Estd. in 2001

Late Shri Narayan Singh Charitable Trust's (Regd.)

THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY

Autonomous College Affiliated to University of Mumbai

Approved by All India Council for Technical Education(AICTE) and Government of Maharashtra(GoM)

Conferred Autonomous Status by University Grants Commission (UGC) for 10 years w.e.f. A.Y 2019-20

Amongst Top 200 Colleges in the Country, Ranked 151st in NIRF India Ranking 2019 in Engineering College category

• ISO 9001:2015 Certified • Programmes Accredited by National Board of Accreditation (NBA), New Delhi

• Institute Accredited by National Assessment and Accreditation Council (NAAC), Bangalore

IN-SEMESTER EXAMINATION (ISE-I) December 2022

FE/FT (Semester-I) CBCGS-HME 2020

Mathematics I

Branch: COMP, CIVIL, CS&E, E&CS, IOT, AI&DS
Div.: All
Duration: 60 Minutes

Date: 26 / 12 /2022
Timing: 10:00 AM to 11:00 AM
Maximum Marks: 20

Instructions –

1. All questions are compulsory.
2. Assume suitable data wherever necessary and state the assumptions made.
3. Diagrams / sketches should be given wherever necessary.
4. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5. Figures to the right indicate full marks.

		Solve any 5 Questions.	Marks
	a.	Is Lagrange's mean value theorem being applicable for $f(x) = x^2$ in [1,2].	02
	b.	Considering the functions $f(x) = \sqrt{x}$ and $g(x) = \frac{1}{\sqrt{x}}$ *in* $[1,2]$, *find* c of Cauchy's mean value theorem.	02
	c.	*If* $u = e^{xy^2}$ evaluate $\frac{\partial^2 u}{\partial x \partial y}$.	02
	d.	Find $\nabla\phi$, when $\phi = xy^2 + yz^3$ at the point (2,-1, 1)	02
	e.	Find the value of $(1 + i\sqrt{3})^6$ using De' Moivre's theorem.	02
	f.	Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n^n}$	02
	g.	If $u = \frac{x+y}{\sqrt{x}+\sqrt{y}}$ then find value of $xu_x + yu_y$	02

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IN-SEMESTER EXAMINATION (ISE-I) December 2022
FE/FT (Semester-I) CBCGS-HME 2020
Mathematics I

Branch: COMP, CIVIL, CS&E, E&CS, IOT, AI&DS
Div.: All
Duration: 60 Minutes
Instructions –

Date: 26 / 12 /2022
Timing: 10:00 AM to 11:00 AM
Maximum Marks: 20

1. All questions are compulsory.
2. Assume suitable data wherever necessary and state the assumptions made.
3. Diagrams / sketches should be given wherever necessary.
4. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5. Figures to the right indicate full marks.

Q.2.	a.	Prove that $\log(1+\tan x) = x - \frac{x^2}{2} + \frac{2x^3}{3} + \ldots\ldots$	05
		OR	
	b.	Evaluate $\lim_{x\to 0} \left[\frac{1^x+2^x+3^x+4^x}{4}\right]^{\frac{4}{x}}$	05
Q.3	a.	If $z = f(u,v),\ u = \log(x^2+y^2),\ v = \frac{y}{x}$, than **show** that $x\frac{\partial z}{\partial y} - y\frac{\partial z}{\partial x} = (1+v^2)\frac{\partial z}{\partial v}$.	05
		OR	
	b.	Find all the stationary points of the function $f(x,y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$ and test whether the function is maximum or minimum at those points. Does function have any saddle point? Justify.	05

IN-SEMESTER EXAMINATION (ISE-II) January 2023
FE/FT (Semester-I) CBCGS-HME 2020
Mathematics I

Branch: COMP, CIVIL, CS&E, E&CS, IOT, AI&DS
Div.: All
Duration: 60 Minutes
Instructions –

Date: 23 / 01 /2023
Timing: 10:00 AM to 11:00 AM
Maximum Marks: 20

1. All questions are compulsory.
2. Assume suitable data wherever necessary and state the assumptions made.
3. Diagrams / sketches should be given wherever necessary.
4. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5. Figures to the right indicate full marks.

