K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

FIRST INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree	**B.E**	**Semester**	**I**
Branch - Stream	**CSE/AIML/CSD/CCE/IOT - CSE**	**Course Type / Code**	**Integrated/22MATS11**
Course Title	**Mathematics - 1 for CSE Stream**	**Date**	**18/01/2023**
Duration	**60 Minutes**	**Max Marks**	**20**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** exterior angle property of a triangle and find the angle between the radius vector and tangent.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = 4sec^2\left(\frac{\theta}{2}\right)$ and $r = 9cosec^2\left(\frac{\theta}{2}\right)$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ/r is a constant for the curve $r = ae^{\theta cot\propto}$	4	CO1	K3
	OR			
2(a)	**Make use of** arc length and find the expression for radius of curvature in Cartesian form.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = a(1 + sin\theta)$ and $r = a(1 - sin\theta)$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ varies inversely as r^{n-1} for the curve $r^n = a^n cosn\theta$	4	CO1	K3
	PART –B			
3(a)	**Utilize** the Maclaurin's series to expand $\log(\sec x)$	4	CO2	K3
(b)	**Solve** $\lim_{x\to 0}\left(\frac{a^x+b^x+c^x}{3}\right)^{\frac{1}{x}}$	4	CO2	K3
	OR			
4(a)	**Utilize** the Maclaurin's series to expand $\log(1+\sin x)$ upto the term containing x^4	4	CO2	K3
(b)	**Solve** $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{\frac{1}{x}}$	4	CO2	K3

Name & Signature of Course In charge:
(NAVEEN.V)

Name & Signature of Module Coordinator:
(Dr. VENKATARAMANA B.S)

HOD AS&H

Principal

Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

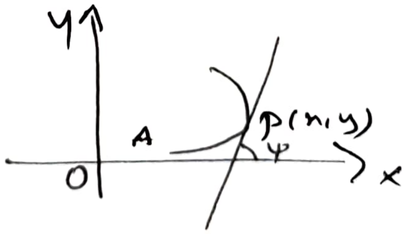
I SESSIONAL TEST 2022-23 ODD SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT -CSE
Course Title : Mathematics -I For CSE Stream
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/ 22MATS11
Date : 18/01/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
① a.	$\psi = \phi + \theta$ $\tan\phi = r\left(\frac{d\theta}{dr}\right)$  	1+1 -2-
b.	$\cot\phi_1 = \tan(\theta/2)$ $\cot\phi_2 = -\cot(\theta/2)$ $\phi_1 = \pi/2 - \theta/2$ $\phi_2 = -\theta/2$ $\lvert\phi_1 - \phi_2\rvert = \pi/2$.	2+1 -1-
c.	$\cot\phi = \cot\alpha \rightarrow \phi = \alpha$ $p = r\sin\alpha$ $\rho = r\frac{dr}{dp}$ $\frac{dp}{dr} = \sin\alpha$ $\frac{\rho}{r} = \operatorname{cosec}\alpha$.	-1- 2+1
② a.	$\overset{\frown}{AP} = s$ $\tan\psi = dy/dx$ $\rho = \frac{(1+y_1^2)^{3/2}}{y_2}$  	-1- -1- -2-
b.	$\cot\phi_1 = \frac{\cos\theta}{1+\sin\theta}$ $\cot\phi_2 = \frac{-\cos\theta}{1-\sin\theta}$ $\tan\phi_1 \cdot \tan\phi_2 = -1 \rightarrow \phi_1 - \phi_2 = \pi/2$	-2- -2-

Q.NO.	POINTS	MARKS
c.	$\phi = \pi/_2 + n\theta \qquad \rho = r\frac{dr}{dp}$	1+1
	$P = r\sin\phi$	
	$P = r\cos n\theta \qquad \rho = \left(\frac{a^n}{1+n}\right)\frac{1}{r^{n-1}}$	-1-
	$P = \frac{r^{n+1}}{an} \qquad \rho \propto \frac{1}{r^{n-1}}$	-1-
③ a.	$y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) + \ldots$	-1-
	$y(0) = 0 \quad y_1(0) = 1 \quad y_2(0) = 1$	-2-
	$y_3(0) = 0 \quad y_4(0) = 2 \quad y_5(0) = 0 \quad y_6(0) = 16$	
	$\log(\sec x) = \frac{x^2}{2} + \frac{x^4}{12} + \frac{x^6}{45} + \ldots$	-1-
b.	$\lim_{x \to 0} \left(\frac{a^x + b^x + c^x}{3}\right)^{1/x} = (abc)^{1/3}$	-4-
④ a.	$y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) + \ldots$	-1-
	$y(0) = 0, \quad y_1(0) = 1, \quad y_2(0) = -1$	-2-
	$y_3(0) = 1, \quad y_4(0) = -2$	
	$\log(1 + \sin x) = x - \frac{x^2}{2} + \frac{x^3}{6} - \frac{x^4}{12} + \ldots$	-1-
b.	$K = \lim_{x \to 0} \left(\frac{\tan x}{x}\right)^{1/x} \longrightarrow 1^{\infty}$	-1-
	$\log_e K = \lim_{x \to 0} \sec^2 x \tan x = 0$	-2-
	$K = e^0 = 1$	-1-

Nani
Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

FIRST INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT - CSE
Course Title : Mathematics - 1 for CSE Stream
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/22MATS11
Date : 18/01/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** exterior angle property of a triangle and find the angle between the radius vector and tangent.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = a\theta$ and $r = a/\theta$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ^2 varies as r^3 for the curve $r(1 - cos\theta) = 2a$	4	CO1	K3
	OR			
2(a)	**Make use of** arc length and find the expression for radius of curvature in polar form.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r^n = a^n cosn\theta$ and $r^n = a^n sinn\theta$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ^2/r is a constant for the curve $r = a(1 + cos\theta)$	4	CO1	K3
	PART –B			
3(a)	**Utilize** the Maclaurin's series to expand $\sqrt{1+\sin 2x}$	4	CO2	K3
(b)	**Solve** $\lim_{x\to 0}\left(\frac{a^x+b^x}{2}\right)^{\frac{1}{x}}$	4	CO2	K3
	OR			
4(a)	**Utilize** the Maclaurin's series to expand $e^{\sin x}$ upto the term containing x^4	4	CO2	K3
(b)	**Solve** $\lim_{x\to\infty}\left(1+\frac{a}{x}\right)^x$	4	CO2	K3

Name & Signature of Course In charge:
(Lakshmi C)

Name & Signature of Module Coordinator:
(Dr. VENKATARAMANA BS)

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

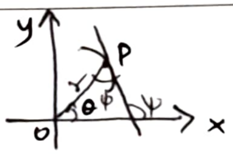
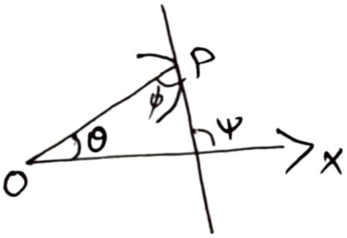
I SESSIONAL TEST 2022-23 ODD SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IoT-CSE
Course Title : Mathematics-1 For CSE Stream
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/ 22MATS11
Date : 18/01/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
① a.	$\psi = \theta + \phi$ $\tan\phi = r\left(\frac{d\theta}{dr}\right)$ 	1+1 – 2 –
b.	$\tan\phi_1 = \theta$ $\quad \tan\phi_2 = -\theta$ $\theta = \pm 1$ $\tan\phi_1 \cdot \tan\phi_2 = -1 \Rightarrow \phi_1 - \phi_2 = \pi/2$	– 2 – – 1 – – 1 –
c.	$\cot\phi = -\cot(\theta/2) \Rightarrow \phi = -\theta/2$ $p = r\sin\phi$ $\quad \rho = r\frac{dr}{dp}$. $p^2 = ar$ $\quad \rho^2 = 4r^3/a$ $2p\frac{dp}{dr} = a$ $\quad \rho^2 \propto r^3$	– 1 – 2 + 1
② a.	$\psi = \theta + \phi$ $\rho = \frac{ds/d\theta}{1 + d\phi/d\theta}$ $\rho = \frac{(r^2 + r_1^2)^{3/2}}{r^2 + 2r_1^2 - rr_2}$ 	– 1 – – 3 –
b.	$\cot\phi_1 = \cot(\pi/2 + n\theta)$ $\quad \cot\phi_2 = \cot n\theta$. $\phi_1 = \pi/2 + n\theta$ $\quad \phi_2 = n\theta$ $\lvert\phi_1 - \phi_2\rvert = \pi/2$.	1 + 1 – 2 –

