Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

Re-EXAMINATION - February 2024

Program: S.Y.B.Tech (Mechanical) Sem III

Course Code: BS-BTM301

Course Name: Applied Mathematics-1

Semester: III

Duration: 3 Hours

Maximum Points: 100

9/2/24

Note:

1. **Attempt Any Five Questions.**
2. **Answers to the sub questions should be grouped together.**
3. **Use of CALCULATOR is prohibited.**

		Questions	Points	CO	BL	Module
1	a	Find the image of the rectangular region bounded by the straight lines $x=0,\ x=1,\ y=0,\ y=2$ in the z-plane under the transformation $w=(1+i)z+(2-i)$. Show the regions graphically	6	4	BL5	7
	b	Obtain Half Range Fourier Cosine of $f(x)$, where $f(x)=lx-x^2,\ 0<x<l$	6	3	BL5	6
	c	Find Eigen Values and corresponding Eigen Vectors of $A=\begin{bmatrix}2 & 1 & 1\\ 2 & 3 & 2\\ 3 & 3 & 4\end{bmatrix}$	8	1	BL3	2
2	a	Evaluate $\int_C (x^2-y^2+x)dx-(2xy+y)dy$ from origin to $(1,1)$ along a parabola $y=x^2$.	6	2	BL5	4

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	b	Show that the transformation $w=\frac{1}{z}$ maps the circle $\lvert z-3\rvert=5$ in to the circle $\left\lvert w+\frac{3}{16}\right\rvert=\frac{5}{16}$	6	4	BL2	7
	c	Find Fourier series of $f(x)=\begin{cases}x-\pi & -\pi\le x\le 0\\ \pi-x, & 0\le x\le\pi\end{cases}$	8	3	BL3	5
3	a	Find the sum and product of the Eigen Values of *adjA* where $A=\begin{bmatrix}2&0&0&0\\3&5&0&0\\4&7&3&0\\5&6&7&1\end{bmatrix}$	6	1	BL4	2
	b	Find Fourier series of $f(x)=x^3$, $-\pi\le x\le\pi$. Hence prove that	6	3	BL5	5
	c	Evaluate $\iint_S(\nabla\times\overline{F})\cdot nds$, where $\overline{F}=(x^2+y-4)\hat{i}+3xyj+(2xz+z^2)k$ and S is the surface of the paraboloid $z=4-(x^2+y^2)$ above XY plane.	8	2	BL5	4
4	a	If $A=\begin{bmatrix}\alpha&\alpha\\\alpha&\alpha\end{bmatrix}$, prove that $e^A=e^{\alpha}\begin{bmatrix}\cosh\alpha&\sinh\alpha\\\sinh\alpha&\cosh\alpha\end{bmatrix}$	6	1	BL5	2
	b	Evaluate $\oint_C[(2x^2-y^2)dx+(x^2+y^2)dy]$ where C is the region bounded by the X –axis and the upper half of the circle $x^2+y^2=4$	6	2	BL3	4
	c	Find two non-singular matrices P and Q such that PAQ is in the normal form $A=\begin{bmatrix}3&2&1&4\\12&4&8&0\\9&5&4&9\end{bmatrix}$	8	1	BL3	1

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5	a	Find the angle between the surfaces $x\log y = z^2 - 1$ and $x^2 z = 2 - y$ at P(1,1,1)	6	2	BL4 ,5	4
	b	Find the image of the infinite strip $\frac{1}{4} < y < \frac{1}{2}$ under the transformation $w = \frac{1}{z}$. Show the region graphically.	6	4	BL4	7
	c	Verify Cayley Hamilton Theorem for $A = \begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and Hence find $A^5 - 2A^4 + 3A^3 + A$	8	1	BL2 BL4	2
6	a	Prove that the set of functions $S = \left\{\sin\left(\frac{\pi x}{2L}\right), \sin\left(\frac{3\pi x}{2L}\right), \sin\left(\frac{5\pi x}{2L}\right), \cdots\cdots\right\}$ is orthogonal over $(0, L)$. Hence construct orthonormal set.	6	3	BL5	6
	b	Find the bilinear transformation which maps the points 1, i, -1 of z-plane on to the points i, 0, $-i$ of w-plane.	6	4	BL3	7
	c	Check whether the matrix $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 3 & -1 \\ 1 & -1 & -1 \end{bmatrix}$ is diagonalizable or not. If it is diagonalizable, find modal matrix and the diagonal matrix.	8	1	BL3 BL5	2
7	a	Find the directional derivative of $\phi(x, y, z) = x^2 y + y^2 z + z^2 x$ at $(1,2,3)$ in the direction of the normal vector to the surface $x^2 + y^2 + z^2 = 3$ at $(1,1,1)$	6	2	BL2 BL3	3
	b	Test the consistency of the following equations and solve them if they are consistent	6	1	BL5	1

Re-EXAMINATION - February 2024

		$3x-y+2z=1$ $x-2y+3z=3$ $x-y+z=-1$ $x+2y-z=3$				
	c	Verify Gauss Divergence Theorem for $\overline{F}=4x\hat{i}-2y^2j+z^2k$ over the surface of the cylinder $x^2+y^2=16$, $z=0$, $z=4$	8	2	BL1 BL3	4

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END SEMESTER-EXAMINATION - DECEMBER 2023

Program: S.Y.B.Tech (Mechanical) Sem III

Course Code: BS-BTM301

Course Name: Applied Mathematics-1

Semester: III

Duration: 3 Hours

Maximum Points: 100

22/12/23

Note:

1. **Attempt Any Five Questions.**
2. **Answers to the sub questions should be grouped together.**
3. **Use of CALCULATOR is prohibited.**