Q.1		Solve any 5 Questions.	Marks
	a.	Evaluate the value of $log_3(-4)$	02
	b.	Check whether $f(z) = x^3 + iy^3$ satisfies C-R equation or not.	02
	c.	Evaluate $\int_0^\infty e^{-x} x^5 \, dx$	02
	d.	Is the following system of equation consistent? $4x + 2y = 7, 2x + y = 6$	02
	e.	Evaluate the value of B (3 , 1/2)	02
	f.	Find the exponential value of cos h x + sin h x	02
	g.	Solve $x^5 - i = 0$ using De'Moivre's theorem.	02

IN-SEMESTER EXAMINATION (ISE-II) January 2023

FE/FT (Semester-I) CBCGS-HME 2020

Mathematics I

Branch: COMP, CIVIL, CS&E, E&CS, IOT, AI&DS
Div.: All
Duration: 60 Minutes
Instructions –

Date: 23 / 01 /2023
Timing: 10:00 AM to 11:00 AM
Maximum Marks: 20

1. All questions are compulsory.
2. Assume suitable data wherever necessary and state the assumptions made.
3. Diagrams / sketches should be given wherever necessary.
4. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5. Figures to the right indicate full marks.

Q.2.	a.	*Prove that* $\dfrac{1}{1-\dfrac{1}{1-\dfrac{1}{1+\sinh^2 x}}} = -\sinh^2 x.$	05
		OR	
	b.	Evaluate $\int_0^2 x^4 (8-x^3)^{-\frac{1}{3}}\, dx$	05
Q.3	a.	Evaluate the rank of the matrix A by reducing them to Normal form Where $A = \begin{bmatrix} 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \\ 1 & 1 & 1 & 2 \end{bmatrix}$	05
		OR	
	b.	Discuss for all values of λ, the nature of solution of the system of equations $x + y + 4z = 6$ $x - 2y - 2z = 6$ $\lambda x + y + z = 6$ have (i) no solution (ii)unique solution (iii) many solutions.	05

END SEMESTER EXAMINATION, FEBRUARY 2023

F. E. /F.T. SEMESTER I (CBCGS-HME 2020)

Branch:	COMP, CIVIL, E&CS, CSE, AI&DS, IoT	Q.P. Code:	R1G10022
Subject:	Mathematics-I	Duration:	2 hours
Subject Code:	BSC103	Max. Marks:	60

Instructions:
1. All sections are compulsory
2. Figures to the right indicate full marks.
3. Assume suitable data if necessary and state the assumptions clearly.
4. Diagrams / sketches should be given wherever necessary.
5. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.

	Section-I (10 Marks)				
	Short Answer question (Answer any 5)	**Marks**	**CO**	**RBT**	**PI**
1	Find a normal to the surface $x^2y+2xz=4$ at the point (2, -2, 2)	2	2	U	2.1.1
2	Find the value of $(\cosh x-\sinh x)^2$	2	3	R	2.1.2
3	Discuss the convergence of the series $\sum_{n=1}^{\infty}\frac{1}{n^n}$	2	1	A	1.1.2
4	Find the rank of the matrix $A=\begin{bmatrix}1 & 2 & -2\\ -1 & 3 & 0\\ 0 & -2 & 1\end{bmatrix}$ by using Echelon form.	2	4	U	2.2.2
5	Find the value of $\sqrt{-\frac{3}{2}}$	2	5	U	1.4.1
6	Check whether x^2+iy^3 satisfies C-R equation or not.	2	6	A	1.1.2
	Section-II (20 Marks)				
	Descriptive Answer question (Answer any 4)	**Marks**	**CO**	**RBT**	**PI**
1	Show that $\lim_{x\to 0}\log_x \sin x = 1$.	5	1	U	2.1.1
2	If $w=\phi(u,v)$, $u=x^2-y^2-2xy$, $v=y$, then show that $(x+y)\frac{\partial w}{\partial x}+(x-y)\frac{\partial w}{\partial y}=(x-y)\frac{\partial w}{\partial v}$.	5	2	R	2.1.2

3	Prove that $\tan\left[\log\left(x^2+y^2\right)\right]=\frac{2a}{1-\left(a^2+b^2\right)}$.	5	3	U	1.1
4	Investigate for what values of λ and μ the system of equations $2x + 3y + 5z = 9$; $7x + 3y - 2z = 8$; $2x + 3y + \lambda z = \mu$ have (i) no solution (ii)unique solution (iii) many solutions.	5	4	A	2.2.2
5	Prove that $B\left(n+\frac{1}{2},n+\frac{1}{2}\right)=\frac{1}{2^{2n}}\frac{\lfloor n+\frac{1}{2}}{\lfloor n+1}\sqrt{\pi}$	5	5	A	1.1.2
6	Find the analytic function whose real part is $e^{-x}(x\sin y - y\cos y)$.	5	6	A	1.4.1
	Section-III (30 Marks)				
	Long Answer question (Answer any 3)	**Marks**	**CO**	**RBT**	**PI**
1	Find all the stationary points of the functions and test whether the function is maximum or minimum at those points for $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$ Also check whether function has saddle point or not.	10	2	A	2.1.2
2	Show that the roots of the equation $(x+1)^6 + (x-1)^6 = 0$ are given by $-i\cot\left[\frac{(2k+1)\pi}{12}\right]$ *for* $k = 0,1,2,3,4,5$ Using De'Moivre's theorem	10	3	A	1.1.2
3	Find nonsingular matrices P and Q such that PAQ is in the normal form where $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ and hence find ρ (PAQ) and ρ (A). Check whether A^{-1} can be expressed in terms of P and Q and hence find A^{-1}	10	4	AN	1.4.1