Q.NO.	POINTS	MARKS
c.	$\phi = \pi/2 + \theta/2$ $\quad \rho = r\frac{dr}{dp}$	1+1
	$p = r\sin\phi$ $p = r\cos\theta/2$ $p^2 = \frac{r^3}{2a}$ $\quad \frac{\rho^2}{r} = \frac{8a}{9}$	1+1
③ a.	$y(x) = y(0) + xy_1(0) + \frac{x^2}{2!}y_2(0) + \dots$	-1-
	$y = \cos x + \sin x$ $y(0) = 1 \quad y_1(0) = +1 \quad y_2(0) = -1$ $y_3(0) = -1 \quad y_4(0) = 1.$	-2-
	$\sqrt{1+\sin 2x} = 1 + x - \frac{x^2}{2} - \frac{x^3}{6} + \frac{x^4}{24} \dots$	-1-
b.	$\lim_{x \to 0} \left(\frac{a^x + b^x}{2}\right)^{1/x} = (ab)^{1/2}$	-4-
④ a.	$y(x) = y(0) + xy_1(0) + \frac{x^2}{2!}y_2(0) + \dots$	-1-
	$y(0) = 1, \quad y_1(0) = 1, \quad y_2(0) = 1$ $y_3(0) = 0 \quad y_4(0) = -3$	-2-
	$e^{\sin x} = 1 + x + \frac{x^2}{2} - \frac{x^4}{8}.$	-1-
b.	$k = \lim_{x \to \infty} (1 + a/x)^x \to 1^\infty$	-1-
	$\log k = a \Rightarrow k = e^a$	-3-

Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

SECOND INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: A

USN

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT - CSE
Course Title : Mathematics for CS stream-1
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/BMATS101
Date : 01/03/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	Solve $(y^3 - 3x^2y)dx - (x^3 - 3xy^2)dy = 0$.	4	CO3	K3
(b)	Solve $y(2xy+1)dx - xdy = 0$	4	CO3	K3
(c)	Make use of the differentiation find the orthogonal trajectory of the curve $r^n = a^n \sin n\theta$	4	CO3	K3
	OR			
2(a)	Solve $\frac{dy}{dx} - ytanx = y^2\, secx$	4	CO3	K3
(b)	Solve $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$	4	CO3	K3
(c)	Make use of the differentiation find the orthogonal trajectory of the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2+\lambda} = 1$ where λ is parameter.	4	CO3	K3
	PART –B			
3(a)	Make use of $u = x^2 + y^2 + z^2$, $v = xy + yz + zx$, $w = x + y + z$ *find* $\frac{\partial(u,v,w)}{\partial(x,y,z)}$	4	CO2	K3
(b)	Make use of row operation find the rank of the matrix $\begin{pmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{pmatrix}$	4	CO4	K3
	OR			
4(a)	Utilize $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$ find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$	4	CO2	K3
(b)	Make use of row operation find the rank of the matrix $\begin{pmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{pmatrix}$	4	CO4	K3

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Name & Signature of
Module Coordinator:
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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 ODD SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT-CSE
Course Title : Mathematics
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/ BMATS101
Date : 01/03/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
1.a)	$\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x} = 3y^2 - 3x^2$, exact D.E. $\therefore$ Solution is $\underset{y\ const}{\int M dx} + \underset{\text{not containg } x}{\int N dy} = c$ $\therefore \int (y^3 - 3x^2 y) dx + \int 0 dy = c$ $\Rightarrow xy^3 - x^3 y = \underline{\underline{c}}$	1 2 1 4
1.b)	$\frac{\partial M}{\partial y} = 4xy + 1$, $\frac{\partial N}{\partial x} = -1$, not exact. $\frac{1}{M}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) = \frac{1}{y(2xy+1)} \cdot 2(2xy+1) = \frac{2}{y} = g(y)$ $IF = e^{-\int g(y) dy} = 1/y^2$ $\therefore$ solution is $x^2 + x/y = c$ //	1 2 1 4
1.c)	$\frac{1}{r}\frac{dr}{d\theta} = \cot n\theta$ $\frac{1}{r}\left(-r^2 \frac{d\theta}{dr}\right) = \cot n\theta \Rightarrow \int \frac{dr}{r} = \int \tan n\theta \, d\theta$ $\Rightarrow \log r = -\log \frac{\sec n\theta}{n} + \log b$ $\Rightarrow r^n = \underline{\underline{b^n}} \cos n\theta$	2 2 4
2.a)	$\div y^2$ on B.S $\Rightarrow \frac{1}{y^2}\frac{dy}{dx} \frac{1}{y} \tan x = \sec x$ — ① $\Rightarrow 1/y = t \Rightarrow -1/y^2 \, dy/dx = dt/dx$ ① $\Rightarrow dt/dx + \tan x \cdot t = -\sec x$, linear in t. $IF = \sec x$, solution is, $\frac{1}{y}\sec x = \underline{\underline{-\tan x}} + c$	2 2 4

Q.NO.	POINTS	MARKS
2. b)	$\frac{\partial M}{\partial y} = 6x^2y - 6xy^2 = \frac{\partial N}{\partial x}$ ∴, exact. ∴ solution is $x^5 + x^3y^2 - x^2y^3 - y^5 = c$	2 2 4
2. c)	Diff wrt $x \Rightarrow \frac{2x}{a^2} + \frac{2y\, dy/dx}{a^2+\lambda} = 0$ $\frac{1}{a^2+\lambda} = \frac{x}{a^2(-y\, dy/dx)}$ Given eqn becomes, $x^2 - \frac{xy}{dy/dx} = a^2$ Replace dy/dx by $(-dx/dy)$, $x^2 + xy\frac{dy}{dx} = a^2$ $\Rightarrow \int y\, dy = \int \frac{a^2-x^2}{x} dx$ solution is, $x^2+y^2 - 2a^2 \log x = 2c$	1 1 1 1 4
3. a)	$u_x = 2x,\ u_y = 2y,\ u_z = 2z,\ v_x = y+z,\ v_y = x+z$ $v_z = y+x,\ w_x = 1,\ w_y = 1,\ w_z = 1.$ $J = \frac{\partial(u,v,w)}{\partial(x,y,z)} = \begin{vmatrix} 2x & 2y & 2z \\ y+z & x+z & y+x \\ 1 & 1 & 1 \end{vmatrix} = 0$	1 2 1 4
3 b)	$R_1 \leftrightarrow R_2$ $A \sim \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 1 \end{bmatrix} \xrightarrow{R_3 \to R_3 - 3R_1,\ R_4 \to R_4 - R_1} A \simeq \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 0 & 1 & -3 & -1 \\ 0 & 1 & -3 & 1 \end{bmatrix} \Rightarrow A \simeq \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ $\Rightarrow \rho(A) = 2.$	3 1 4
4 a)	$x\frac{\partial u}{\partial x} = \frac{x}{y}\frac{\partial u}{\partial p} - \frac{z}{x}\frac{\partial u}{\partial r},\ y\frac{\partial u}{\partial y} = \frac{y}{z}\frac{\partial u}{\partial q} - \frac{x}{y}\frac{\partial u}{\partial p}$ $z\frac{\partial u}{\partial z} = \frac{z}{x}\frac{\partial u}{\partial r} - y/z\frac{\partial u}{\partial q} \Rightarrow x u_x + y u_y + z u_z = 0$	2 2 4
4 b)	$R_1 \leftrightarrow R_2 \begin{bmatrix} 2 & 1 & 3 & 4 \\ 4 & 0 & 2 & 1 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix} \Rightarrow A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 0 & -3 & -4 \\ 0 & 0 & 0 & 1 \end{bmatrix} \Rightarrow \rho(A) = 4$	2+2=4

Course Incharge **Module Coordinator** **HOD**

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

SECOND INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: B

USN

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT - CSE
Course Title : Mathematics for CS stream-1
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/BMATS101
Date : 01/03/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Solve** $(y^2 - x^2)dx + 2xydy = 0$.	4	CO3	K3
(b)	**Solve** $\frac{dy}{dx} + \frac{y}{x} = y^2 x$	4	CO3	K3
(c)	**Make use** of the differentiation find the orthogonal trajectory of the curve $r = a(1 + \cos\theta)$	4	CO3	K3
	OR			
2(a)	**Solve** $(x^2 + y^2 + x)dx + xydy = 0$	4	CO3	K3
(b)	**Solve** $[y\left(1 + \frac{1}{x}\right) + cosy]dx + (x + log\, x - xsiny)dy = 0$	4	CO3	K3
(c)	**Make use of** differential equation prove that $y^2 = 4a(x + a)$ is self orthogonal.	4	CO3	K3
	PART –B			
3(a)	**Make use** of $u = \frac{yz}{x}, v = \frac{zx}{y}, w = \frac{xy}{z}$ *find* $\frac{\partial(u,v,w)}{\partial(x,y,z)}$	4	CO2	K3
(b)	**Make use** of row operation find the rank of the matrix $\begin{pmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{pmatrix}$	4	CO4	K3
	OR			
4(a)	**Utilize** the first order derivative find the extreme values of the function $f(x, y) = x^3 + 3xy^2 - 3y^2 - 3x^2 + 4$	4	CO2	K3
(b)	**Make use** of row operation find the rank of the matrix $\begin{pmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{pmatrix}$	4	CO4	K3

Lakshmi C
Name & Signature of
Course In charge:
(Lakshmi C)

Name & Signature of
Module Coordinator:
(Dr. Venkataramana BS)

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Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 ODD SEMESTER

SET B

SCHEME AND SOLUTION

Semester : I
Degree : B.E
Course Type / Code : Integrated/ BMATS101
Branch - Stream : CSE/AIML/CSD/CCE/IOT –CSE
Date : 01/03/2023
Course Title : Mathematics
Max Marks : 20
Duration : 60 Minutes

