Fig. 1. Draw a velocity diagram and determine the speed of the crank in rpm. OA= 50mm, AB= 200 mm, BC= 110 mm, CD= 220 mm and DE= 100 mm. **Apply 6**

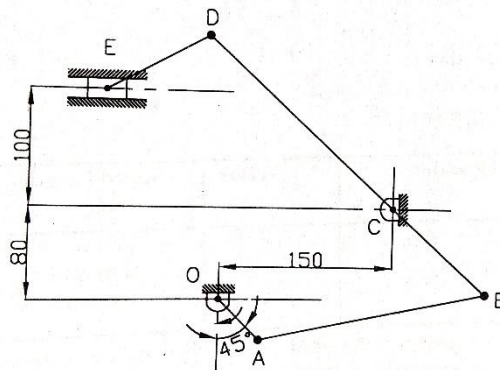


Fig. 1

- B) Explain with sketches different types of constrained motions. **Remember 6**

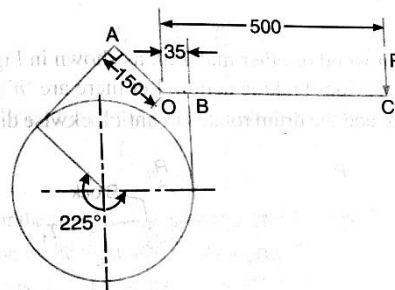
Q.2 Solve Any Two of the following.

- A) A shaft has a number of collars integral with it. The external diameter of the collar is 400 mm and the shaft diameter is 250 mm. if the intensity of the pressure is 0.35 N/mm² and the coefficient of friction is 0.05. Estimate power absorbed when the shaft runs at 105 rpm carrying a load of 150 kN and a number of collars required. **Apply 6**
- B) Derive the expression for a total torque acting on a truncated conical pivot bearing considering uniform wear, **Remember 6**
- C) A conical pivot supports a load of 20 kN, the cone angle is 120° and the intensity of normal pressure is not to exceed 0.3 N/mm². The external **Apply 6**

diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 rpm and the coefficient of friction is 0.1. Find the power absorbed in friction. Assume uniform pressure.

Q. 3 Solve Any Two of the following.

- A) A centrifugal clutch is to transmit 15 kW at 900 rpm. The shoes are four in number. **Apply** **6**
 The speed at which the engagement is $3/4^{\text{th}}$ of the running speed. The inside radius of the pulley rim is 150 mm and the center of gravity of the shoe lies at 120 mm from the center of the spider. The shoes are lined with Ferrodo for which the coefficient of the friction may be taken as 0.25. Determine the mass of the shoes and size of the shoes, if the angle subtended by the shoes as the center of the spider is 60° and the pressure exerted on the shoes is 0.1 N/mm^2 .
- B) A differential band brake as shown in Fig. 2 has an angle of contact of 225° . **Apply** **6**
 The band has a compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 Nm and the coefficient of friction between the band and drum is 0.3. Find the necessary force 'P' for the clockwise rotation of the drum and the value of 'OA' for the brake to be self-locking when the drum rotates in clockwise.



All dimensions in mm.

Fig. 2

- C) Differentiate between absorption type dynamometers and transmission type dynamometers. **Remember** **6**

Q.4 Solve the following.

- A) Draw the profile of a cam operating a roller reciprocating follower having a lift of 40 mm. the roller diameter is 20 mm. the minimum radius of the cam is 30 mm. the cam raises the follower with simple harmonic motion for 110° of its rotation followed by a period of dwell for 80° . the follower descends for the next 120° rotation of the cam follower with uniform acceleration and deceleration followed by a dwell period. **Apply** **6**

B) Explain with figures any three types of followers.

Remember 6

Q. 5 Solve Any Two of the following.

A) Explain the direct and reverse crank method for determining unbalanced forces in radial engines.

Remember 6

B) Explain the method of balancing of several masses in the same planes.

Remember 6

C) A four-cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance.

Apply 6

***** End *****

Dr. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular / Supplementary End Semester Examination – Summer 2023

Course: **B. Tech.** Branch: **Mechanical Engineering** Semester: **IV**

Subject Code & Name: **BTMC402 Theory of Machines - I**


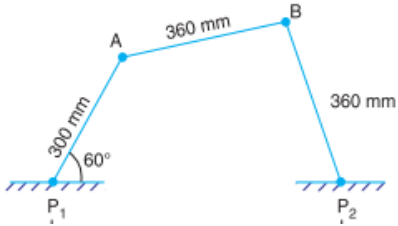
Max Marks: **60**

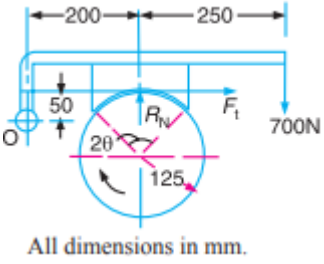
Date: **15/07/23**

Duration: **3.45 Hr.**

Instructions to the Students:

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		(Level/CO)	Marks
Q. 1	Solve Any TWO of the following.		
A)	Explain in brief the inversions of Four Bar Chain.	Remember	06
B)	<p>An engine mechanism is shown in figure 1. The crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100 mm from B. In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s².</p> <p>Find: 1. Velocity of G and angular velocity of AB, and 2. Acceleration of G and angular acceleration of AB.</p>  <p align="center">Fig. 1</p>	Apply	06
C)	<p>The dimensions and configuration of the four bar mechanism, shown in Fig. 2, are as follows: P₁A = 300 mm; P₂B = 360 mm; AB = 360 mm, and P₁P₂ = 600 mm. The angle AP₁P₂ = 60°. The crank P₁A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s², both clockwise. Determine the angular velocities and angular accelerations of P₂B, and AB and the velocity and acceleration of the joint B.</p>  <p align="center">Fig. 2</p>	Apply	06
Q.2	Solve Any TWO of the following.		
A)	State the laws of (i) Static friction ; (ii) Dynamic friction	Understanding	06