		Questions	Points	CO	BL	Module
1	a	Find the image of the rectangular region bounded by the straight lines $x=0,\ x=1,\ y=0,\ y=2$ in the z-plane under the transformation $w=(1+i)z+(2-i)$. Show the regions graphically	6	4	BL5	7
	b	Obtain Half Range Fourier Sine of $f(x)$, where $f(x)=\begin{cases} x & 0<x\le 1/2 \\ 1-x, & 1/2\le x<1 \end{cases}$	6	3	BL5	6
	c	Find Eigen Values and corresponding Eigen Vectors of $A=\begin{bmatrix} 3 & -2 & 3 \\ 10 & -3 & 5 \\ 5 & -4 & 7 \end{bmatrix}$	8	1	BL3	2
2	a	Evaluate $\int_C (x^2-y^2+x)dx-(2xy+y)dy$ from origin to $(4,2)$ along a parabola $y^2=x$.	6	2	BL5	4

END SEMESTER-EXAMINATION - DECEMBER 2023

	b	Show that the transformation $w=\frac{1}{z}$ maps the circle $\lvert z-2\rvert=3$ in to the circle $\left\lvert w+\frac{2}{5}\right\rvert=\frac{3}{5}$	6	4	BL2	7
	c	Find Fourier series of $f(x)=\begin{cases}x-\pi & -\pi\le x\le 0\\ \pi-x, & 0\le x\le\pi\end{cases}$	8	3	BL3	5
3	a	Find the sum and product of the Eigen Values of A^{-1} where $A=\begin{bmatrix}2&0&0&0\\3&4&0&0\\4&-5&-3&0\\5&6&7&1\end{bmatrix}$	6	1	BL4	2
	b	Find Fourier series of $f(x)=x^2,\ 0\le x\le 2\pi$. Hence prove that $\frac{\pi^2}{12}=\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\cdots$	6	3	BL5	5
	c	Evaluate $\iint_S\left(\nabla\times\overline{F}\right)\cdot\hat{n}ds$, where $\overline{F}=(x^2+y-4)\hat{i}+3xy\hat{j}+(2xz+z^2)\hat{k}$ and S is the surface of the paraboloid $z=9-\left(x^2+y^2\right)$ above XY plane.	8	2	BL5	4
4	a	If $A=\begin{bmatrix}2&-1&1\\0&1&3\\0&0&-1\end{bmatrix}$, find A^{50}	6	1	BL5	2
	b	Evaluate $\oint_C\left[(2x^2-y^2)dx+(x^2+y^2)dy\right]$ where C is the region bounded by the X – axis and the upper half of the circle $x^2+y^2=4$	6	2	BL3	4
	c	Find two non-singular matrices P and Q such that PAQ is in the normal form	8	1	BL3	1

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END SEMESTER-EXAMINATION - DECEMBER 2023

		$A=\begin{bmatrix}2 & -2 & 3\\ 3 & -1 & 2\\ 1 & 2 & -1\end{bmatrix}$				
5	a	Find the angle between the surfaces $x\log y=z^2-1$ and $x^2z=2-y$ at P(1,1,1)	6	2	BL4 ,5	4
	b	Find the image of the circle $x^2+y^2-4x=0$ under the transformation $w=\frac{2z+3}{z-4}$	6	4	BL4	7
	c	Verify Cayley Hamilton Theorem for $A=\begin{bmatrix}2 & -1 & 1\\ 1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$ and Hence find $A^5-2A^4+3A^3+A$	8	1	BL2 BL4	2
6	a	Prove that the set of functions $S=\left\{\sin\left(\frac{\pi x}{2L}\right), \sin\left(\frac{3\pi x}{2L}\right), \sin\left(\frac{5\pi x}{2L}\right),\cdots\cdots\right\}$ is orthogonal over $(0,L)$. Hence construct orthonormal set.	6	3	BL5	6
	b	Find the bilinear transformation which maps the points 1, i, -1 of z-plane on to the points 0, 1, ∞ of w-plane.	6	4	BL3	7
	c	Check whether the matrix $A=\begin{bmatrix}3 & -1 & 1\\ -1 & 3 & -1\\ 1 & -1 & -1\end{bmatrix}$ is diagonalizable or not. If it is diagonalizable, find modal matrix and the diagonal matrix.	8	1	BL3 BL5	2
7	a	Find the directional derivative of $\phi(x,y,z)=x^3y+y^3z+z^3x$ at $(1,-1,3)$ in the direction of the normal vector to the surface $x^2+y^2+z^2=9$ at $(-2,2,1)$	6	2	BL2 BL3	3

END SEMESTER-EXAMINATION - DECEMBER 2023

	b	Test the consistency of the following equations and solve them if they are consistent $2x+3y-z-2=0$ $x+2y+z+3=0$ $3x+y-2z-1=0$	6	1	BL5	1
	c	Verify Gauss Divergence Theorem for $\overline{F}=4x\hat{i}-2y^2\hat{j}+z^2\hat{k}$ over the surface of the cylinder $x^2+y^2=16,\ z=0,\ z-4$	8	2	BL1 BL3	4

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Munshi Nagar, Andheri (W) Mumbai – 400058

Previous Semester Examination - February 2024

Program: S.Y.B.Tech (Mechanical) Sem III **Duration: 3 Hours**

Course Code: BS-BTM301 **Maximum Points: 100**

Course Name: Laplace, Fourier, Complex, Linear Algebra

Semester: III

Note:

1. **Attempt Any Five Questions.**
2. **Answers to the sub questions should be grouped together.**
3. **Use of CALCULATOR is prohibited.**

		Questions	Points	CO	BL	Module
1	a	Find the image of the rectangular region bounded by the straight lines $x=0,\ x=1,\ y=0,\ y=2$ in the z-plane under the transformation $w=(1+i)z+(2-i)$. Show the regions graphically	6	4	BL5	7
	b	Obtain Half Range Fourier Cosine of $f(x)$, where $f(x)=lx-x^2,\ 0<x<l$	6	3	BL5	6
	c	Find Eigen Values and corresponding Eigen Vectors of $A=\begin{bmatrix}2 & 1 & 1\\ 2 & 3 & 2\\ 3 & 3 & 4\end{bmatrix}$	8	1	BL3	2
2	a	Evaluate $L^{-1}\left\{\frac{s}{(s+1)(s+2)(s+3)}\right\}$	6	2	BL5	4
	b	Show that the transformation $w=\frac{1}{z}$ maps the circle $\lvert z-3\rvert=5$ in	6	4	BL2	7