Q.NO.	POINTS	MARKS
1.a)	$\frac{\partial M}{\partial y} = 2y = \frac{\partial N}{\partial x}$, eqⁿ is exact. ∴ solution is $\int M\,dx + \int N\,dy = c$ $\Rightarrow xy^2 - \frac{x^3}{3} = c$.	2 2 4
1.b)	$\frac{dy}{dx} + y/x = y^2 x \Rightarrow \div y^2$ on BS $\frac{1}{y^2} dy/dx + \frac{1}{yx} = x$ → ① put $1/y = t \Rightarrow -1/y^2 \frac{dy}{dt} = \frac{dt}{dx}$ $\Rightarrow \frac{dt}{dx} - t \cdot 1/x = -x$, & IF = $1/x$ ∴ Solⁿ is $\frac{1}{xy} = -x + c$	1 1 2 4
1.c)	$\log r = \log a + \log(1+\cos\theta)$, Replace $\frac{dr}{d\theta}$ by $\left(-r^2 \frac{d\theta}{dr}\right)$ $\Rightarrow \frac{1}{r}\frac{dr}{d\theta} = -\frac{\sin\theta}{1+\cos\theta}$. $\int \frac{dr}{r} = \int \cot\theta/2\, d\theta \Rightarrow r = b\left(\frac{1-\cos\theta}{2}\right)$ is the required OT.	2 2 4
2.a)	$\frac{\partial M}{\partial y} = 2y \neq \frac{\partial N}{\partial x} = y$. $\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} = y$, near to N. ∴ $\frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) = \frac{y}{xy} = 1/x = f(x)$. & IF = x ∴ Given eqⁿ becomes $M = x^3 + xy^2 + x^2$, $N = x^2 y$ solution is $\frac{x^4}{4} + \frac{x^2 y^2}{2} + \frac{x^3}{3} = c$ //	1 1 2 4
2b)	$\frac{\partial M}{\partial y} = 1 + 1/x - \sin y = \frac{\partial N}{\partial x}$. , eqⁿ is exact. ∴ solution is $y(x + \log x) + x\cos y = c$ //	2 2 4

Q.NO.	POINTS	MARKS
2.c)	$y^2 = 4a(x+a) \to ①$. Diff wrt x, $y\frac{dy}{dx} = 4a(1)$ $\Rightarrow a = y/2\ dy/dx \to ②$, use ② in ① ① $\Rightarrow y^2 = 2x\ dy/dx + y\,(dy/dx)^2 \to ③$, is the DE of given curve. Replace dy/dx by $(-dx/dy)$ $\Rightarrow y = y(dy/dx)^2 + 2x\ dy/dx \to ④$, is the DE of required OT. ∴ ③ & ④ same, given curve is self orthogonal.	1 1 1 1 4
3.a)	$J = \frac{\partial(u,v,w)}{\partial(x,y,z)} = \begin{vmatrix} -\frac{yz}{x^2} & z/x & y/x \\ z/y & -\frac{zx}{y^2} & x/y \\ y/z & x/z & -xy/z^2 \end{vmatrix} = 4.$	2 2 4
3.b)	$R_1 \leftrightarrow R_2 \Rightarrow A \sim \begin{bmatrix} 2 & 1 & 3 & 4 \\ 4 & 0 & 2 & 1 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix} \xrightarrow{R_2-2R_1,\ R_3-R_1,\ R_4-R_1} A \sim \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 2 & 1 & 3 \\ 0 & 2 & -2 & 0 \end{bmatrix}$ $\Rightarrow A \sim \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 0 & -3 & -4 \\ 0 & 0 & 0 & 1 \end{bmatrix} \Rightarrow \rho(A) = 4.$	3 1 4
4a)	$f_x = 3x^2 + 3y^2 - 6x$, $f_y = 6xy - 6y$ Critical points are $(0,0), (2,0), (1,1), (1,-1)$ $A = 6x-6$, $B = 6y$, $C = 6x-6$, at $(0,0)$, $A = -6$, $B = 0$, $C = -6$, $AC - B^2 = 36$, maximum. at $(2,1)$, $A = 6$, $B = 0$, $C = 6$, $AC - B^2 = 36$, minimum. at $(1,1)$ & $(1,-1)$ saddle point, $f_{min} = 0$, $f_{max} = 4$.	1 1 2 4
4b)	$\rho(A) = 2$	2+2=4

Lakshmi C
Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

THIRD INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT - CSE
Course Title : Mathematics for CS stream-1
Duration : 60 Minutes
Semester : I
Course Type / Code : Integrated/BMATS101
Date : 27/03/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** congruence to find the last digit in 7^{126}.	4	CO5	K3
(b)	**Utilize** the concept of congruence find the remainder when the number 2^{1000} is divided by 13.	4	CO5	K3
(c)	**Make use of** Chinese Remainder Theorem solve $x \equiv 2\ (mod\ 3)$, $x \equiv 3 (mod\ 5), x \equiv 2\ (mod\ 7)$	4	CO5	K3
	OR			
2(a)	**Solve** $14x \equiv 12\ (mod\ 18)$.	4	CO5	K3
(b)	**Solve** the system of linear congruence $2x + 6y \equiv 1\ (mod\ 7)$, $4x + 3y \equiv 2(mod\ 7)$.	4	CO5	K3
(c)	**Utilize** RSA algorithm to encrypt the message STOP with key (2537, 13) using the prime numbers 43 and 59.	4	CO5	K3
	PART –B			
3(a)	**Make use of** row transformations, find the values of λ and μ such that the system of equations $x + y + z = 6,\ x + 2y + 3z = 10,\ x + 2y + \lambda z = \mu$ may have (i) Unique solution (ii) Infinite solution (iii) No solution	4	CO4	K3
(b)	**Solve** by Gauss elimination method $x_1 - 2x_2 + 3x_3 = 2,\ 3x_1 - x_2 + 4x_3 = 4,$ $2x_1 + x_2 - 2x_3 = 5$	4	CO4	K3
	OR			
4(a)	**Solve** by Gauss Seidel method $20x + y - 2z = 17,\ 3x + 20y - z = -18,$ $2x - 3y + 20z = 25$.	4	CO4	K3
(b)	**Make use of** Rayleigh power method to find the dominant Eigen value and corresponding Eigen vector of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking the initial eigen vector as $[1 \quad 1 \quad 1]^T$.	4	CO4	K3

SNEHA G KULKARNI
Name & Signature of Course In charge:

Name & Signature of Module Coordinator:
(Dr. VENKATARAMANA B S)

HOD AS&H

Principal

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 ODD SEMESTER

SET A

SCHEME AND SOLUTION

Degree	:	B.E	**Semester**	:	I
Branch - Stream	:	CSE/AIML/IOT/CCE/CSD-CSE	**Course Type / Code**	:	Integrated/BMATS101
Course Title	:	Mathematics for CSE stream-1	**Date**	:	27/03/2023
Duration	:	60 Minutes	**Max Marks**	:	20

Q.NO.	POINTS	MARKS
1 (a)	$7^4 \equiv 81 \equiv 1 \pmod{10} \Rightarrow (7^4)^{31} \equiv 1 \pmod{10} \Rightarrow 7^{124} \equiv 1 \pmod{10}$	2
	$7^2 \equiv 9 \pmod{10}$ $\therefore$ $7^{124} \times 7^2 \equiv 1 \times 9 \pmod{10} \Rightarrow 7^{126} \equiv 9 \pmod{10}$	2
		4
(b)	$2^6 \equiv 64 \equiv -1 \pmod{13}$. $2^{1000} = 2^{6 \times 166 + 4}$	1
	$2^{1000} = (2^6)^{166} \times 2^4 = (-1)^{166} \pmod{13} \times 3 \pmod{13}$	2
	$2^{1000} \equiv 3 \pmod{13}$.	1
(c)	$x = (a_1 M_1 M_1^{-1} + a_2 M_2 M_2^{-1} + a_3 M_3 M_3^{-1}) \bmod M$.	1
	$M = m_1 \times m_2 \times m_3 = 3 \times 5 \times 7 = 105$,	
	$M_1 = \frac{M}{m_1} = \frac{105}{3} = 35$, $M_2 = \frac{M}{m_2} = 21$, $M_3 =$	1
	$M_1^{-1} = 2$, $M_2^{-1} = 1$, $M_3^{-1} = 1$.	1
	$x = (2 \times 35 \times 2 + 3 \times 21 \times 1 + 2 \times 15 \times 1) \bmod 105$	1
	$x = 233 \bmod 105 \Rightarrow x \equiv 23 \pmod{105}$	
2(a)	$a=14, b=12, n=18$ $GCD(14, 18) = 2$. $\frac{b}{d} = \frac{12}{2} = 6 \rightarrow$ Solution exist	
	$d \bmod n = 2 \bmod 18 = 2 \rightarrow 2$ solution exist.	2
	Dividing by 2 $\Rightarrow 7x \equiv 6 \pmod 9 \Rightarrow 7 \cdot 7^{-1} x \equiv 6 \cdot 7^{-1} \pmod 9$	
	$\therefore x \equiv 6 \cdot 4 \pmod 9 \Rightarrow x \equiv 24 \equiv 6 \pmod 9$.	
	$\therefore x_0 = 6$. General solution is $x_k = x_0 + k(\frac{n}{d})$	2
	$\therefore x_1 = 6 + 1(\frac{18}{2}) = 15$.	
(b)	$a=2, b=6, r=1, c=4, d=3, s=2, n=7$ $gcd(2,6,7) = 1$	1
	$gcd(4,3,7) = 1$. $gcd(2,6,7) \mid c \Rightarrow$ Solution exists.	
	$gcd(ad-bc, n) = gcd(18, 7) = 1 \Rightarrow$ Unique solution	1