B)	conical pivot supports a load of 20 kN, the cone angle is 120° and the intensity of normal pressure is not to exceed 0.3 N/mm^2 . The external diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 r.p.m. and the coefficient of friction is 0.1, find the power absorbed in friction. Assume uniform pressure.	Apply	06
C)	Derive the expression for a total torque acting on a conical pivot bearing considering uniform wear.	Analyze	06
Q.3 Solve Any TWO of the following.			
A)	With neat sketch, explain the Multi plate clutch.	Understanding	06
B)	<p>A single block brake is shown in Fig. 3. The diameter of the drum is 250 mm and the angle of contact is 90°. If the operating force of 700 N is applied at the end of a lever and the coefficient of friction between the drum and the lining is 0.35, determine the torque that may be transmitted by the block brake.</p>  <p style="text-align: center;">All dimensions in mm.</p> <p style="text-align: center;">Fig 3</p>	Apply	06
C)	Discuss the Prony Brake Dynamometer and Rope brake Dynamometer with neat sketches.	Create	06
Q.4 Solve the following.			
A)	Explain the different types of followers.	Understanding	06
B)	<p>Construct the profile of a cam to suit the following specifications : Least radius of cam = 50 mm ; Diameter of roller = 25 mm; Angle of lift = 90° ; Angle of Dwell = 45°; Angle of fall = 75° ; Lift of the follower = 24.5 mm ; Number of pauses are two of equal interval between motions.</p> <p>During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform.</p>	Analyze	06
Q.5 Solve Any TWO of the following.			
A)	Explain the method of balancing of several masses in the same planes.	Understanding	06
B)	Explain the direct and reverse crank method for determining unbalanced forces in radial engines.	Understanding	06
C)	Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are $45^\circ, 75^\circ$ and 135° . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.	Apply	06

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Examination – Summer 2022

Course: B. Tech.

Branch :Mech.Engg

Semester :IV

Subject Code & Name:

BTMEC402 Theory of Machines I

Max Marks: 60

Date:

Duration: 3 Hr.

Instructions to the Students:

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4. Assume suitable data wherever necessary and mention it clearly.

(Level/CO) Marks

Q. 1 Solve Any Two of the following. (This is just a sample instruction)

A)

Fig. 1 shows part of an opposed piston engine mechanism. The velocity of the piston E for the given instant is 780 mm/s. the crank OA rotates at a uniform speed in a clockwise direction and makes an angle of 45° to vertical as shown in Fig. 1. Draw a velocity diagram and determine the speed of the crank in rpm. OA= 50mm, AB= 200 mm, BC= 110 mm, CD= 220 mm and DE= 100 mm.

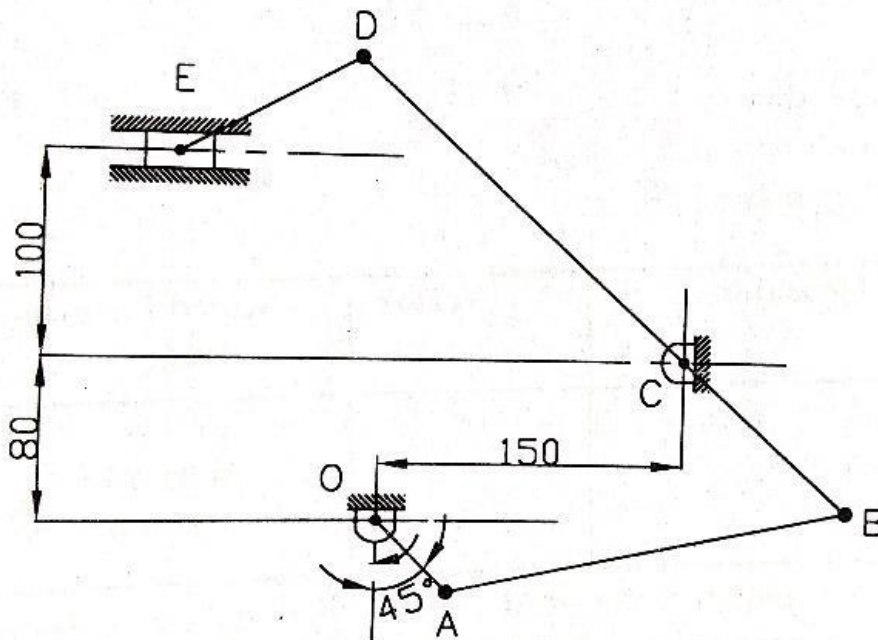


Fig No 01

B)

Explain with sketches different types of constrained motions.

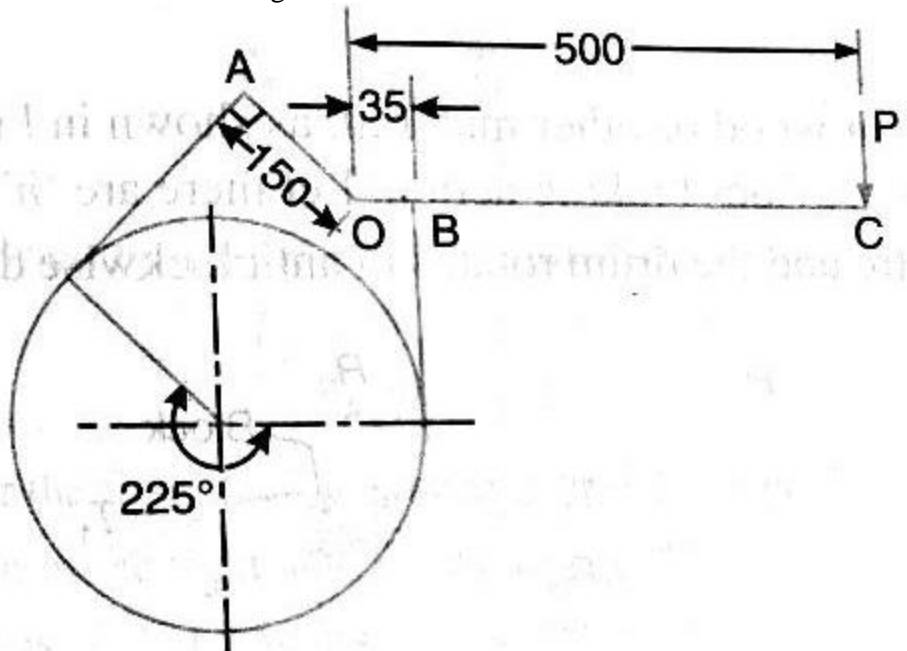
C)