Previous Semester Examination - February 2024

		to the circle $\left\|w+\frac{3}{16}\right\|=\frac{5}{16}$				
	c	Find Fourier series of $f(x)=\begin{cases}x-\pi & -\pi\le x\le 0\\ \pi-x, & 0\le x\le\pi\end{cases}$	8	3	BL3	5
3	a	Find the sum and product of the Eigen Values of $adjA$ where $A=\begin{bmatrix}2&0&0&0\\3&5&0&0\\4&7&3&0\\5&6&7&1\end{bmatrix}$	6	1	BL4	2
	b	Find Fourier series of $f(x)=x^3$, $-\pi\le x\le\pi$.	6	3	BL5	5
	c	Evaluate (i) $L\{te^t\cos 3t\}$ (ii) $L\left\{\frac{\cos at-\cos bt}{t}\right\}$	8	2	BL5	4
4	a	If $A=\begin{bmatrix}\alpha&\alpha\\\alpha&\alpha\end{bmatrix}$, prove that $e^A=e^{\alpha}\begin{bmatrix}\cosh\alpha&\sinh\alpha\\\sinh\alpha&\cosh\alpha\end{bmatrix}$	6	1	BL5	2
	b	Prove that $\int_0^{\infty}\frac{e^{-\sqrt{2}t}\sinh t\cdot\sin t}{t}dt=\frac{\pi}{8}$	6	2	BL3	4
	c	Find two non-singular matrices P and Q such that PAQ is in the normal form $A=\begin{bmatrix}3&2&1&4\\12&4&8&0\\9&5&4&9\end{bmatrix}$	8	1	BL3	1
5	a	Evaluate $L\left\{\int_0^t e^{-3u}\cdot\sin 2u\,du+4^t\right\}$	6	2	BL4 ,5	4
	b	Find the image of the infinite strip $\frac{1}{4}<y<\frac{1}{2}$ under the	6	4	BL4	7

Previous Semester Examination - February 2024

		transformation $w=\frac{1}{z}$. Show the region graphically.				
	c	Verify Cayley Hamilton Theorem for $A=\begin{bmatrix}2 & -1 & 1\\ 1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$ and Hence find $A^5-2A^4+3A^3+A$	8	1	BL2 BL4	2
6	a	Prove that the set of functions $S=\left\{\sin\left(\frac{\pi x}{2L}\right),\ \sin\left(\frac{3\pi x}{2L}\right),\ \sin\left(\frac{5\pi x}{2L}\right),\cdots\cdots\right\}$ is orthogonal over $(0,L)$. Hence construct orthonormal set.	6	3	BL5	6
	b	Find the bilinear transformation which maps the points 1, i, -1 of z-plane on to the points i, 0, $-i$ of w-plane.	6	4	BL3	7
	c	Check whether the matrix $A=\begin{bmatrix}3 & -1 & 1\\ -1 & 3 & -1\\ 1 & -1 & -1\end{bmatrix}$ is diagonalizable or not. If it is diagonalizable, find modal matrix and the diagonal matrix.	8	1	BL3 BL5	2
7	a	Find Fourier series of $f(x)=4-x^2,\ 0\le x\le 2$.	6	2	BL2 BL3	3
	b	Test the consistency of the following equations and solve them if they are consistent $3x-y+2z=1$ $x-2y+3z=3$ $x-y+z=-1$ $x+2y-z=3$	6	1	BL5	1
	c	Evaluate $(i)\ L\{\sin t\cdot\sin 2t\cdot\sin 3t\}$ $(ii)\ L^{-1}\left\{\frac{2s+3}{s^2+4s+8}\right\}$	8	2	BL1 BL3	4

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Munshi Nagar, Andheri (W) Mumbai – 400058

END-SEM-EXAMINATIONS Dec 2023

S. Y. B. Tech (M) Sem III

Program :BTech Mechanical engg **Duration** :3 hr

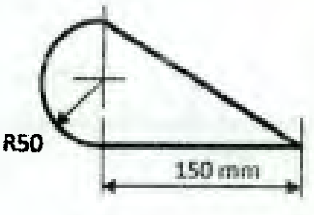
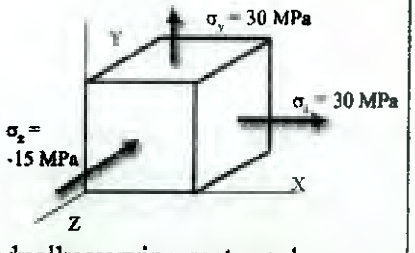
Course Code :PC-BTM302 **Maximum Points** :100

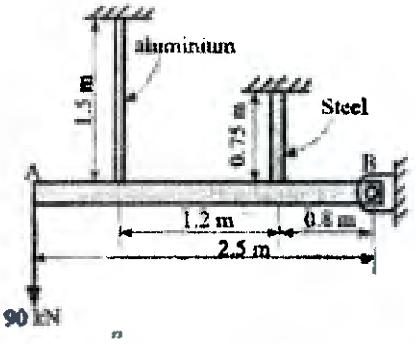
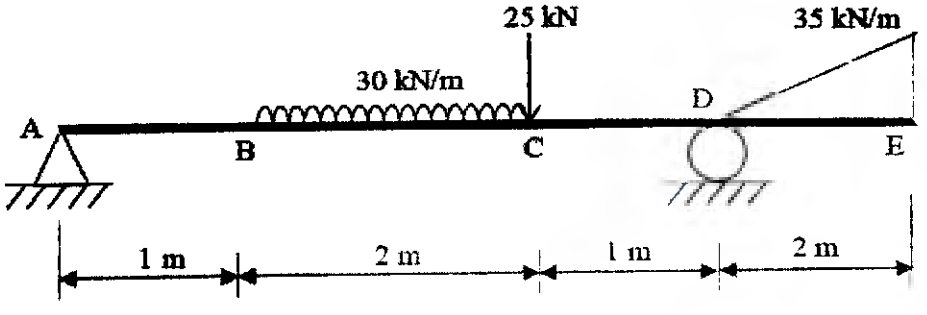
Course Name :Strength of Materials.