Q.NO.	POINTS	MARKS
	$2x+6y\equiv 1 \pmod 7$ $\underline{4x+3y\equiv 2 \pmod 7)\times 2}$ $-6x \equiv -3 \pmod 7$ $2x\equiv 1 \pmod 7$ $7 \mid 2x-1 \Rightarrow 2x-1=7k$ $x=\frac{7k+1}{2}$ $\therefore k=1 \Rightarrow x=4$ $\therefore x=4 \pmod 7$	
	$2x+6y\equiv 1 \pmod 7$ $8+6y\equiv 1 \pmod 7$ $6y\equiv -7 \pmod 7$ $7 \mid 6y+7$ $\therefore y=\frac{7k-7}{6}$ $\therefore y=0 \pmod 7$	1 1
3(a)	$R_2\to R_2-R_1,\ R_3\to R_3-R_1$ $\begin{bmatrix}1&1&1&:&6\\0&1&2&:&4\\0&1&\lambda-1&:&\mu-6\end{bmatrix}\xrightarrow{R_3-R_2}\begin{bmatrix}1&1&1&:&6\\0&1&2&:&4\\0&0&\lambda-3&:&\mu-10\end{bmatrix}$	1
	Unique solution: $\rho[A]=\rho[A:B]=3$, $\rho[A]$ will be 3 if $\lambda-3\neq 0 \Rightarrow \lambda\neq 3$	1
	Infinite solution: $\rho[A]=\rho[A:B]=2<3$, $\lambda=3$, $\mu=10$	1
	No solution: $\rho[A]\neq\rho[A:B]$ $\lambda=3$, $\mu\neq 10$.	1
(b)	$R_2\to R_2-3R_1,\ R_3\to R_3-2R_1$ $\begin{bmatrix}1&-2&3&:&2\\0&5&-5&:&-2\\0&5&-8&:&1\end{bmatrix}R_3-R_2\begin{bmatrix}1&-2&3&:&2\\0&5&-5&:&-2\\0&0&-3&:&3\end{bmatrix}$	2
	$\therefore x_1=2.2,\ x_2=-1.4,\ x_3=-1.$	2
4(a)	$x=\frac{1}{20}[17-y+2z],\ y=\frac{1}{20}[-18-3x+z],\ z=\frac{1}{20}[25-2x+3y]$	1
	I Iteration: $x^{(1)}=0.85,\ y^{(1)}=-1.0275,\ z^{(1)}=1.0109$	1
	II Iteration: $x^{(2)}=1.0025,\ y^{(2)}=-0.9998,\ z^{(2)}=0.9998$	1
	III Iteration: $x^{(3)}=0.9997,\ y^{(3)}=-1.0000,\ z^{(3)}=1.0000$	1
	$\therefore x=1,\ y=-1,\ z=1.$	
(b).	$AX^{(0)}=6\begin{bmatrix}1\\0\\0.67\end{bmatrix}=\lambda^{(1)}X^{(1)},\ AX^{(1)}=7.34\begin{bmatrix}1\\-0.36\\0.55\end{bmatrix}=\lambda^{(2)}X^{(2)}$	2
	$\lambda^{(3)}X^{(3)}=7.82\begin{bmatrix}1\\-0.46\\0.51\end{bmatrix},\ \lambda^{(4)}X^{(4)}=7.94\begin{bmatrix}1\\-0.49\\0.5\end{bmatrix},\ \lambda^{(5)}X^{(5)}=7.98\begin{bmatrix}1\\-0.5\\0.5\end{bmatrix}$	2

$\therefore \lambda=8$ & $X=[1\ \ -0.5\ \ 0.5]^T$

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

THIRD INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: B

USN

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT - CSE
Course Title : Mathematics for CS stream-I
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/BMATS101
Date : 27/03/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** congruence find the remainder when $349 \times 74 \times 36$ is divided by 3.	4	CO5	K3
(b)	**Utilize** the concept of congruence to find the last digit in 7^{2013}.	4	CO5	K3
(c)	**Make use of** congruency to find the least positive values of x such that (i) $89 \equiv (x+3)(mod\ 4)$ (ii)$71 \equiv x\ (mod\ 8)$.	4	CO5	K3
	OR			
2(a)	Solve the following equations using Chinese Remainder Theorem $x \equiv 5\ (mod\ 3), x \equiv 2\ (mod\ 5), x \equiv 1\ (mod\ 11)$.	4	CO5	K3
(b)	**Solve** the polynomial congruence $x^3 + 2x - 3 \equiv 0\ (mod\ 9)$.	4	CO5	K3
(c)	**Make use of** the Fermat's Little Theorem, show that $8^{30} - 1$ is divisible by 31.	4	CO5	K3
	PART –B			
3(a)	**Make use of** row transformation, test for consistency and solve the linear system of equations $5x_1 + x_2 + 3x_3 = 20$, $2x_1 + 5x_2 + 2x_3 = 18$ and $3x_1 + 2x_2 + x_3 = 14$.	4	CO4	K3
(b)	**Apply** Gauss elimination method to solve the system of equations $x + y + z = 9, 2x + y - z = 0$ and $2x + 5y + 7z = 52$.	4	CO4	K3
	OR			
4(a)	**Utilize** Gauss-Seidel iterative method to solve $5x + 2y + z = 12$, $x + 4y + 2z = 15$ and $x + 2y + 5z = 20$ by taking the initial approximation to the solution as $(1, 0, 3)$.	4	CO4	K3
(b)	**Make use of** Rayleigh power method find the largest Eigen value and the corresponding Eigen vector of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ by taking the initial Eigen vector as $[1 \quad 0 \quad 0]^T$.	4	CO4	K3

Name & Signature of
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(Lakshmi C)

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(Dr. VENKATARAMANA B)

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 ODD SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : CSE/AIML/IOT/CCE/CSD-CSE
Course Title : Mathematics for CSE stream-1
Duration : 60 Minutes
Semester : I
Course Type / Code : Integrated/BMATS101
Date : 27/03/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
1 (a)	$349 \equiv 1 (\mod 3)$, $74 \equiv 2 (\mod 3)$, $36 \equiv 0 (\mod 3)$	2
	$349 \times 74 \times 36 \equiv 1 \times 2 \times 0 (\mod 3) \equiv 0 (\mod 3)$	2
	Remainder is 0.	
(b)	$7^4 \equiv 81 \equiv 1 (\mod 10) \Rightarrow (7^4)^{503} \equiv 1^{503} (\mod 10)$	1
	$\Rightarrow 7^{2012} \equiv 1 (\mod 10)$ & $7 \equiv 7 (\mod 10)$	1
	$\therefore 7^{2012} \cdot 7 \equiv 1 \cdot 7 (\mod 10) \Rightarrow 7^{2013} \equiv 7 (\mod 10)$	2
	Last digit is 7	
(c)	(i) $4 \mid 89-(x+3) \Rightarrow 89-x-3=4n \Rightarrow 86-x=4n$.	2
	Let $x=2 \Rightarrow 86-2=84$ (multiple of 4)	1
	$\therefore x=2$	
	(ii) $71 \equiv x (\mod 8) \Rightarrow 8 \mid 71-x \Rightarrow 71-x=8n$.	1
	$\therefore x=71-8n$, for $n=8$, $x=71-64=7$	1
	$\therefore$ Least $x=7$	
2(a)	$x=(a_1M_1M_1^{-1}+a_2M_2M_2^{-1}+a_3M_3M_3^{-1}) \mod M$	1
	$a_1=5$, $m_1=3$, $a_2=2$, $m_2=5$, $a_3=1$, $m_3=11$, $M=3\times5\times11=165$	1
	$M_1=\frac{M}{m_1}=55$, $M_2=\frac{M}{m_2}=33$, $M_3=\frac{M}{m_3}=15$.	1
	$M_1^{-1}=1$, $M_2^{-1}=2$, $M_3^{-1}=3$	1
	$x=(5\times55\times1+2\times33\times2+1\times15\times3) \mod 165 \equiv 122 (\mod 165)$	
(b)	The solution lies in the set $\{-4,-3,-2,-1,0,1,2,3,4\}$	1
	$f(-4) \equiv -75 \not\equiv 0 (\mod 9)$, $f(-3) \equiv 0 (\mod 9)$, $f(-2) \equiv -15 (\mod 9)$	1
	$f(-1) \equiv -6 (\mod 9)$, $f(0) \equiv -3 (\mod 9)$, $f(1) \equiv 0 (\mod 9)$, $f(2) \equiv 0 (\mod 9)$	1
	$f(3) \equiv 30 \not\equiv 0 (\mod 9)$, $f(4) \equiv 69 \not\equiv 0 (\mod 9)$ $\therefore x=-3,1,2 (\mod 9)$	1
	$\therefore$ Solutions are $x=1,2,6 (\mod 9)$	