PTO

4	Show that $\int_0^a \sqrt{\frac{x^3}{a^3-x^3}}dx = \frac{a\sqrt{\pi}\,\lfloor\frac{5}{6}}{\lfloor\frac{1}{3}}$ Also state the properties of beta and gamma functions used to prove the value of above integral.	10	5	A	1.4.1
5	Prove that $\sin^{-1}x = x + \frac{1}{2}\frac{x^3}{3} + \frac{1\cdot3}{2\cdot4}\frac{x^5}{5} + \frac{1\cdot3\cdot5}{2\cdot4\cdot6}\frac{x^7}{7} + ...$ Hence deduce that $\cos^{-1}x = \frac{\pi}{2} - x - \frac{x^3}{6} - \frac{3x^5}{40} - \frac{5x^7}{112} - .....$ (-3)	10	1	A	2.1.2

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Estd. in 2001

IN-SEMESTER EXAMINATION-1

FE/FT (Semester-I)

SUBJECT – MATHEMATICS-I

Branch: E&TC/IT/MECH/M&ME/AI&ML **Date: 09/10/2023**
Div.: ALL **Timing: 4:00 PM to 5:00 PM**
Duration: 60 Minutes **Maximum Marks: 20**

Instructions –

1. All questions are compulsory.
2. Assume suitable data wherever necessary and state the assumptions made.
3. Diagrams / sketches should be given wherever necessary.
4. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5. Figures to the right indicate full marks.

Q.1		Answer any 5 of the following questions	Marks	Course Outcomes	Learning Levels
	a.	*If* $f(x) = \ln\left\{\frac{x^2+6}{5x}\right\}$ *in [2, 3] then find c of R.M.V.T.*	2	CO 1	R
	b.	If $f(x) = \sin^{-1}x$ [0,1] then find c of LMVT.	2	CO 1	A
	c.	*If* $u = \log\left(\frac{x}{y}\right)$ *then find* $u_x + u_y$	2	CO 2	R
	d.	*If* $z = x^y + y^x$ *then evaluate of* $\frac{\partial z}{\partial x}$.	2	CO 2	U
	e.	*If* $u = \frac{z}{x} + \frac{y}{z}$ *then find value of* $\frac{\partial u}{\partial x}$ *and* $\frac{\partial u}{\partial y}$.	2	CO 2	R
	f.	Find the value of i^{56}	2	CO 3	U
	g.	*Find the value of complex conjugate of* $\frac{1+i}{1-i}$	2	CO 3	U
Q.2	a.	Evaluate $\lim_{x \to a} \left(2 - \frac{x}{a}\right)^{\tan\left(\pi x/2a\right)}$	5	CO 1	A
		OR			
	b.	*If* $u = f[e^{y-z}, e^{z-x}, e^{x-y}]$, *then show that* $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$	5	CO 2	A
Q.3	a.	If $u(x + y) = x^2 + y^2$ show that $\left[\frac{\partial u}{\partial x} - \frac{\partial u}{\partial y}\right]^2 = 4\left[1 - \frac{\partial u}{\partial x} - \frac{\partial u}{\partial y}\right]$	5	CO 2	U
		OR			
	b.	*Solve the equation* $x^2 + x^{-2} = i$ *using De'Moivre's theorem*	5	CO 3	A

IN-SEMESTER EXAMINATION-II

F.E/F. T (Semester-I)

SUBJECT – Mathematics-1

Branch: E & TC, IT, MECH, M&ME, AI & ML
Div.: ALL
Duration: 60 Minutes
Instructions –

Date: 20/11/2023
Timing: 4:00 PM to 5:00 PM
Maximum Marks: 20

1. All questions are compulsory.
2. Assume suitable data wherever necessary and state the assumptions made.
3. Diagrams / sketches should be given wherever necessary.
4. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5. Figures to the right indicate full marks.