Semester :III

Instruction : Refer below

1. Question No. 1 is compulsory
2. Solve any four out of remaining six.
3. Answers to each sub-questions are grouped together
4. Use of scientific calculator is allowed
5. Begin answer to each question on new page.
6. Keep some margin on left side of answer paper
7. **Candidates should write the answer legibly**

Q. no.	Description	Pts	CO	BL
1	a) Define following terms: Poisson's ratio, Yield stress, Modulus of rigidity, Section modulus, Torsional stiffness.	5	1,2 ,3	2,3
	b) A 4 mm thick plate is to be punched of a shape shown in figure. Determine the minimum punching force to be applied on a punch. The ultimate shear strength of plate is 300 MPa. What is the corresponding compressive stress in the punch. 	5		
	c) A solid cube of side 200 mm is subjected to triaxial stresses as shown in the figure. Calculate the strain and change in lengths in all directions. E = 200 GPa, ν = 0.3 	5		
	d) Derive the axial extension for a bar of gradually varying rectangular cross section.	5		
2	a) A cantilever beam of length L is subjected to point load 'w' acting at L/2 from free end. Develop expression for the deflection of the beam at free end. The beam has area moment of inertia of I and modulus of elasticity E.	5	1,2	2,3
	b) A simply supported beam has a span of 15 m and carries two point loads of 4 kN and 9 kN at 6 m and 10 m respectively from left end. Find the deflection under each load and the maximum deflection. E = 200 GPa and $I = 400 \times 10^6$ mm^4	15		

3	a) A compound bar consists of three bars of width 30 mm and thickness 6 mm joined together rigidly to form an equivalent bar of width 30 mm and thickness 18 mm. Consider that the middle bar is of aluminium alloy with Young's modulus of elasticity E_{Al}= 70 GPa and the two steel bars are rigidly fixed to the aluminium alloy bar on its either side with Young's modulus of elasticity Es = 200 GPa. If the bars are initially joined at 20 °C and the temperature of the whole assembly is then raised to 50 °C, determine the stresses set up in the steel and the aluminium alloy bars. Take the coefficient of thermal expansion of steel and aluminium alloy as $\alpha_s=12\times10^{-6}$/°C and $\alpha_{Al}=22\times10^{-6}$/°C, respectively.	10	1,2	3,4
	b) A rigid bar AB is supported by a pin at B and by two rods as shown in the figure. Find the stress in each rod. Cross-sectional area of steel rod is 500 mm^2 and that of aluminium rod is 400 mm^2. Neglect the weight of the bar. Take the Young's modulus of elasticity of steel and aluminium as 200 GPa and 70 GPa, respectively. 	10		
4	a) Show that for a beam subjected to pure bending, neutral axis coincides with the centroid of the cross-section.	5	1,2	3,4
	b) Develop the shear force and bending moment diagram for the beam ABCDE as shown in fig. 	15		
5	a) An I-section 300 mm x 100 mm having flange thickness 12 mm and web thickness of 6 mm is part of a simply supported beam structure. At certain location it is subjected to shear force of 250 kN acting perpendicular to the flange surface. Determine the maximum and minimum shear stress in the web at this location. Also calculate the percentage of vertical shear carried only by the web of the beam.	15	1,2	3,4
	b) A circular shaft transmits 30 kW at 400 rpm. It is supported in bearings 6 meters apart and at 2 meters from one bearing, it carries a rotor exerting a transverse load of 15 kN on the shaft. Determine a suitable diameter for the shaft taking into account both bending and torsional stresses if the maximum shear stress is not to exceed 40 MPa	5		
6	a) At a point in a material subjected to two-dimensional stress, one of the principal stresses is 50 MPa, tensile. On a plane at 30° to this principal	10	1,2	2,3

	plane, the normal stress is zero. Determine the other principal stress, the shear stress on the plane of zero normal stress and planes on which the normal and shear stresses are equal in magnitude.			
	b) A cylindrical shell, 1100 mm in diameter, thickness of metal 15 mm and 3.2 m long, is subjected to internal pressure of 1.8 MPa. Calculate the change in diameter, length and volume of shell under pressure. Use thin cylinder theory. E = 210 GPa, Poisson's ratio = 0.27.	10	1,2 ,4	
7	a) A cast iron water pipe of 300 mm inside diameter and 10 mm thick is supported over a span of 4 meters. Find the maximum stress in the pipe metal, when the pipe is running full. Take density of cast iron as 70.6 kN/m^3 and that of water as 9.8 kN/m^3	7		2,3
	b) A rectangular beam section of 40mm wide and 100 mm depth is subjected to a moment of 10 kN-m. Determine the maximum stress in the beam. Also calculate the radius of curvature of neutral axis at this section. Consider E = $2x10^5$ N/mm^2.	7		
	c) A hollow steel shaft transmits 20 kW of power at 360 rpm. Total angle of twist in a length of 5 meter is 2^0. Find diameter of shaft if permissible shear stress is 60 MPa. Take G = 80 GPa.	6		

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Re-EXAMINATIONS Feb 2024

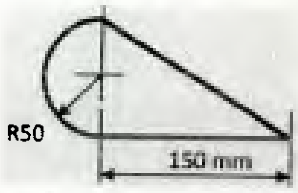
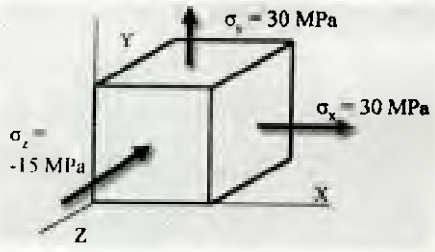
S.Y. B.Tech (M) Sem III