Q.NO.	POINTS	MARKS
(c)	$a=8,\ p=31$. $GCD(8,31)=1$. We have $a^{p-1}-1\equiv 0 \pmod p$	2
	$8^{31-1}-1\equiv 0 \pmod{31} \Rightarrow 8^{30}-1\equiv 0 \pmod{31}$	2.
3(a)	$R_2\to 5R_2-2R_1$, $R_3\to 5R_3-3R_1$ $\begin{bmatrix}5 & 1 & 3 & : & 20\\ 0 & 23 & 4 & : & 50\\ 0 & 7 & -4 & : & 10\end{bmatrix}$ $R_3\to 23R_3-7R_2$ $\begin{bmatrix}5 & 1 & 3 & : & 20\\ 0 & 23 & 4 & : & 50\\ 0 & 0 & -120 & : & -120\end{bmatrix}$	2
	$\rho[A]=\rho[A:B]=3$. $\Rightarrow$ System is consistent and has unique solution	1
	$\therefore x_1=3,\ x_2=2,\ x_3=1$	1
(b)	$R_2\Rightarrow R_2-2R_1$, $R_3\to R_3-2R_1$ $\begin{bmatrix}1 & 1 & 1 & : & 9\\ 0 & -1 & -3 & : & -18\\ 0 & 3 & 5 & : & 34\end{bmatrix}$ $R_3\to R_3+3R_2$ $\begin{bmatrix}1 & 1 & 1 & : & 9\\ 0 & -1 & -3 & : & -18\\ 0 & 0 & -4 & : & -20\end{bmatrix}$	2
	$x+y+z=9\ ;\ -y-3z=-18,\quad -4z=-20$	1
	$\therefore x=1,\ y=3,\ z=5$.	1
4(a)	$x=\frac{1}{5}[12-2y-z],\ y=\frac{1}{4}[15-x-2z],\ z=\frac{1}{5}[20-x-2y]$	1
	$x^{(0)}=1,\ y^{(0)}=0,\ z^{(0)}=3,\ x^{(1)}=1.8,\ y^{(1)}=1.8,\ z^{(1)}=2.92$	1
	$x^{(2)}=1.096,\ y^{(2)}=2.016,\ z^{(2)}=2.9744,\ x^{(3)}=0.99872$	1
	$y^{(3)}=2.01312,\ z^{(3)}=2.995,\ x^{(4)}=0.99575,\ y^{(4)}=2.0035$	1
	$z^{(4)}=2.9994$. $x=0.9958,\ y=2.0036,\ z=2.9994$	
(6)	$x^{(0)}=[1\ \ 0\ \ 0]^T,\ AX^{(0)}=2\begin{bmatrix}1\\0\\0.5\end{bmatrix}=\lambda^{(1)}X^{(1)},\ AX^{(1)}=2.5\begin{bmatrix}1\\0\\0.8\end{bmatrix}=\lambda^{(2)}X^{(2)}$	1
	$AX^{(2)}=2.8\begin{bmatrix}1\\0\\0.93\end{bmatrix}=\lambda^{(3)}X^{(3)},\ AX^{(3)}=2.93\begin{bmatrix}1\\0\\0.98\end{bmatrix}=\lambda^{(4)}X^{(4)}$	1
	$AX^{(4)}=2.98\begin{bmatrix}1\\0\\0.99\end{bmatrix}=\lambda^{(5)}X^{(5)},\ AX^{(5)}=2.99\begin{bmatrix}1\\0\\0.997\end{bmatrix}=2.997\begin{bmatrix}1\\0\\0.999\end{bmatrix}$	1
	$\lambda=2.997\simeq 3,\ x=[1\ \ 0\ \ 1]^T$	1

Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

FIRST INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E
Branch - Stream : ECE - EE
Course Title : Mathematics - 1 for EE Stream
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/22MATE11
Date : 18/01/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** exterior angle property of a triangle and find the angle between the radius vector and tangent.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = 4sec^2\left(\frac{\theta}{2}\right)$ and $r = 9cosec^2\left(\frac{\theta}{2}\right)$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ/r is a constant for the curve $r = ae^{\theta cot\propto}$	4	CO1	K3
	OR			
2(a)	**Make use of** arc length and find the expression for radius of curvature in Cartesian form.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = a(1 + sin\theta)$ and $r = a(1 - sin\theta)$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ varies inversely as r^{n-1} for the curve $r^n = a^n cosn\theta$	4	CO1	K3
	PART –B			
3(a)	**Utilize** the Maclaurin's series to expand $\log(\sec x)$	4	CO2	K3
(b)	**Solve** $\lim_{x\to 0}\left(\frac{a^x+b^x+c^x}{3}\right)^{\frac{1}{x}}$	4	CO2	K3
	OR			
4(a)	**Utilize** the Maclaurin's series to expand $\log(1+\sin x)$ upto the term containing x^4	4	CO2	K3
(b)	**Solve** $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{\frac{1}{x}}$	4	CO2	K3

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Name & Signature of Course In charge:
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Name & Signature of Module Coordinator:
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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

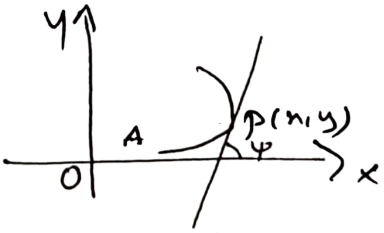
I SESSIONAL TEST 2022-23 ODD SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ECE - EE
Course Title : Mathematics-1 for EE stream
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/ 22MATE11
Date : 18/01/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
① a.	$\psi = \phi + \theta$ $\tan\phi = r\left(\frac{d\theta}{dr}\right)$ 	1+1 —2—
b.	$\cot\phi_1 = \tan(\theta/2)$ $\cot\phi_2 = -\cot(\theta/2)$ $\phi_1 = \pi/2 - \theta/2$ $\phi_2 = -\theta/2$ $\lvert\phi_1 - \phi_2\rvert = \pi/2$.	2+1 —1—
c.	$\cot\phi = \cot\alpha \Rightarrow \phi = \alpha$ $p = r\sin\alpha$ $\rho = r\frac{dr}{dp}$ $\frac{dp}{dr} = \sin\alpha$ $\frac{\rho}{r} = \operatorname{cosec}\alpha$.	—1— 2+1
② a.	$\overset{\frown}{AP} = s$ $\tan\psi = dy/dx$ $\rho = \frac{(1+y_1^2)^{3/2}}{y_2}$ 	—1— —1— —2—
b.	$\cot\phi_1 = \frac{\cos\theta}{1+\sin\theta}$ $\cot\phi_2 = \frac{-\cos\theta}{1-\sin\theta}$ $\tan\phi_1 \cdot \tan\phi_2 = -1 \Rightarrow \phi_1 - \phi_2 = \pi/2$	—2— —2—

Q.NO.	POINTS	MARKS
c.	$\phi = \pi/2 + n\theta$ $\quad \rho = r\frac{dr}{dp}$	1+1
	$p = r\sin\phi$	-1-
	$p = r\cos n\theta$ $\quad \rho = \left(\frac{a^n}{1+n}\right)\frac{1}{r^{n-1}}$	-1-
	$p = \frac{r^{n+1}}{a^n}$ $\quad \rho \propto \frac{1}{r^{n-1}}$	
③ a.	$y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) + \dots$	-1-
	$y(0) = 0 \quad y_1(0) = 1 \quad y_2(0) = 1$	-2-
	$y_3(0) = 0 \quad y_4(0) = 2 \quad y_5(0) = 0 \quad y_6(0) = 16$	
	$\log(\sec x) = \frac{x^2}{2} + \frac{x^4}{12} + \frac{x^6}{45} + \dots$	-1-
b.	$\lim_{x\to 0}\left(\frac{a^x + b^x + c^x}{3}\right)^{1/x} = (abc)^{1/3}$	-4-
④ a.	$y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) + \dots$	-1-
	$y(0) = 0, \quad y_1(0) = 1, \quad y_2(0) = -1$	-2-
	$y_3(0) = 1, \quad y_4(0) = -2$	
	$\log(1 + \sin x) = x - \frac{x^2}{2} + \frac{x^3}{6} - \frac{x^4}{12} + \dots$	-1-
b.	$K = \lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{1/x} \longrightarrow 1^{\infty}$	-1-
	$\log_e K = \lim_{x\to 0} \sec^2 x \tan x = 0$	-2-
	$K = e^0 = 1$	-1-

Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

KSIT

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree	:	**B.E**	**Semester**	:	**I**
Branch - Stream	:	**ECE - EE**	**Course Type / Code**	:	**Integrated/22MATE11**
Course Title	:	**Mathematics - 1 for EE Stream**	**Date**	:	**18/01/2023**
Duration	:	**60 Minutes**	**Max Marks**	:	**20**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** exterior angle property of a triangle and find the angle between the radius vector and tangent.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = a\theta$ and $r = a/\theta$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ^2 varies as r^3 for the curve $r(1 - cos\theta) = 2a$	4	CO1	K3
	OR			
2(a)	**Make use of** arc length and find the expression for radius of curvature in polar form.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r^n = a^n cosn\theta$ and $r^n = a^n sinn\theta$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ^2/r is a constant for the curve $r = a(1 + cos\theta)$	4	CO1	K3
	PART –B			
3(a)	**Utilize** the Maclaurin's series to expand $\sqrt{1+\sin 2x}$	4	CO2	K3
(b)	**Solve** $\lim_{x\to 0}\left(\frac{a^x+b^x}{2}\right)^{\frac{1}{x}}$	4	CO2	K3
	OR			
4(a)	**Utilize** the Maclaurin's series to expand $e^{\sin x}$ upto the term containing x^4	4	CO2	K3
(b)	**Solve** $\lim_{x\to\infty}\left(1+\frac{a}{x}\right)^x$	4	CO2	K3