How Kinematic pairs are classified ? Explain with neat Diagram

6

6

6

Q.2	Solve Any Two of the following. <i>(This is just a sample instruction)</i>		
A)	Derive the expression for a total torque acting on a truncated conical pivot bearing considering uniform wear,		6
B)	A shaft has a number of collars integral with it. The external diameter of the collar is 400 mm and the shaft diameter is 250 mm. if the intensity of the pressure is 0.35 N/mm ² and the coefficient of friction is 0.05. Estimate power absorbed when the shaft runs at 105 rpm carrying a load of 150 kN and a number of collars required.		6
C)	Write a short note on Friction types with suitable example.		6
Q. 3	Solve Any One of the following. <i>(This is just a sample instruction)</i>		
A)	<p>A differential band brake as shown in Fig. 2 has an angle of contact of 225°. The band has a compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 Nm and the coefficient of friction between the band and drum is 0.3. Find the necessary force 'P' for the clockwise rotation of the drum and the value of 'OA' for the brake to be self-locking when the drum rotates in clockwise.</p>  <p>All dimensions in mm.</p> <p style="text-align: center;">Fig No 02</p>		6
B)	Differentiate between absorption type dynamometers and transmission type dynamometers		6
Q.4	Solve Any Two of the following. <i>(This is just a sample instruction)</i>		
A)	How cams are classified? Explain in details with neat sketches.		6
B)			6

	Draw the profile of a cam operating a roller reciprocating follower having a lift of 40 mm. the roller diameter is 20 mm. the minimum radius of the cam is 30 mm. the cam raises the follower with simple harmonic motion for 110° of its rotation followed by a period of dwell for 80°.the follower descends for the next 120° rotation of the cam follower with uniform acceleration and deceleration followed by a dwell period.		
C)	Explain with figures any three types of followers.		6
Q. 5	Solve Any One of the following. <i>(This is just a sample instruction)</i>		
A)	A four-cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance.		6
B)	Explain the method of balancing of several masses in the same planes		6
	*** End ***		

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Examination – Summer 2022

Course: B. Tech.

Branch :Mech.Engg

Semester :IV

Subject Code & Name:

BTMEC402 Theory of Machines I

Max Marks: 60

Date:

Duration: 3 Hr.

Instructions to the Students:

1. All the questions are compulsory.
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(Level/CO) Marks

Q. 1 Solve Any Two of the following. (This is just a sample instruction)

A)

Fig. 1 shows part of an opposed piston engine mechanism. The velocity of the piston E for the given instant is 780 mm/s. the crank OA rotates at a uniform speed in a clockwise direction and makes an angle of 45° to vertical as shown in Fig. 1. Draw a velocity diagram and determine the speed of the crank in rpm. OA= 50mm, AB= 200 mm, BC= 110 mm, CD= 220 mm and DE= 100 mm.

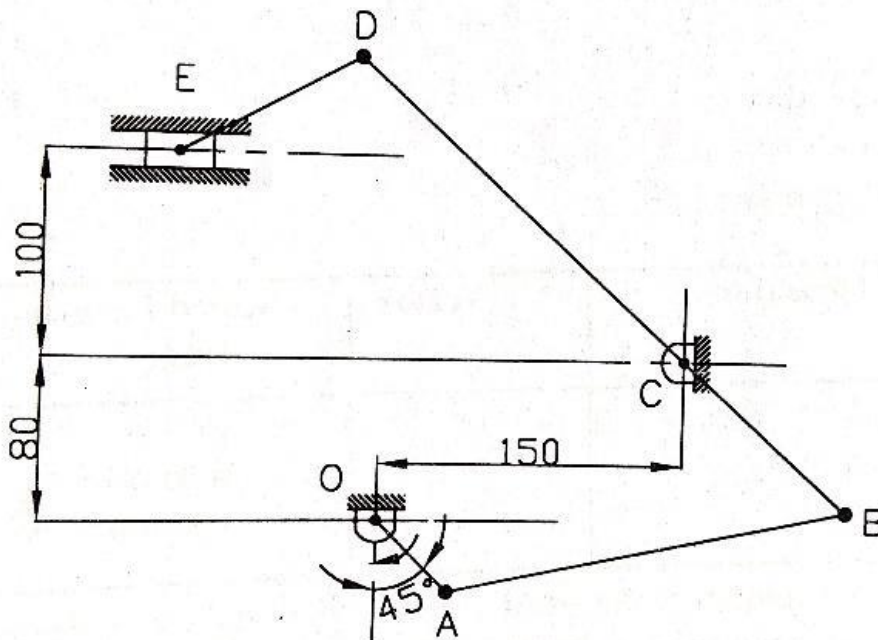


Fig No 01

B)

Explain with sketches different types of constrained motions.