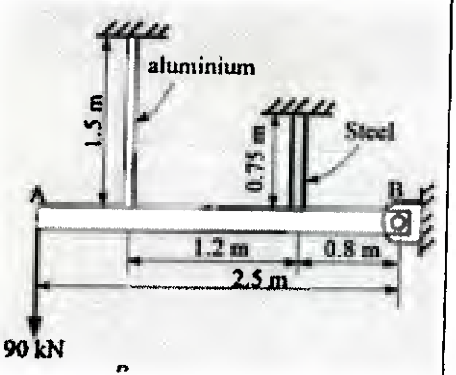
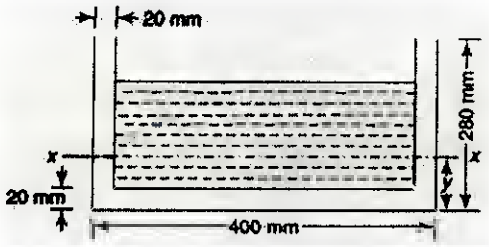
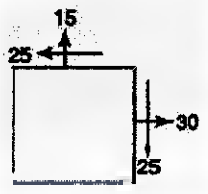
16/2/24

Program	:BTech Mechanical **engg**	**Duration**	:3 hr
Course Code	:PC-BTM302	**Maximum Points**	:100
Course Name	:Strength of Materials.		
Semester	:III		

Instruction : Refer below

1. Question No. 1 is compulsory
2. Solve any four out of remaining six.
3. Answers to each sub-questions are grouped together
4. Use of scientific calculator is allowed
5. Begin answer to each question on new page.
6. Keep some margin on left side of answer paper
7. **Candidates should write the answer legibly**

Q. no.	Description	Pts	CO	BL
1	a) Define following terms: Ultimate stress, Bulk modulus, moment resistance, pure bending, principal stress.	5	1,2 ,3	2,3
	b) A 3 mm thick plate is to be punched of a shape shown in figure. Determine the minimum punching force to be applied on a punch and the ultimate shear strength of plate material, if corresponding compressive stress in the punch is 64 MPa. 	5		
	c) A solid cube of side 150 mm is subjected to triaxial stresses as shown in the figure. Calculate the strain in all directions and change in volume. E = 210 GPa, $\nu = 0.27$ 	5		
	d) A rectangular beam section of 30mm wide and 75 mm depth is subjected to a moment of 12 kN-m. Determine the maximum stress in the beam. Also calculate the radius of curvature of neutral axis at this section. Consider E = 2×10^5 N/mm^2.	5		2,3
2	a) A cantilever beam of length L is subjected to uniform load per unit length 'w' acting on entire span. Develop expression for the slope and deflection; also find its maximum value. The beam has area moment of inertia of I and modulus of elasticity E.	10	1,2	
	b) A cantilever beam has a span of 3 m and carries a point load of 10 kN at mid-span of beam. Find the deflection at the free end of the beam. E = 200 GPa and $I = 400 \times 10^6$ mm^4.	10		

3	a) A bronze bar of length 3 m with a cross-sectional area of 320 mm^2 is placed between two rigid walls. At a temperature of –20 °C, there is a gap of 2 mm between the bar end and the rigid wall. Find the temperature at which the compressive stress in the bar will be 40 MPa.	10	1,2	3,4
	b) A rigid bar AB is supported by a pin at B and by two rods as shown in the figure. Find the stress in each rod. Cross-sectional area of steel rod is 400 mm^2 and that of aluminium rod is 300 mm^2. Neglect the weight of the bar. Take the Young's modulus of elasticity of steel and aluminium as 210 GPa and 72 GPa, respectively. 	10		
4	a) A cast iron channel supported at two points, 11 meter apart as shown in fig. Determine maximum depth of water in the channel if the tensile and compressive bending stresses are not to exceed 18 MPa and 48 MPa respectively. Water weighs 9.81 kN/m^3 and cast iron 68 kN/m^3. 	10	1,2	3,4
	b) A cantilever of 10 m span carries loads of 4 kN and 6 kN at 2 m and 6 m respectively from the fixed end along with another load of 6 kN at the free end. Draw the shear force and bending moment diagram.	10		
5	a) An I-section 100 mm x 40 mm having flange thickness 4 mm and web thickness of 3 mm is part of a simply supported beam structure. At certain location it is subjected to shear force of 15 kN acting perpendicular to the flange surface. Determine the maximum and minimum shear stress in the web at this location. Also calculate shear stress at the bottom of flange.	10	1,2	3,4
	b) A hollow steel shaft transmits 200 kW of power at 150 rpm. The total angle of twist in a length of 5 m of the shaft is 3^0. Find the inner and outer diameters of the shaft if permissible shear stress of 60 MPa and G= 80 GPa.	10		
6	a) For the state of a stress as shown in fig. Find the magnitude and direction of principal stress and plane of maximum shear stress. 	10	1,2	2,3
	b) A bar of 12 mm diameter is acted upon an axial load of 20 kN. The change in diameter is measured as 0.003 mm. Determine; poisson's ratio, modulus of elasticity, bulk modulus if G = 80 GPa.	10		
7	a) Show that for rectangular c/s the maximum shear stress is 50% higher than mean shear stress.	6		
	b) Derive the axial extension for a bar under self-weight having uniform circular cross section.	6		
	c) Derive the expression for stress on oblique plane under bi-axial loading.	8		

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

End Semester RE-Examination February 2024

Program: Mechanical Engineering S.Y. (M) Sem III Duration: 3 hour

Course Code: **PC BTM 306** Maximum Points:100

Course Name: **Manufacturing Science** Semester: III

Note:

1) Attempt any Five main questions our of remaining six main questions
2) Assume suitable data and mention it at top on solution and draw necessary sketch wherever necessary.