Lakshmi C

Name & Signature of Course In charge:

(Lakshmi.C)

Name & Signature of Module Coordinator:

(Dr. VENKATARAMANA R.S)

HOD AS&H

Principal

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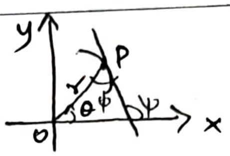
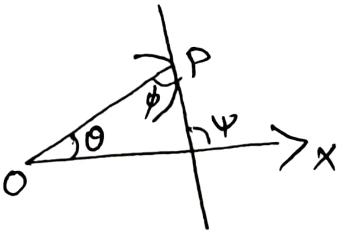
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

I SESSIONAL TEST 2022-23 ODD SEMESTER

SET B

SCHEME AND SOLUTION

Semester : I
Degree : B.E
Course Type / Code : Integrated/ 22MATE11
Branch - Stream : ECE - EE
Date : 18/01/2023
Course Title : Mathematics-1 For EE stream
Max Marks : 20
Duration : 60 Minutes

Q.NO.	POINTS	MARKS
① a.	$\psi = \theta + \phi$ $\tan\phi = r\left(\frac{d\theta}{dr}\right)$ 	1 + 1 - 2 -
b.	$\tan\phi_1 = \theta$ $\quad\tan\phi_2 = -\theta$. $\theta = \pm 1$ $\tan\phi_1 \cdot \tan\phi_2 = -1 \Rightarrow \phi_1 - \phi_2 = \pi/2$	-2 - -1 - -1 -
c.	$\cot\phi = -\cot(\theta/2) \Rightarrow \phi = -\theta/2$ $p = r\sin\phi$ $\quad \rho = r\frac{dr}{dp}$. $p^2 = ar$ $\quad \rho^2 = 4r^3/a$ $2p\frac{dp}{dr} = a$ $\quad \rho^2 \propto r^3$	-1 - 2 + 1
② a.	$\psi = \theta + \phi$ $\rho = \frac{ds/d\theta}{1 + d\phi/d\theta}$ $\rho = \frac{(r^2 + r_1^2)^{3/2}}{r^2 + 2r_1^2 - rr_2}$ 	- 1 - -3 -
b.	$\cot\phi_1 = \cot(\pi/2 + n\theta)$ $\quad \cot\phi_2 = \cot n\theta$. $\phi_1 = \pi/2 + n\theta$ $\quad \phi_2 = n\theta$ $\lvert\phi_1 - \phi_2\rvert = \pi/2$.	1 + 1 -2 -

Q.NO.	POINTS	MARKS
c.	$\phi = \pi/_2 + \theta/_2$ $\quad \rho = r\dfrac{dr}{dp}$	1+1
	$p = r\sin\phi$ $p = r\cos\theta/_2$ $\quad \dfrac{\rho^2}{r} = \dfrac{8a}{9}$ $p^2 = \dfrac{r^3}{2a}$	1+1
③ a.	$y(x) = y(0) + xy_1(0) + \dfrac{x^2}{2!}y_2(0) + \dots$ $y = \cos x + \sin x$	1
	$y(0) = 1 \quad y_1(0) = +1 \quad y_2(0) = -1$ $y_3(0) = -1 \quad y_4(0) = 1.$	2
	$\sqrt{1+\sin 2x} = 1 + x - \dfrac{x^2}{2} - \dfrac{x^3}{6} + \dfrac{x^4}{24} \dots$	1
b.	$\lim\limits_{x\to 0}\left(\dfrac{a^x+b^x}{2}\right)^{1/x} = (ab)^{1/2}$	4
④ a.	$y(x) = y(0) + xy_1(0) + \dfrac{x^2}{2!}y_2(0) + \dots$	1
	$y(0) = 1,\ y_1(0) = 1,\ y_2(0) = 1$ $y_3(0) = 0 \quad y_4(0) = -3$	2
	$e^{\sin x} = 1 + x + \dfrac{x^2}{2} - \dfrac{x^4}{8}.$	1
b.	$K = \lim\limits_{x\to\infty}(1+a/x)^x \rightarrow 1^\infty$	1
	$\log K = a \Rightarrow K = e^a$	3

Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
SECOND INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

KSIT

SET: A

USN

Degree	: B.E	Semester	: I
Branch - Stream	: ECE- EES	Course Type / Code	: Integrated/BMATE101
Course Title	: Mathematics for EE stream -I	Date	: 01/03/2023
Duration	: 60 Minutes	Max Marks	: 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Solve** $(y^3 - 3x^2y)dx - (x^3 - 3xy^2)dy = 0$.	4	CO3	K3
(b)	**Solve** $y(2xy + 1)dx - xdy = 0$	4	CO3	K3
(c)	**Make use** of the differentiation find the orthogonal trajectory of the curve $r^n = a^n \sin n\theta$	4	CO3	K3
	OR			
2(a)	**Solve** $\frac{dy}{dx} - ytanx = y^2\, secx$	4	CO3	K3
(b)	**Solve** $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$	4	CO3	K3
(c)	**Make use** of the differentiation find the orthogonal trajectory of the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2 + \lambda} = 1$ where λ is parameter.	4	CO3	K3
	PART –B			
3(a)	**Make use** of $u = x^2 + y^2 + z^2,\ v = xy + yz + zx,\ w = x + y + z$ find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$	4	CO2	K3
(b)	**Make use** of row operation find the rank of the matrix $\begin{pmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{pmatrix}$	4	CO4	K3
	OR			
4(a)	**Utilize** $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$ find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$	4	CO2	K3
(b)	**Make use** of row operation find the rank of the matrix $\begin{pmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{pmatrix}$	4	CO4	K3

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Name & Signature of Course In charge:

Name & Signature of Module Coordinator:

(Dr. Venkataraman BS)

HOD AS&H

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 ODD SEMESTER

SCHEME AND SOLUTION

SET A

Semester : I
Course Type / Code : Integrated/ BMATE101
Date : 01/03/2023
Max Marks : 20

Degree : B.E
Branch - Stream : ECE- EES
Course Title : Mathematics
Duration : 60 Minutes

Q.NO.	POINTS	MARKS
1.a)	$\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x} = 3y^2 - 3x^2$, exact D.E. ∴ Solution is $\underset{y\ \text{const}}{\int M\,dx} + \underset{\text{not containing } x}{\int N\,dy} = c$ $\therefore \int (y^3 - 3x^2y)\,dx + \int 0\,dy = c$ $\Rightarrow xy^3 - x^3y = \underline{\underline{c}}$	1 2 1 4
1.b)	$\frac{\partial M}{\partial y} = 4xy+1$, $\frac{\partial N}{\partial x} = -1$, not exact. $\frac{1}{M}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) = \frac{1}{y(2xy+1)} \cdot 2(2xy+1) = \frac{2}{y} = g(y)$ $IF = e^{-\int g(y)dy} = 1/y^2$ ∴ solution is $x^2 + x/y = c$ //	1 2 1 4
1.c)	$\frac{1}{r}\frac{dr}{d\theta} = \cot n\theta$ $\frac{1}{r}\left(-r^2\frac{d\theta}{dr}\right) = \cot n\theta \Rightarrow \int \frac{dr}{r} = \int \tan n\theta\, d\theta$ $\Rightarrow \log r = -\frac{\log \sec n\theta}{n} + \log b$ $\Rightarrow r^n = \underline{\underline{b^n \cos n\theta}}$	2 2 4
2.a)	$\div\, y^2$ on B.S $\Rightarrow \frac{1}{y^2}\frac{dy}{dx}\ \frac{1}{y}\tan x = \sec x \rightarrow ①$ $\Rightarrow 1/y = t \Rightarrow -1/y^2\, dy/dx = dt/dx$ $① \Rightarrow dt/dx + \tan x \cdot t = -\sec x$, linear in t. $IF = \sec x$, solution is, $\frac{1}{y}\sec x = \underline{\underline{-\tan x + c}}$	2 2 4