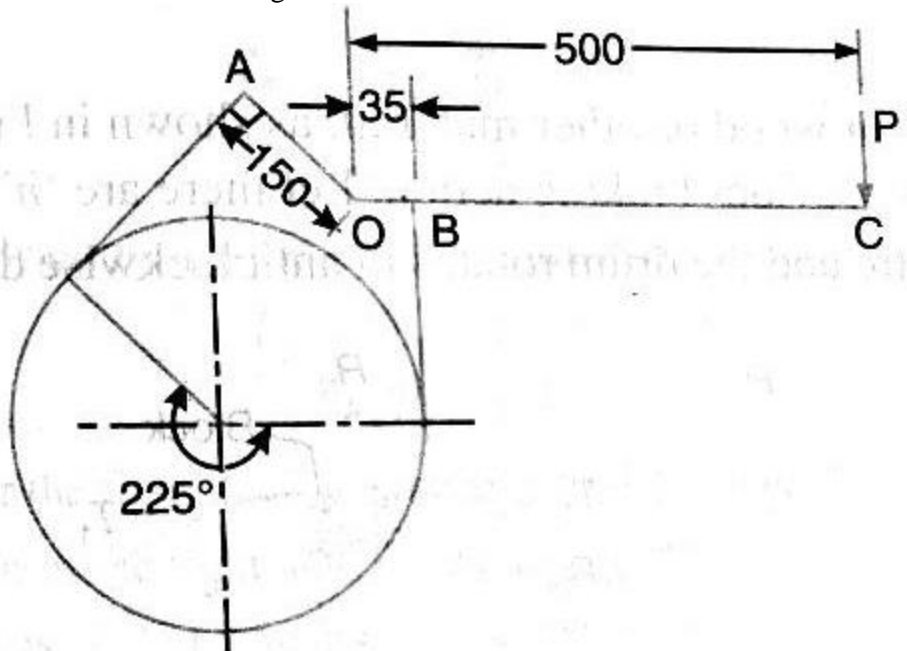
C)

How Kinematic pairs are classified ? Explain with neat Diagram

6

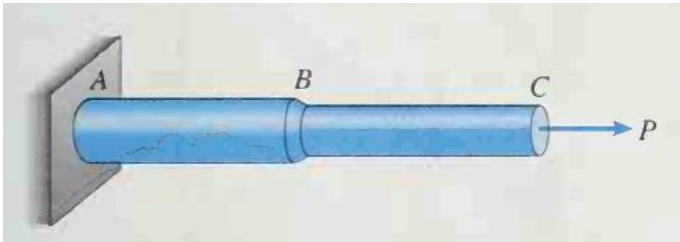
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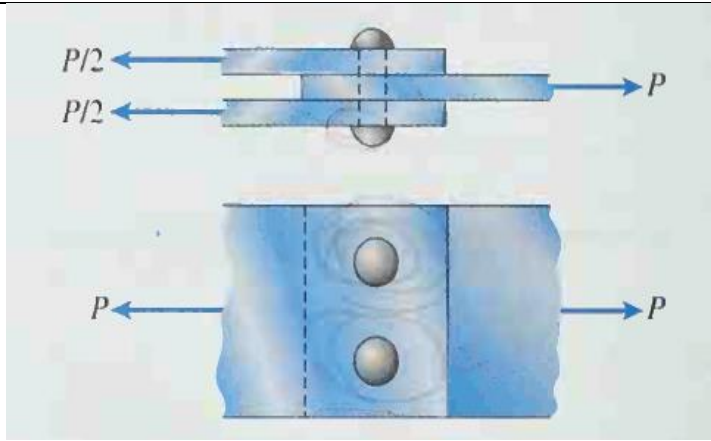
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Q.2	Solve Any Two of the following. <i>(This is just a sample instruction)</i>		
A)	Derive the expression for a total torque acting on a truncated conical pivot bearing considering uniform wear,		6
B)	A shaft has a number of collars integral with it. The external diameter of the collar is 400 mm and the shaft diameter is 250 mm. if the intensity of the pressure is 0.35 N/mm ² and the coefficient of friction is 0.05. Estimate power absorbed when the shaft runs at 105 rpm carrying a load of 150 kN and a number of collars required.		6
C)	Write a short note on Friction types with suitable example.		6
Q.3	Solve Any One of the following. <i>(This is just a sample instruction)</i>		
A)	<p>A differential band brake as shown in Fig. 2 has an angle of contact of 225°. The band has a compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 Nm and the coefficient of friction between the band and drum is 0.3. Find the necessary force 'P' for the clockwise rotation of the drum and the value of 'OA' for the brake to be self-locking when the drum rotates in clockwise.</p>  <p>All dimensions in mm.</p> <p style="text-align: center;">Fig No 02</p>		6
B)	Differentiate between absorption type dynamometers and transmission type dynamometers		6
Q.4	Solve Any Two of the following. <i>(This is just a sample instruction)</i>		
A)	How cams are classified? Explain in details with neat sketches.		6
B)			6

	Draw the profile of a cam operating a roller reciprocating follower having a lift of 40 mm. the roller diameter is 20 mm. the minimum radius of the cam is 30 mm. the cam raises the follower with simple harmonic motion for 110° of its rotation followed by a period of dwell for 80°.the follower descends for the next 120° rotation of the cam follower with uniform acceleration and deceleration followed by a dwell period.		
C)	Explain with figures any three types of followers.		6
Q. 5	Solve Any One of the following. <i>(This is just a sample instruction)</i>		
A)	A four-cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance.		6
B)	Explain the method of balancing of several masses in the same planes		6
	*** End ***		

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE Supplementary Semester Examination – Summer 2022 Course: B. Tech. Branch : Mechanical Engg. Semester : IV Subject Code & Name: BTMEC403 – Strength of Materials Max Marks: 60 Date: Duration: 3.00 Hrs.			
Instructions to the Students: 1. All the questions are compulsory. 2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question. 3. Use of non-programmable scientific calculators is allowed. 4. Assume suitable data wherever necessary and mention it clearly.			
		(Level/CO)	Marks
Q. 1	Solve Any Two of the following.		
A)	Define and explain the term ‘Poisson’s ratio’. How is it calculated based on lateral and axial strains?	CO1	06
B)	A short hollow circular tube (with vertical axis) is applied with an axial load of 5 kN. The inner and outer diameters of the tube are 75 mm and 100 mm, respectively. The original length of the tube is 500 mm which is reduced by 0.2 mm after applying the load. Determine the compressive stress and strain in the tube. (Neglect the self weight of the tube and assume the tube does not buckle under the load).	CO2	06
C)	A stepped metal rod ABC (as shown in figure below) is subjected to an axial pull of 7 kN. The diameters of the two sections AB and section BC of the rod are 65 mm and 30 mm respectively. Find out in which of the two sections the stress will be maximum? Also find out the stresses in section AB and BC of the rod. 	CO2	06
Q.2	Solve Any Two of the following.		
A)	Three steel plates of 18 mm thickness each are joined with the help of two rivets of 15 mm diameter each. If the plates are pulled (as shown in the figure below) with $P = 6$ kN, calculate the maximum shear stress induced in the rivets.	CO3	06



B) The tensile stresses at a point across mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2 . Determine the normal, tangential and resultant stresses on a plane inclined at 30 degrees to the axis of minor stress.