Notes:

Q.No.	Questions	Points	CO	BL	Mod
Q1 A	Give a sketch of the finished component (in terms of product geometry only) as manufactured using Vertical axis turret lathe machine (no theory explanation required)? Give in brief sequence of machining operations for manufacturing the same component using minimum number of setup [6M]. Give classification of NC machine tools based on different criteria's? [4M]	10	4	1,2	3
Q1 B	Estimate best welding speed to be used for welding of 15 mm EN8 plates with an ambient temperature of 27° C with welding transformer set at 20 V and current passing is 300 A. Arc efficiency is 0.86 and possible travel speeds are 6 to 10 mm/s. limiting cooling rate for satisfactory performance is 5.5° C/s at a temperature of 580° C. Data- k= 0.03 J/mm.s.°C, R= 6° C/s, T_o = 27° C, T_c = 600° C, V= 20 V, I = 300A, ρ*c = 0.0033 J/mm³°C. For thick plate, rate of cooling, $R = \frac{2\pi k(T_c - T_0)^2}{H_{net}}$ For thin plate, rate of cooling, $R = 2\pi k\rho c\left(\frac{h}{H_{net}}\right)^2 (T_c - T_0)^3$ $\tau = h\sqrt{\frac{\rho c(T_c - T_0)}{H_{net}}}$	10	1,2	2	2
Q2 A	Write a short note on Investment casting process along with stepwise sketch? Also give its application?	10	1,2	3	1
Q2 B	Explain material removal *mechanism* [3M] and *characteristics* [3M] of "Electro discharge" process along with a neat schematic sketch?	10	3	1	5
Q3 A	Explain with neat schematic sketch Gas metal arc welding process and its applications? [5M]	10	1,2	2	2

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End Semester RE-Examination February 2024

	Justify, how is the solid state welding process is better compare to other joining processes? [5M]				
Q3 B	Draw neat sketch of Tool room lathe machine tool? Using sketch discuss about profile manufacturing accessory used on lathe machine tool?	10	4	3	3
Q4 A	Give three important *differences* between Multi-spindle and Gang drilling machine? [5M] Draw neat sketch of helical flute drill tool and show helix angle, cutting lip angle, lip length? [5M]	10	4	1,3	4
Q4 B	Write short note on following; a) Plastic vaccum forming process b) Gating system in sand mold				
Q5 A	For machining the small pocket on "*High strength temperature resistant alloys*", which nontraditional machining process is suitable? Give a neat schematic *sketch* of the set up and give *characteristics* of that process?	10	1,3	3	5
Q5 B	Explain the *factors* required to be considered for selection of grinding wheel? Give significance of following terms related to grinding wheel a) Grade of hardness, b) Structure?	10	1,4	2	7
Q6 A	What is role of Jig and Fixture on machining cost of components Explain it using sketch (machining cost Vs quantity of production)? List down 5 points (either sketch or explanation) to be consider while design of locating elements?	10	4	2	6
Q6 B	List down 5 points (either sketch or explanation) to be consider while design of Clamp elements? Give application and use of Pot jig along with sketch?	10	4	1	6
Q7 A	List down basic requirements for efficient grinding. Explain each one in 2 points? Write short note on Vertical spindle rotary table grinder machine along with its neat schematic sketch?	10	4	2	7
Q7 B	What is automatic tool changer unit? Give its sketch and explain its operation? For manufacturing Helical gear having 237 numbers teeth's, suggest a work holding device having indexing mechanism, calculate the characteristics of accessories required if reduction ratio up to 40:1 available in indexing mechanism of work holding device? [5M]  	10	4	2	4

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RE-EXAMINATION FEBRUARY-2024

Program: B.Tech. Mechanical | Duration: 3 Hour

Course Code: PCC-BTM305 | Maximum Points: 100

Course Name: Thermodynamics | Semester: III

Notes

1) **Solve: Any FIVE Questions.**
2) Answers must be **SPECIFIC** and in **legible** handwriting.
3) Draw **neat system diagram/s and process diagrams** wherever necessary.
4) Use **Steam tables and Mollier Chart provided by Examination section,** if required.
5) Illustrate your answers with suitable examples as and where necessary.
6) **Assume suitable data wherever necessary and state the same.**

Q. No.	Question	Points	CO	BL	Modul
1.	**a) Define:** i) Thermodynamic system, surrounding and universe. ii) Thermodynamic property iii) Thermodynamic cycle. **Explain:** Types of thermodynamic systems with suitable examples and neat sketches.	10	1	I, II	1
	c) A gas undergoes a thermodynamic cycle comprising of following 03 processes: 1) Process 1-2: Constant pressure process, p_1= *1.4 bar*, V_1 = *0.028 m³*, W_{1-2} = *10.5 kJ*, 2) Process 2-3: Compression with p.V = C, $U_2 = U_3$, 3) Process 3-1: Constant volume process, *U1 – U3 = - 26.4 kJ*. There are no significant changes in K.E. and P.E. of the system during the entire cycle. i) **Draw:** p-V diagram of the cycle, ii) **Evaluate:** Net work transfer (W_{net}) of the cycle in kJ, and iii) **Evaluate:** Net heat transfer (Q_{net}) of the cycle in kJ.	10	1, 4	I, VI	1, 2
2.	**a) State:** General form of steady flow energy equation for a control volume. **Derive:** Steady flow energy equation for i) turbine and ii) nozzle. **State:** Assumptions made. **Draw:** neat system diagram.	10	3	I, V	2
	b) In a steady flow device *135 kJ /kg* of the work is done by the fluid. The specific volume, pressure and velocity of the fluid at the inlet of the device are *0.37 m³/kg*, *600 kPa* and *16 m/s* respectively. The inlet pipe of the device is *32 m* above the floor level and the discharge pipe is on the floor level. At the outlet of the device, the specific	10	4	I, VI	2