Q.NO.	POINTS	MARKS
2. b)	$\frac{\partial M}{\partial y} = 6x^2y - 6xy^2 = \frac{\partial N}{\partial x}$, exact. ∴ solution is $x^5 + x^3y^2 - x^2y^3 - y^5 = c$	2 2 4
2. c)	Diff wrt x ⇒ $\frac{2x}{a^2} + \frac{2y\,dy/dx}{a^2+\lambda} = 0$ $\frac{1}{a^2+\lambda} = \frac{x}{a^2(-y\,dy/dx)}$ Given eqn becomes, $x^2 - \frac{xy}{dy/dx} = a^2$ Replace dy/dx by $(-dx/dy)$, $x^2 + xy\frac{dy}{dx} = a^2$ ⇒ $\int y\,dy = \int \frac{a^2-x^2}{x}\,dx$ solution is, $x^2+y^2-2a^2\log x = 2c$.	1 1 1 1 4
3. a)	$u_x = 2x$, $u_y = 2y$, $u_z = 2z$, $v_x = y+z$, $v_y = x+z$ $v_z = y+x$, $w_x = 1$, $w_y = 1$, $w_z = 1$. $J = \frac{\partial(u,v,w)}{\partial(x,y,z)} = \begin{vmatrix} 2x & 2y & 2z \\ y+z & x+z & y+x \\ 1 & 1 & 1 \end{vmatrix} = 0$	1 2 1 4
3 b)	$R_1 \leftrightarrow R_2$ $A \sim \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 1 \end{bmatrix} \xrightarrow{R_3 \to R_3 - 3R_1,\ R_4 \to R_4 - R_1} A \simeq \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 0 & 1 & -3 & -1 \\ 0 & 1 & -3 & 1 \end{bmatrix} \Rightarrow A \simeq \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ ⇒ $\rho(A) = 2$.	3 1 4
4 a).	$x\frac{\partial u}{\partial x} = \frac{x}{y}\frac{\partial u}{\partial p} - \frac{z}{x}\frac{\partial u}{\partial r}$, $y\frac{\partial u}{\partial y} = \frac{y}{z}\frac{\partial u}{\partial q} - \frac{x}{y}\frac{\partial u}{\partial p}$ $z\frac{\partial u}{\partial z} = \frac{z}{x}\frac{\partial u}{\partial r} - y/z\,\frac{\partial u}{\partial q}$ ⇒ $xu_x + yu_y + zu_z = 0$	2 2 4
4 b)	$R_1 \leftrightarrow R_2$ $\begin{bmatrix} 2 & 1 & 3 & 4 \\ 4 & 0 & 2 & 1 \\ 4 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix} \Rightarrow A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 0 & -3 & -4 \\ 0 & 0 & 0 & 1 \end{bmatrix} \Rightarrow \rho(A) = 4$	2+2=4

Course Incharge **Module Coordinator** **HOD**

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

SECOND INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

KSIT

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree :	**B.E**	**Semester :**	**I**
Branch - Stream :	**ECE-EES**	**Course Type / Code :**	**Integrated/BMATE101**
Course Title :	**Mathematics for EE stream-I**	**Date :**	**01/03/2023**
Duration :	**60 Minutes**	**Max Marks :**	**20**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	Solve $(y^2 - x^2)dx + 2xydy = 0$.	4	CO3	K3
(b)	Solve $\frac{dy}{dx} + \frac{y}{x} = y^2 x$	4	CO3	K3
(c)	Make use of the differentiation find the orthogonal trajectory of the curve $r = a(1 + \cos\theta)$	4	CO3	K3
	OR			
2(a)	Solve $(x^2 + y^2 + x)dx + xydy = 0$	4	CO3	K3
(b)	Solve $[y\left(1 + \frac{1}{x}\right) + cosy]dx + (x + log\ x - xsiny)dy = 0$	4	CO3	K3
(c)	Make use of differential equation prove that $y^2 = 4a(x + a)$ is self orthogonal.	4	CO3	K3
	PART –B			
3(a)	Make use of $u = \frac{yz}{x}, v = \frac{zx}{y}, w = \frac{xy}{z}$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$	4	CO2	K3
(b)	Make use of row operation find the rank of the matrix $\begin{pmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{pmatrix}$	4	CO4	K3
	OR			
4(a)	Utilize the first order derivative find the extreme values of the function $f(x,y) = x^3 + 3xy^2 - 3y^2 - 3x^2 + 4$	4	CO2	K3
(b)	Make use of row operation find the rank of the matrix $\begin{pmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{pmatrix}$	4	CO4	K3

Lakshmi C

Name & Signature of Course In charge:

(Lakshmi·C)

Name & Signature of Module Coordinator:

(Mr. Venkataraman B S)

HOD AS&H

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 ODD SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ECE-EES
Course Title : Mathematics
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/ BMATE101
Date : 01/03/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
1.a)	$\frac{\partial m}{\partial y} = 2y = \frac{\partial N}{\partial x}$, eq^n is exact. ∴ solution is $\int M dx + \int N dy = c$ $\Rightarrow xy^2 - \frac{x^3}{3} = C$.	2 2 4
1.b)	$\frac{dy}{dx} + y/x = y^2 x \Rightarrow \div y^2$ on B S $\frac{1}{y^2} dy/dx + \frac{1}{yx} = x$ →① put $1/y = t \Rightarrow -1/y^2 \frac{dy}{dt} = \frac{dt}{dx}$ $\Rightarrow \frac{dt}{dx} - t \cdot 1/x = -x$, & IF = $1/x$ ∴ soln is $\frac{1}{xy} = -x + c$	1 1 2 4
1.c)	$\log r = \log a + \log(1+\cos\theta)$, Replace $\frac{dr}{d\theta}$ by $\left(-r^2 \frac{d\theta}{dr}\right)$ $\Rightarrow \frac{1}{r}\frac{dr}{d\theta} = -\frac{\sin\theta}{1+\cos\theta}$ $\int \frac{dr}{r} = \int \cot\theta/2 \, d\theta \Rightarrow r = b\left(\frac{1-\cos\theta}{2}\right)$ is the required OT.	2 2 4
2.a)	$\frac{\partial m}{\partial y} = 2y$ & $\frac{\partial N}{\partial x} = y$. $\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} = y$, near to N. ∴ $\frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) = \frac{y}{xy} = 1/x = f(x)$ & IF = x ∴ Given eq^n becomes $M = x^3 + xy^2 + x^2$, $N = x^2 y$ solution is $\frac{x^4}{4} + \frac{x^2y^2}{2} + \frac{x^3}{3} = c$ //	1 1 2 4
2 b)	$\frac{\partial m}{\partial y} = 1 + 1/x - \sin y = \frac{\partial N}{\partial x}$, eq^n is exact. ∴ solution is $y(x+\log x) + x\cos y = c$ //	2 2 4

Q.NO.	POINTS	MARKS
2 c)	$y^2 = 4a(x+a)$ → ① Diff w.r.t x, $y\frac{dy}{dx} = 4a(1)$ $\Rightarrow a = y/2 \; dy/dx$ → ②, use ② in ① ① ⇒ $y^2 = 2x \, dy/dx + y(dy/dx)^2$ → ③, is the DE of given curve. Replace dy/dx by $(-dx/dy)$ $\Rightarrow y = y(dy/dx)^2 + 2x \, dy/dx$ → ④, is the DE of required OT. ∴ ③ & ④ same, given curve is self orthogonal.	1 1 1 1 4
3. a)	$J = \frac{\partial(u,v,w)}{\partial(x,y,z)} = \begin{vmatrix} -\frac{yz}{x^2} & z/x & y/x \\ z/y & -\frac{zx}{y^2} & x/y \\ y/z & x/z & -xy/z^2 \end{vmatrix} = 4.$	2 2 4
3. b)	$R_1 \leftrightarrow R_2 \Rightarrow A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 4 & 0 & 2 & 1 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix} \xRightarrow{R_2-2R_1,\; R_3-R_1,\; R_4-R_1} A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 2 & 1 & 3 \\ 0 & 2 & -2 & 0 \end{bmatrix}$ $\Rightarrow A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 0 & -3 & -4 \\ 0 & 0 & 0 & 1 \end{bmatrix} \Rightarrow \rho(A) = 4.$	3 1 4
4 a)	$f_x = 3x^2 + 3y^2 - 6x$, $f_y = 6xy - 6y$ Critical points are $(0,0)$, $(2,0)$, $(1,1)$, $(1,-1)$ $A = 6x-6$, $B = 6y$, $C = 6x-6$. at $(0,0)$, $A = -6$, $B = 0$, $C = -6$, $AC - B^2 = 36$, maximum. at $(2,1)$, $A = 6$, $B = 0$, $C = 6$, $AC - B^2 = 36$, minimum. at $(1,1)$ & $(1,-1)$ saddle point, $f_{min} = 0$, $f_{max} = 4$.	1 1 2 4
4b)	$\rho(A) = 2$	2+2=4

Lakshmi C
Course Incharge

Module Coordinator

HOD

KSIT

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
THIRD INTERNAL TEST QUESTION PAPER 2022-23ODDSEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree : **B.E**
Branch - Strean : **ECE- EES**
Course Title : **Mathematics for EE stream-1**
Duration : **60 Minutes**