CO3

06

C) Define and explain following terms:

- A. Resilience
- B. Proof Resilience
- C. Modulus of Resilience

CO3

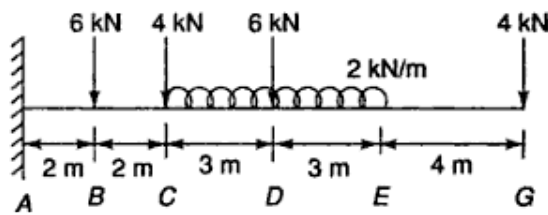
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Q. 3 Solve Any Two of the following.

A) For the cantilever beam as shown in figure below, calculate the shear force and bending moment and draw the shear force and bending moment diagram.

CO04

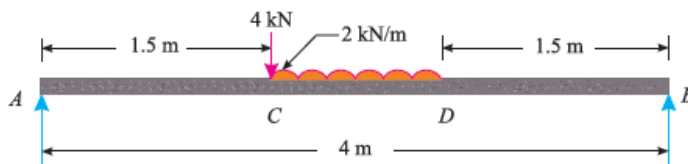
06



B) A simply supported beam 4 m span is carrying loads as shown in figure. Draw shear force and bending moment diagrams for the beam.

CO4

06



C) Describe various types of supports for beam with the help of neat sketch.

CO4

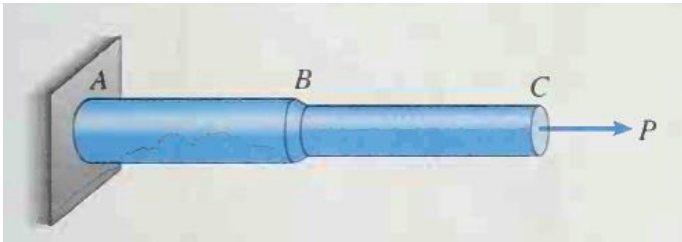
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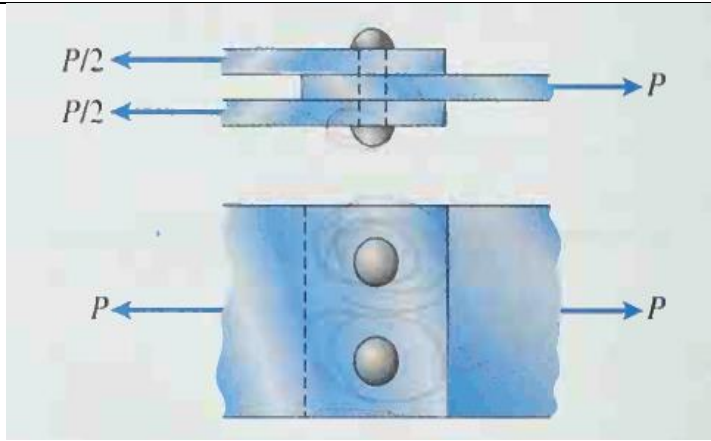
Q.4 Solve Any Two of the following.

A) A wooden beam 100 mm wide, 250 mm deep and 3 m long is carrying a uniformly distributed load of 40 kN/m . Determine the maximum shear stress

06

	and sketch the variation of shear stress and along the depth of the beam.		
B)	Explain the assumptions of theory of simple bending.		06
C)	A beam 6 m long, simply supported at its ends, is carrying a point load of 50 kN at its center. The moment of inertia inertia of the beam is given as equal to $78 \times 10^6 \text{ mm}^4$. If E for the material of the beam is $2.1 \times 10^5 \text{ mm}^4$. Calculate: 1. Deflection at the center of the beam and 2. Slope at the support.	CO5	06
Q. 5	Solve Any Two of the following.		
A)	Find the maximum shear stress induced in a solid circular shaft of diameter 15 cm when the shaft transmits 150 kW power at 180 rpm.	CO5	06
B)	Describe various types of end conditions of columns.	CO6	06
C)	Write short note on 'Limitation of Euler's formula'.	CO6	06
	*** End ***		

<p align="center">DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE</p> <p align="center">Supplementary Semester Examination – Summer 2022</p> <p>Course: B. Tech. Branch : Mechanical Engg. Semester : IV</p> <p>Subject Code & Name: BTMEC403 – Strength of Materials</p> <p>Max Marks: 60 Date: Duration: 3.00 Hrs.</p>			
<p>Instructions to the Students:</p> <p>1. All the questions are compulsory.</p> <p>2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.</p> <p>3. Use of non-programmable scientific calculators is allowed.</p> <p>4. Assume suitable data wherever necessary and mention it clearly.</p>			
		(Level/CO)	Marks
Q. 1	Solve Any Two of the following.		
A)	Define and explain the term ‘Poisson’s ratio’. How is it calculated based on lateral and axial strains?	CO1	06
B)	A short hollow circular tube (with vertical axis) is applied with an axial load of 5 kN. The inner and outer diameters of the tube are 75 mm and 100 mm, respectively. The original length of the tube is 500 mm which is reduced by 0.2 mm after applying the load. Determine the compressive stress and strain in the tube. (Neglect the self weight of the tube and assume the tube does not buckle under the load).	CO2	06
C)	<p>A stepped metal rod ABC (as shown in figure below) is subjected to an axial pull of 7 kN. The diameters of the two sections AB and section BC of the rod are 65 mm and 30 mm respectively. Find out in which of the two sections the stress will be maximum? Also find out the stresses in section AB and BC of the rod.</p> <div style="text-align: center;">  <p>The diagram shows a blue stepped metal rod fixed to a wall at point A. The rod consists of two sections: section AB with a larger diameter and section BC with a smaller diameter. A force P is applied at point C, pulling the rod to the right.</p> </div>	CO2	06
Q.2	Solve Any Two of the following.		
A)	Three steel plates of 18 mm thickness each are joined with the help of two rivets of 15 mm diameter each. If the plates are pulled (as shown in the figure below) with P = 6 kN, calculate the maximum shear stress induced in the rivets.	CO3	06