RE-EXAMINATION FEBRUARY-2024

	volume, pressure and velocity of the fluid are *0.62 m^3/kg, 100 kPa* and *270 m/s* respectively. The heat loss from the device to the surrounding is *9 kJ /kg*. **Evaluate:** i) Change in the internal energy of fluid while moving from inlet to exit of the device ii) Ratio of inlet to outlet diameter of the device. **Draw:** Neat system diagram.				
3.	**a) Explain:** Kelvin-Planck statement and Claussius statement of second law of thermodynamics. **Justify:** Equivalence of both the statements. **Draw:** Neat block diagrams for each statement and justification of equivalence of both the statements.	**10**	1, 3	I, II, VI	3
	b) 1 kg of ice at - *5 °C* is converted to superheated steam at *250°C*. The pressure during this conversion process is constant at 1 atm. **Draw:** T-s diagram for the entire process showing each stage of the entire process, without the saturated solid, liquid and vapor curves. **Evaluate:** Change in entropy for each stage of the conversion process Refer the following data: c_p of ice = *2.093 kJ/ kg. K*, latent heat of fusion of ice, h_{sf} = *336.96 kJ/ kg*, c_p of water = *4.187 kJ/ kg. K*, latent heat of vaporization of water, h_{fg} = *2257 kJ/ kg*, c_p of steam = *2.093 kJ/ kg. K*.	**10**	4	I, VI	4, 5
4.	**a) Explain:** Working of **an ideal Rankine cycle** for steam power plant. **Draw:** Neat i) system diagram, ii) T-s diagram and iii) h-s diagram for the cycle.	**10**	1, 3	I, II	5
	b) A steam power plant works on an ideal Rankine cycle. Steam turbine receives the steam at *15 bar* and *350°C* and is exhausted to condenser at *0.06 bar*. **Evaluate:** i) Thermal efficiency of the plant, **Draw:** Neat i) system diagram, and ii) T-s diagram for the cycle.	**10**	4	I, VI	5
5.	**a)** In an air standard **Otto cycle**, the compression ratio is 8. Air is supplied to the engine at *35°C* and *0.1 MPa*. The heat supplied in combustion process is *2100 kJ/kg*. **Evaluate:** i) Maximum temperature and pressure of the cycle and ii) Cycle efficiency. **Draw:** p-V and T-s diagram of the cycle.	**10**	4	I, VI	6
	b) Explain: Difference between working of an open and closed cycle gas turbine plant, operating on air standard Brayton cycle. **Draw:** I) neat system diagram and ii) p-V diagram for both the cycles.	**10**	1, 3	I, II	6

RE-EXAMINATION FEBRUARY-2024

6.	**a) Explain:** Working of a Vapor Compression Refrigeration (VCR) cycle. **Draw:** Neat i) system diagram, ii) T-s and p-h diagram for the cycle.	**10**	1, 3	I, II	3, 7
	b) Describe: Working of a four- stoke I.C. engine and **Draw:** well labelled diagram showing its main components.	**10**	1, 3	I, II	1, 6
7.	Write short notes on **ANTY THREE** of the following	**20**	1	II	
	a) Cogeneration and trigeneration				7
	b) Reheat cycle				5
	c) Fuel cells				7
	d) Joule's Experiment				2
	e) Entropy- Claussius inequality and principle of increase				4

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering
(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
End Semester Exam
December 2023

29/12/23

Max. Marks: 100 Duration: 3 Hours
Class: S.Y. Mech/Electrical Semester: III Program: B.Tech
Course Code : HSM BTM 307/ BTE 301

Organizational Communication and Interpersonal Skills

Note:

- ***Question 1 and Question 2 is Compulsory***
- **Out of remaining 5 questions attempt any 3**
- **Each question carries 20 marks**
- **Start every question from fresh page.**

Questions	Answer the following questions:	POINTS	CO	BL	PI
Q.1.	Attempt any ***Two questions out of Six***. Each question carries Ten marks: A. Define a team. What are the types of teams? What are the advantages and disadvantages of working in a team? B. Differentiate between a leader and a Boss. Explain the six different leadership styles with an example each. C. Explain in detail Stephen Covey's Time Management Quadrant. What are the different techniques to be adopted for utilizing time effectively? D. "***Stress management*** helps in leading a happier and healthier life". What are some psychological and emotional signs of stress? E. Define reports. Explain contents of a report. F. List the prefatory parts of a report with an explanation	**20**	**01,2, 3,4,5**	**04**	**10.1. 3**
Q.2	All India Council of Technical Education has appealed the Principals of all engineering colleges to implement National Education Policy	**05+ 15**	**04**	**03**	**4.1.2**

	2020 with an immediate effect. The Principal Sardar Patel College of Engineering has appointed you as Dean Academics of the institute and has requested you to submit a feasibility report the pros and cons of implementing the NEP policy all across branches and semesters from 2024, January In the capacity of Dean Academics and Keeping the academics, Infrastructure, Laboratories, submit a **Memo Report** to Principal Dr Mohan Murudi, along with your five recommendations. (Apply minimum four procedures to collect the required data).	**20**			
Q.3.	Imagine you are the General Secretary of the college. The Chairperson Student Welfare Committee has requested you to submit a detailed program for SPHINX the annual technical and Cultural Event of the college to be conducted in the month of February for four days. Conduct the Student Council meeting to discuss the dates, Budget, List of events, Arrangements, list of Celebrities, Evening events.	**(20)**	**01**	**02, 03**	**3.1.1**
A.	Draft the notice and agenda for the meeting	**10**			
B.	Assuming the meeting conducted prepare the minutes of the meeting.	**10**			
Q.4	Draft a Job Application Letter for the Job opening mentioned below.	**(20)**	**02**	**01**	**10.1.2**
A.	Prepare a detailed resume for the post mentioned.	**10**			
B.	Wipro Eligibility Criteria for Fresher's 2024 • Candidate Should have 60% throughout their academics. • Students from Students who have completed Graduation and Graduation in BE, B.Tech or 5 Year Integrated M.Tech. • All Engineering Branches are Eligible. **Backlog Criteria** • Candidate should not have any backlog at the time of Selection Process. **Education Criteria** • Maximum 3 years in education gap ,if any, is allowed between 10th and graduation. • Candidate should have done a full degree course recognized by the Central/State Government of India.	**10**			