Q.1		Answer any 5 of the following questions	Marks	Course Outcomes	Learning Levels
	a.	Find A^{-1} if $A = \frac{1}{\sqrt{3}}\begin{bmatrix} 1 & 1+i \\ 1-i & -1 \end{bmatrix}$ is unitary matrix.	2	4	U
	b.	Find the value of $\beta(\frac{1}{4}, \frac{3}{4})$	2	5	U
	c.	Find the value of $\Delta\left(\frac{5x+12}{x^2+5x+6}\right)$	2	6	R
	d.	Prove that $\Delta\nabla = \nabla\Delta$	2	6	R
	e.	Define orthogonal matrix and unitary matrix.	2	4	R
	f.	Find the value of $\lceil 10$	2	5	U
	g.	Find the value of $\lceil \frac{-3}{2}$	2	5	U
Q.2	a.	Examine whether the vectors $[1,1,-1],[2,3,-5],\ [2,-1,4]$ are linearly independent or dependent.	5	4	A
		OR			
	b.	Approximate the integral of the function $y = e^x$ from $x = 0$ to $x = 1$ using Rectangle method with six rectangles.	5	6	U
Q.3	a.	*Evaluate* $\int_0^{\frac{\pi}{2}} \sqrt{\tan x}\, dx \int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{\cot x}} dx$	5	5	A
		OR			
	b.	Find the approximate value of $\int_0^6 e^x\, dx$ by using Simpson's $3/8^{th}$ rule with 6 subintervals.	5	6	U

END SEMESTER EXAMINATION, DECEMBER 2023
F.E/F.T SEMESTER I (CBCGS-HME 2023)

Branch:	**E&TC/IT/MECH/M&ME/AI&ML**	**Q.P. Code:**	**R11G2402-2**
Subject:	**Mathematics-I**	**Duration:**	**2 hours**
Subject Code:	BSC1202	**Max. Marks:**	**60**

Instructions:
1. **All sections are compulsory**
2. **Figures to the right indicate full marks.**
3. **Assume suitable data if necessary and state the assumptions clearly.**

Section-I	**Short Answer Questions (Answer any 05 questions out of 06)**				**(10 Marks)**
Q. No.		**Marks**	**CO**	**RBT Level**	**PI**
1	Expand $f(x) = x^2 + x - 1$ in powers of (x-2) using Taylor's series.	2	1	R	1.1.1
2	If $u = e^{x^y}$ then find value of $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$.	2	2	R	1.1.1
3	Find the polar form of -i	2	3	R	1.1.1
4	Express $\begin{bmatrix} 0 & -4 \\ 4 & 0 \end{bmatrix}$ as sum of Hermitian and skew Hermitian matrices.	2	4	U	1.1.1
5	Find the value of $\beta(\frac{1}{4}, \frac{3}{4})$	2	5	U	1.1.1
6	Prove that $(1+\Delta)(1-\nabla) = 1$	2	6	R	2.1.3
Section-II	**Descriptive Answer Questions(Answer any 04 out of 06)**				**(20 Marks)**
1	Illustrate $\lim_{x\to\infty}\left(\frac{ax+1}{ax-1}\right)^x$	5	1	U	1.3.1
2	If $u = f[e^{y-z}, e^{z-x}, e^{x-y}]$, then show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$	5	2	U	1.3.1
3	Solve $x^6 - 1 = 0$ using De'Moivre's theorem	5	3	A	2.1.3
4	Evaluate the rank of the matrix $A = \begin{bmatrix} 1 & 1 & -1 & 1 \\ 1 & -1 & 2 & -1 \\ 3 & 1 & 0 & 1 \end{bmatrix}$ by reducing to normal form.	5	4	A	1.3.1
5	Evaluate $\int_0^2 x^4(8-x^3)^{-\frac{1}{3}}\,dx$	5	5	A	1.3.1

6	Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin x}{x} dx$ by using Trapezoidal rule with 6 subintervals.	5	6	A	1.3.1
Section-III	**Long Answer Question (Answer any 03 out of 05)**				**(30 Marks)**
1	*Construct the series for* $\log(1+x)$ *in power of* x *and hence find the series of* $\log_e\left(\frac{1+x}{1-x}\right)$ *and hence find* $\log_e\left(\frac{11}{9}\right)$	10	1	A	2.1.3
2	Test for the following functions for maxima and minima $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$	10	2	AN	2.4.1
3	Show that (i) $\tanh^{-1} x = \sinh^{-1} \frac{x}{\sqrt{1-x^2}}$ (ii) $\operatorname{sech}^{-1}(\sin\theta) = \log \cot\left(\frac{\theta}{2}\right)$	10	3	U	1.3.1
4	Find non -singular matrices P and Q such that PAQ is in the normal form and hence find $\rho(A)$ and $\rho(PAQ)$ for $A = \begin{bmatrix} 3 & -2 & 0 & 1 \\ 0 & 2 & 2 & 7 \\ 1 & -2 & -3 & 2 \\ 0 & 1 & 2 & 1 \end{bmatrix}$	10	4	A	2.1.3
5	Prove that $\int_0^3 \frac{x^{\frac{3}{2}}}{\sqrt{3-x}} dx \int_0^1 \frac{dx}{\sqrt{1-x^{\frac{1}{4}}}} = \frac{432\pi}{35}$	10	5	U	1.3.1