B) The tensile stresses at a point across mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2 . Determine the normal, tangential and resultant stresses on a plane inclined at 30 degrees to the axis of minor stress.

CO3

06

C) Define and explain following terms:

- A. Resilience
- B. Proof Resilience
- C. Modulus of Resilience

CO3

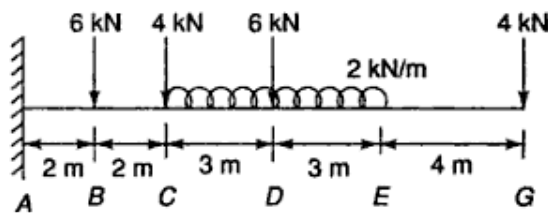
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Q. 3 Solve Any Two of the following.

A) For the cantilever beam as shown in figure below, calculate the shear force and bending moment and draw the shear force and bending moment diagram.

CO04

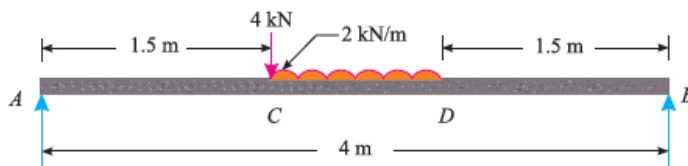
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B) A simply supported beam 4 m span is carrying loads as shown in figure. Draw shear force and bending moment diagrams for the beam.

CO4

06



C) Describe various types of supports for beam with the help of neat sketch.

CO4

06

Q.4 Solve Any Two of the following.

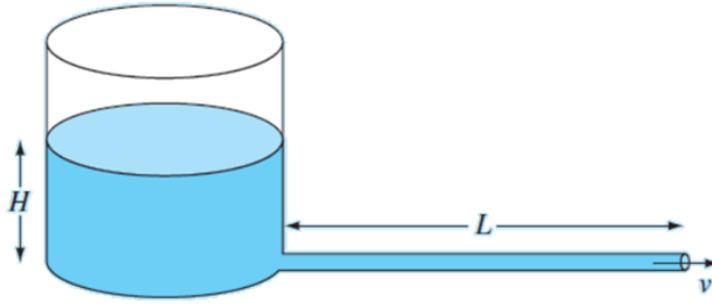
A) A wooden beam 100 mm wide, 250 mm deep and 3 m long is carrying a uniformly distributed load of 40 kN/m . Determine the maximum shear stress

06

	and sketch the variation of shear stress and along the depth of the beam.		
B)	Explain the assumptions of theory of simple bending.		06
C)	A beam 6 m long, simply supported at its ends, is carrying a point load of 50 kN at its center. The moment of inertia inertia of the beam is given as equal to $78 \times 10^6 \text{ mm}^4$. If E for the material of the beam is $2.1 \times 10^5 \text{ mm}^4$. Calculate: 1. Deflection at the center of the beam and 2. Slope at the support.	CO5	06
Q. 5	Solve Any Two of the following.		
A)	Find the maximum shear stress induced in a solid circular shaft of diameter 15 cm when the shaft transmits 150 kW power at 180 rpm.	CO5	06
B)	Describe various types of end conditions of columns.	CO6	06
C)	Write short note on 'Limitation of Euler's formula'.	CO6	06
	*** End ***		

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE**Supplementary Semester Examination – Summer 2022****Course: B. Tech.****Branch : Mechanical Engg.****Semester : IV****Subject Code & Name: BTMEC404 – Numerical Methods in Mechanical Engineering****Max Marks: 60****Date:****Duration: 3.00 Hrs.**

Instructions to the Students:			
<ol style="list-style-type: none"> 1. All the questions are compulsory. 2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question. 3. Use of non-programmable scientific calculators is allowed. 4. Assume suitable data wherever necessary and mention it clearly. 			
		(Level/CO)	Marks
Q. 1	Solve Any Two of the following.		
A)	Explain the terms with the help of suitable examples: <ol style="list-style-type: none"> 1. True error 2. Approximate error 3. Truncation error 4. Round-off error 	CO-1	06
B)	Write short note on 'Total numerical error'	CO-1	06
C)	Explain the terms: <ol style="list-style-type: none"> 1. Blunders 2. Formulation errors 3. Data uncertainty 	CO-1	06
Q.2	Solve Any Two of the following.		
A)	Using bisection method find the roots of the equation $f(x) = x^{10} - 1$ <p>Calculate the roots till the approximate error falls below 5%. Note that the root lies between 0 to 1.3.</p>	CO-2	06
B)	Using Newton-Raphson method, find the root of the equation using initial guess as 0. $f(x) = e^{-x} - x$ <p>Carry out minimum four iterations.</p>	CO-2	06
C)	The velocity of water v (m/s), during the discharge from a cylindrical tank through a long pipe can be calculated as $v = \sqrt{2gH} \tanh\left(\frac{\sqrt{2gH}}{2L} t\right)$	CO-4	06



If $g = 9.81 \text{ m/s}^2$, H =initial head (m), L = Length of pipe (m), and t = elapsed time (s). Determine the head needed to achieve $v=5 \text{ m/s}$ in 2.5 sec for a 4 m long pipe. Use bisection method with initial guesses as 0 m and 2 m. carry out minimum three iterations.