	Other Important Criteria • Students applying in Wipro must be Indian citizens or should carry a PIO or OCI card, in case holding a passport of any other country. • Candidate should have done a full degree course recognized by the Central/State Government of India • Students should be proficient in Microsoft, Canva, Matlab and C programming softwares. **Service Agreement** • Applicable for 15 months post joining @ INR 75,000 on pro rata basis				
Q.5. **A.** **B.**	Your best friend's concepts are clear and her reasoning is sound, but in the feedback to her presentations, the audience often says that she is very feeble. You just cannot hear her beyond the first two rows. She fumbles with words during presentations. She has also not made her PowerPoint slides properly as she has not read any rules for preparing PowerPoint presentations. You want to see her improve the quality of delivery of her presentations, as you feel this is a critical skill needed for going forward and achieving success as an engineer. What suggestions would you give her for presentations regarding improvement in the Content, Delivery, and Non-Verbal communication? What tips would you like to give for the talk power formula and the Visual Aids during presentation?	**(20)** **10** **10**	**05**	**04**	**10.1.3**
Q.6. A. **Q.6. B.**	"The first step in getting the right job and adding value to your career is to plan for your job". Explain sequentially the nuances and their stages to be focussed while planning. Prepare a detailed swot analysis in the quadrant for the Placements for Engineering students in SPCE.	**(10)** **(10)**	**02**	**01**	**10.1.2**
Q.7. A.	Multiple Choice questions: Each question carries 02 marks **1. Business Etiquette_____** **a. Ensures a business communicates with all the proper people** b. Is a guide to personal success c. Helps a business avoid civil rights complaints d. Ensures a professional business environment is maintained.	**(10)**	**01,03**	**03**	

	2. The four areas covered by business etiquette are: a. Texting, dress, computers and dinners b. informal, formal, verbal and non-verbal c. communication styles, dress and appearance, technology and social situations d. Communication Styles, transportation, financial and social situations e. None of these **3. You disagree with a point your boss made at your weekly brain storming session you:** a. random blurt your opinion in front of everyone b. politely disagree and suggest an alternative idea. c. ask to meet personally with your superior once the session is done to voice your objections d. complain to your co-workers behind your boss's back **4. It is casual Friday, but you have a meeting with a client. How should you dress that day?** a. casually b. A little nicer than usual, but nothing too formal c. In your Suit d. In business casual **5. Your office culture allows you to keep personal items on your desk and in your cubicle. You:** a. Fill your desk with pictures of family, kids, artwork and favourite Knick knacks b. Balance personal and office items. One in five objects can be personal c. Avoid displaying anything other than work related items d. your cubicle is for keeping papers and files so you do not have any space for personal items.				
Q.7. B.	Prepare your own business card and write 10 important etiquettes to be followed for a business card.	**(10)**			

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END SEMSTER EXAMINATION DECEMBER-JANUARY 2023-24

Program: B.Tech. Mechanical T. Y. B. Tech (ME) Duration: 3 Hour

Course Code:MC-BTM002 Maximum Points: 100

Course Name: Indian Traditional Knowledge Semester: III

Notes:

1) **Solve: Any FIVE Questions.**
2) Write **ELLABORATIVE answers in legible** handwriting.
3) **Illustrate your answers with suitable examples as and where necessary.**

Q. No.	Question	Points	CO	BL	Modul
1.	**a) Justify:** *"India is the unique country with unity in diversity as its core strength since ancient times"* giving suitable examples.	10	1	VI	1
	b) Justify: with suitable examples remarks of Major Eliot that *"India is the Richest Prize in the World in all respects."*	10	1	VI	1
2.	**a) List:** names of the Vedas and Upvedas. **Justify:** *Vedas are the etemal source of knowledge from Indian tradition for mankind since ancient times."*	10	2	I, VI	2
	b) Describe: The contributions of Maharshi Vyasa for the enrichment of ancient Indian scriptures.	10	2, 3	II	2, 6
3.	**a) Describe:** Work and notable contributions of ancient Indian scientists Maharshi Kanad and Acharya Varahmihir.	10	2	II	3
	b) Justify: *Ancient Indian wisdom was more superior than any other civilization in the world.* **Illustrate:** with TWO notable contributions by ancient Indian scholars in the field of mathematics and astronomy.	10	2	III, VI	3
4.	**a) Describe:** Contribution of Maharshi Patanjali for Yoga. **Justify:** *"Yoga is the key for long life with good health"* in context of ancient as well as modem India.	10	2	II, VI	4
	b) Justify: Medical and hygienic importance of any ONE ancient Indian tradition/ practice. **Describe:** Contributions of Sushrut for medical sciences in ancient India.	10	2	II, VI	4
5.	**a) State:** Classical dance forms of India since ancient times. **Describe:** any TWO of them with significance.	10	3	I,II	5

END SEMSTER EXAMINATION DECEMBER-JANUARY 2023-24

	b) State: Main folk dance of any TWO states in India. **Describe:** Significance, historical/ mythological background and reason for performance of any ONE of them.	**10**	3	I, II	5
6.	**a) State:** Major languages in Indian since ancient times. **Describe:** Significance of any TWO of them.	**10**	3	I, II	6
	b) List: Any 03 great epics of India since ancient times. **Describe:** Learnings from any ONE of them in context of modern lifestyle of today.	**10**	2, 3	I, II	2, 6
7.	**a) Describe:** Work and teachings of Sant Dhyaneshwar Maharaj. **Justify:** *"Philosophy and Teachings of Sant Dhyaneshwar Maharaj are applicable even today in modern times"*	**10**	4	II, VI	7
	b) Describe: Work, and teachings of Bhagvan Mahavir Vardhaman. **Justify:** *"Significance of philosophy and teachings of* Bhagvan Mahavir Vardhaman *in modern times today"*	**10**	4	II, VI	7