Q. 3	Solve Any Two of the following.																
A)	Solve the following system of equations using Cramer's rule. $2x_1 + x_2 + x_3 = 9$ $3x_1 + x_2 = 10$ $2x_2 + 5x_3 = 9$	CO-2	06														
B)	Solve the following system of equations using Gauss elimination method. $10x_1 + 2x_2 - x_3 = 27$ $-3x_1 - 6x_2 + 2x_3 = -61.5$ $x_1 + x_2 + 5x_3 = -21.5$	CO-2	06														
C)	Solve the following system of equations using Gauss elimination method with partial pivoting. $8x_1 + 2x_2 - 2x_3 = -2$ $10x_1 + 2x_2 + 4x_3 = 4$ $12x_1 + 2x_2 + 2x_3 = 6$	CO-2	06														
Q.4	Solve Any Two of the following.																
A)	Evaluate the following integral using Simpson's 1/3 rd Rule. $\int_0^{\pi/2} (6 + 3 \cos x) dx$	CO-2	06														
B)	Evaluate the integral of the following tabulated data using trapezoidal rule. <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>x</td> <td>0</td> <td>0.1</td> <td>0.2</td> <td>0.3</td> <td>0.4</td> <td>0.5</td> </tr> <tr> <td>F(x)</td> <td>1</td> <td>8</td> <td>4</td> <td>3.5</td> <td>5</td> <td>1</td> </tr> </tbody> </table> <p>Also comment on how the accuracy of trapezoidal rule be increased?</p>	x	0	0.1	0.2	0.3	0.4	0.5	F(x)	1	8	4	3.5	5	1	CO-2	06
x	0	0.1	0.2	0.3	0.4	0.5											
F(x)	1	8	4	3.5	5	1											
C)	Write algorithm for evaluating an integration using Trapezoidal rule.	CO-4	06														
Q. 5	Solve Any Two of the following.																
A)	Fit a straight line with zero intercept to the following data using least-square regression method.	CO-2	06														

	X	2	4	6	7	10	11	14	17	20			
	Y	1	2	5	2	8	7	6	9	12			
B)	Use Newton's interpolating polynomial to determine y at x =8 to the best of accuracy using the following data.										CO-2	06	
	X	0	1	2	5.5	11	13	16	18				
	Y	0.5	3.134	5.3	9.9	10.2	9.35	7.2	6.2				
C)	Solve the following from $t = 1.5$ to $t = 2.5$ using fourth-order Runge-Kutta method.										CO-2	06	
	$\frac{dy}{dx} = \frac{-2y}{1+t}$												
	If $y(0) = 2$												
*** End ***													

Instructions to the Students:

1. All the questions are compulsory
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question
3. Use of non-programmable scientific calculators is allowed
4. Assume suitable data wherever necessary and mention it clearly

(Level/CO) Marks

Q.1 Attempt Any Two

A) Derive an expression for deformation of uniformly tapering circular cross-sectional body (CO1) 6

B) A composite bar made of copper, steel and brass is rigidly attached to the end supports as shown in figure 01. Determine the stresses in the three portions of the bar when the temperature of the composite system is raised by 70°C when
 i) The supports are rigid ii) the supports yield by 0.6 mm.
 $E_c = 100 \text{ GPa}$, $E_s = 205 \text{ GPa}$, $E_b = 95 \text{ GPa}$
 $\alpha_c = 18 \times 10^{-6} / ^{\circ}\text{C}$, $\alpha_s = 11 \times 10^{-6} / ^{\circ}\text{C}$,
 $\alpha_b = 19 \times 10^{-6} / ^{\circ}\text{C}$ (CO2) 6

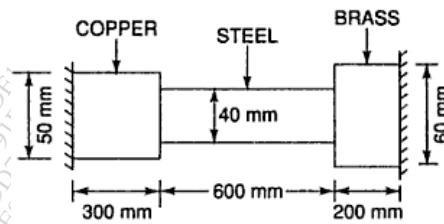


Figure 01

C) A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 150 MPa on the other at right angle. Each of the above stresses is accomplished by a shear stress of 100 MPa such that when associated with the minor stress tends to rotate the element in anticlockwise direction. Find;
 i. Principal stresses and their direction
 ii. Maximum shear stress (CO3) 6

Q.2 Attempt Any Two

A) A wagon weighing 20 kN is attached to a wire rope and is moving at the speed of 5.4 kmph. The rope suddenly jams and wagon is brought to rest. If length of rope is 50 m and diameter is 36 mm, find maximum instantaneous stress and elongation of rope. Take $E = 200 \text{ GPa}$. (CO2) 6

B) A rectangular pier is subjected to a compressive load of 450 kN as shown in figure 02. Find stress intensities on all the four corners of the pier.

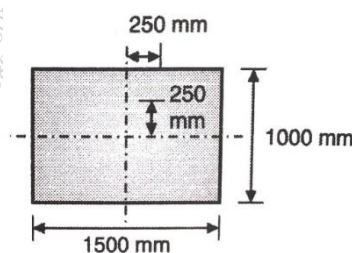


Figure 02

(CO3) 6

- C) Interpret a relationship between rate of loading, shear force and bending moment (CO4) 6

Q.3 Attempt Any Two

- A) An I-section beam 350 mm X 150 mm has a web thickness 10 mm & flange thickness 20 mm. If the shear force acting on the section is 40 kN, then find;
 a) Maximum shear stress developed in the section (CO3) 6
 b) Sketch the shear stress distribution diagram
 c) Total shear force carried by web
- B) Derive an expression for Flexural equation along with assumptions (CO2) 6
- C) A beam of T-section, 4 m long carries a uniformly distributed load 'w' per meter run throughout its length. The beam is simply supported at its ends. The T-section has web 18.8 cm X 1.2 cm and flange is 10 cm X 1.2 cm. What is the maximum value of 'w', so that the stress in the section does not exceed 60 MPa? (CO3) 6

Q.4 Attempt Any Two

- A) Derive an expression for Torsional formula along with assumptions (Understand) 6
- B) A Hollow shaft with diameter ratio of 3/8 is required to transmit 500 kW at 100 rpm, the maximum torque being 20% greater than mean. The maximum shear stress is not to exceed 60 N/mm² and the twist in the length of 3 m is not to exceed 1.4°. Calculate the minimum diameter required for the shaft. Take G = 84 N/mm². (Apply) 6
- C) A hollow CI column of external diameter 200 mm, length 4 meter with both the ends fixed, supports an axial load of 800 kN. Determine the thickness of the column required by using Rankine's formula taking constant of 1/6400 & working stress at 80 MN/m² (Apply) 6

Q.5 Attempt Any Two

- A) Draw shear force and bending moment diagrams for the beam loaded as shown in figure 03

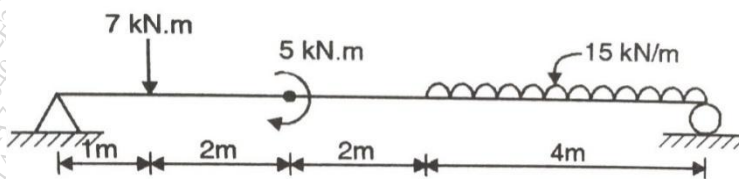


Figure 03

- B) Draw shear force and bending moment diagrams for the cantilever beam as shown in figure 04

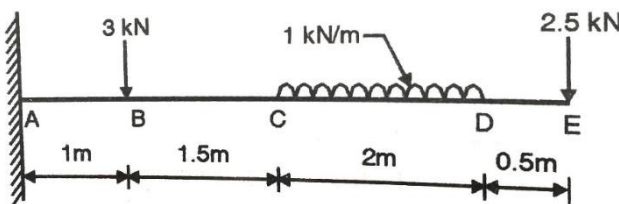


Figure 04

- C) A beam ABCD has an internal hinge at B and is loaded shown in figure 05. Plot shear force and bending moment diagrams and locate point of contra flexure.

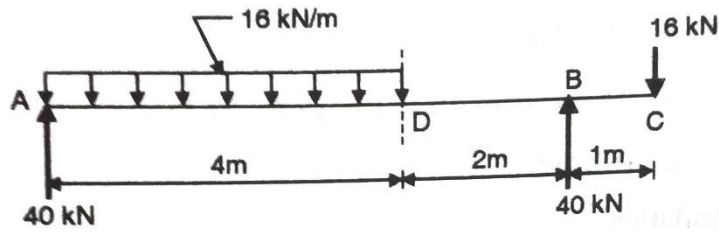


Figure 05

*** END ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

Course: B. Tech.

Branch : Mechanical

Semester : IV

Subject Code & Name: BTMPE405A- Numerical Methods in Engg.

Max Marks:60

Date: 27/8/2022

Duration: 3.45 Hr.

Instructions to the Students:

1. All Questions are Compulsory
2. Draw neat diagram wherever necessary.
3. Figures to right indicates full marks
4. Assume suitable data wherever necessary and mention it clearly

	(Level/CO)	Marks
Q.1 Solve Any Two of the following.		
A) Define and Explain the precision and Accuracy with an example	CO1	06
B) The discharge Q over a notch for head H is calculated by the formula $Q = kH^{5/2}$ where 'k' is given constant. If the head is 75cm and an error of 0.15cm is possible in its measurement, estimate the percentage error in computing the discharge.	CO1	06
C) Explain with an example error Propagation with example	CO1	06
Q.2 Solve Any Two of the following.		
A) The bacteria concentration (C) in a reservoir varies as $C=4e^{-2t}+e^{-0.1t}$. Calculate the time required for bacteria concentration to be 0.5	CO2	06
B) Using Bisection method find positive root for $\sqrt{32}$ upto three decimal places	CO3	06
C) Using Newton Raphson method, find a root upto three decimal place for the $x^3+2x^2+10x-20=0$ take $x_0=1$	CO2	06
Q.3 Solve Any Two of the following.		
A) Solve by Gauss Elimination Method	CO2	06
B) Solve by Crammers rule	CO2	06
C) A fruit seller selling different size mangoes. He sell a small size magno for Rs 3/-, medium size mango for Rs 5/-, and large size mango for Rs 7/-. The seller sells total 15 mangos and has made Rs 77/-. He has sold 2 more medium size mangos than small mangos. How many of each size did he sell.	CO3	06

Q.4 Solve Any Two of the following.

A) Evaluate the $\int_0^1 \left(\frac{1}{x^2+1} \right) dx$ by using two point Simpsons 1/3 rule

CO2 06

B) Evaluate the $\int_0^{0.5} \left(\frac{x}{\sin x} \right) dx$ using Trapezoidal method

CO2 06

C) A train is moving at the speed of 30 m/s. Suddely the brakes are applied.The speed of the train per second after 't' is given by

CO3 06

Time 't' in second	0	5	10	15	20	25	30	35	40	45
Speed 'v' in m/s	30	24	19	16	13	11	10	8	7	5

Estimate the distance moved by the train in 45 seconds

Q.5 Solve Any Two of the following.

A) A chemical factory wishing to study the effect of the extraction time (T) on the efficiency of an extraction operation (E) obtained data is as shown in the table. Fit a straight line to given data by least square method

CO3 06

T	27	45	41	19	35	39	19	49	15	31
E	57	64	80	46	62	72	52	77	57	68

B) Given $\frac{dy}{dx} = \frac{y-x}{y+x}$ with $y(0)=1$. Find $y(0.1)$ using modified Eulers method

CO2 06

C) Find $y(0.2)$ by using Runge-Kutta method taking $h=0.1$ and $y(0)=1$ from the system of equation, $dy/dx = x + y^2$

CO2 06

***** End *****