Semester : **I**
Course Type /Code : **Integrated/BMATE101**
Date : **27/03/2023**
Max Marks : **20**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	Solve $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)dzdydx.$	4	CO5	K3
(b)	**Make use of** the definition of Beta and Gamma functions derive the relation between Beta and Gamma function.	4	CO5	K3
(c)	**Make use** of Beta and Gamma function, show that $\int_0^{\pi/2}\frac{d\theta}{\sqrt{sin\theta}}\times\int_0^{\pi/2}\sqrt{sin\theta}\,d\theta=\pi$	4	CO5	K3
	OR			
2(a)	**Make use** of Beta and Gamma functions, show that $\Gamma(\frac{1}{2})=\sqrt{\pi}$.	4	CO5	K3
(b)	**Make use of** double integrals, Change the order of integration and evaluate $\int_0^1\int_{\sqrt{y}}^1 dxdy$	4	CO5	K3
(c)	**Make use of** Beta and Gamma functions, evaluate $\int_0^{\pi/2}\sqrt{tan\theta}d\theta.$	4	CO5	K3
	PART –B			
3(a)	**Utilize** the Gauss-Seidel iteration method, solve the system of equations $10x+y+z=12, x+10y+z=12, x+y+10z=12.$	4	CO4	K3
(b)	**Utilize** Rayleigh's power method, find the largest eigen value and corresponding eigen vector of the matrix $\begin{bmatrix}6 & -2 & 2\\ -2 & 3 & -1\\ 2 & -1 & 3\end{bmatrix}$ by taking the initial eigen vector as$[1,1,1]'$	4	CO4	K3
	OR			
4(a)	**Identify** the value of $\lambda and\mu$ such that the system of equations $x+y+z=6, x+2y+3z=10, x+2y+\lambda z=\mu$, may have a) Unique solutionb) Infinite solution c) No solution	4	CO4	K3
(b)	**Solve** the system of equations by Gauss –Jordan method $x+y+z=10, 2x-y+3z=19, x+2y+3z=22.$	4	CO4	K3

Mamatha

Name & Signature of Course In charge:

Mamatha.N

Name & Signature of Module Coordinator

(Dr VENKATARAMANA.BS)

HOD AS&H

Principal

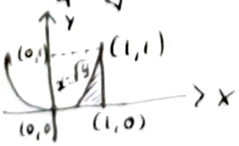
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 ODD SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ECE-EEE
Course Title : Mathematics for EEE stream-1
Duration : 60 Minutes
Semester : I
Course Type / Code : Integrated/BMATE101
Date : 27/03/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
1 a)	$I = \int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dz\,dy\,dx = \frac{8abc}{3}(a^2+b^2+c^2)$	4m
c)	$I_1 = \int_0^{\pi/2} \sin^{-1/2}\theta \cos^0\theta\, d\theta = \frac{1}{2}\beta(1/4, 1/2)$	3m
	$I_2 = \int_0^{\pi/2} \sin^{1/2}\theta \cos^0\theta\, d\theta = \frac{1}{2}\beta(3/4, 1/2)$	1m
	$I_1 \times I_2 = \pi$	
b)	$\beta(m,n) = 2\int_0^{\pi/2} \sin^{2m-1}\theta \cos^{2n-1}\theta\, d\theta$, $\Gamma(n) = 2\int_0^{\infty} e^{-x^2} x^{2n-1}\, dx$	2m
	$\Gamma(m) = 2\int_0^{\infty} e^{-y^2} y^{2m-1}\, dy$, $\Gamma(m).\Gamma(n) = 4\int_0^{\infty}\int_0^{\infty} e^{-(x^2+y^2)} x^{2n-1} y^{2m-1}\, dx\,dy$	2m
	$\Gamma(m).\Gamma(n) = \Gamma(m+n).\beta(m,n) \Rightarrow \beta(m,n) = \frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$	
	OR	
2 a)	$\beta(1/2, 1/2) = \Gamma(1/2).\Gamma(1/2)$, $\beta(1/2. 1/2) = 2\int_0^{\pi/2} \sin^0\theta \cos^0\theta\, d\theta = \pi$	2m 2m
	$\therefore \pi = \{\Gamma(1/2)\}^2 \Rightarrow \Gamma(1/2) = \sqrt{\pi}$	
b)	$I = \int_0^1\int_{\sqrt{y}}^1 dx\,dy$ on changing order $I = \int_{x=0}^{1}\int_{y=0}^{x^2} dy\,dx$  $I = 1/3$	2m 2m
c)	$I = \int_0^{\pi/2} \sqrt{\tan\theta}\, d\theta = \int_0^{\pi/2} \sin^{1/2}\theta \cos^{-1/2}\theta\, d\theta$	1m
	$= \frac{1}{2}\beta(3/4, 1/4) = \frac{1}{2}\frac{\Gamma(3/4)\Gamma(1/4)}{\Gamma(1)} = \pi/\sqrt{2}$	3m

Q.NO.	POINTS	MARKS
	Part - B	
3a)	1st iteration; $x^{(1)}=1.2,\ y^{(1)}=1.08,\ z^{(1)}=0.972$	1m
	$z^{(2)}=1.0001$	1m
	2nd iteration; $x^{(2)}=0.9948,\ y^{(2)}=1.0033,\ z^{(3)}=1.00003$	1m
	3rd iteration; $x^{(3)}=0.9996,\ y^{(3)}=1.0000,\ z^{(4)}=1$	1m
	4th iteration; $x^{(4)}=0.99999\simeq 1\ \ y^{(4)}=0.99999\simeq 1,$	
b)	$Ax^{(0)}=\begin{bmatrix}6\\0\\4\end{bmatrix}=6\begin{bmatrix}1\\0\\0.67\end{bmatrix},\ Ax^{(1)}=\begin{bmatrix}7.34\\-2.67\\4.01\end{bmatrix}=7.34\begin{bmatrix}1\\-0.36\\0.55\end{bmatrix}$	2m
	$Ax^{(2)}=\begin{bmatrix}7.82\\-3.63\\4.01\end{bmatrix}=7.82\begin{bmatrix}1\\-0.46\\0.51\end{bmatrix},\ Ax^{(3)}=\begin{bmatrix}7.94\\-3.89\\3.99\end{bmatrix}=7.94\begin{bmatrix}1\\-0.49\\0.5\end{bmatrix}$	1m
	$Ax^{(4)}=\begin{bmatrix}7.98\\-3.97\\3.99\end{bmatrix}=7.98\begin{bmatrix}1\\-0.5\\0.5\end{bmatrix}\ Ax^{(5)}=\begin{bmatrix}8\\-4\\4\end{bmatrix}=8\begin{bmatrix}1\\-0.5\\0.5\end{bmatrix}$	1m
	dominant Eigen value = 8, Eigen vector = $[1, -0.5, 0.5]$	
	OR	
4a)	$[A:B]\sim\begin{bmatrix}1&1&1&:&6\\0&1&2&:&4\\0&0&\lambda-3&:&\mu-10\end{bmatrix}$ a) unique Soln; If $\lambda\neq 3$ $\rho(A)=\rho(A:B)=3$	2m
	b) Infinite Soln; $\lambda-3=0,\ \mu-10=2,\ \rho(A)=\rho(A:2)=2$	1m
	c) No Soln; $\rho(A)\neq\rho(A:B)$, $\lambda=3$ and $\mu\neq 10$	1m
b)	$[A:B]\sim\begin{bmatrix}9&0&0&:&43\\0&-9&0&:&-14\\0&0&-3&:&-11\end{bmatrix}$	2m
	$x=\frac{43}{9},\ y=\frac{14}{9},\ z=\frac{11}{3}$	2m

Mamatha

Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

THIRD INTERNAL TEST QUESTION PAPER 2022-23ODDSEMESTER

SET: B

USN | | | | | | | | | |

Degree	:	**B.E**	**Semester**	:	**I**
Branch - Stream	:	**ECE-EES**	**Course Type / Code**	:	**Integrated/BMATE101**
Course Title	:	**Mathematics for EE stream-1**	**Date**	:	**27/03/2023**
Duration	:	**60 Minutes**	**Max Marks**	:	**20**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.		Marks	CO	K-Level
	PART-A			
1(a)	**Solve** $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\ dydx\,dz.$	4	CO5	K3
(b)	**Make use of** Beta and Gamma functions,show that $\Gamma(\frac{1}{2})=\sqrt{\pi}.$	4	CO5	K3
(c)	**Make use of** Beta and Gamma functions , $\int_{0}^{\pi/2}\frac{d\theta}{\sqrt{sin\theta}}\times\int_{0}^{\pi/2}\sqrt{sin\theta}d\theta=\pi$	4	CO5	K3
	OR			
2(a)	**Make use of** the definition of Beta and Gamma functions ,derive the relation between Beta and Gamma function.	4	CO5	K3
(b)	**Make use of** integral calculus, evaluate $\int_{0}^{\infty}\int_{0}^{\infty}e^{-(x^2+y^2)}dxdy$ by changing into polar coordinates.	4	CO5	K3
(c)	**Make use of** Beta and Gamma functions, evaluate $\int_{0}^{\pi/2}\sqrt{cot\theta}d\theta.$	4	CO5	K3
	PART –B			
3(a)	**Make use of** linear equations, solve by Gauss-Seidel method $5x+2y+z=12, x+4y+2z=15, x+2y+5z=20.$	4	CO4	K3
(b)	**Make use of** Rayleigh's power method, find the dominant eigen value and the corresponding eigen vector of $\begin{bmatrix}4 & 1 & -1\\ 2 & 3 & -1\\ 2 & 1 & 5\end{bmatrix}$ by taking the initial eigen vector as $[1,0,0]'$	4	CO4	K3
	OR			
4(a)	**Make use of** linear equations ,test for consistency to the system of equations $x-2y+3z=2, 3x-y+4z=4, 2x+y-2z=5.$	4	CO4	K3
(b)	**Solve** the system of equations by Gauss –elimination method $2x+y+4z=12, 4x+11y-z=33, ,8x-3y+2z=20$	4	CO4	K3

Name & Signature of Course In charge:

Naveen. V

Name & Signature of Module Coordinator

(Dr. VENKATARAMANA.BS)

HOD AS&H

Principal

Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 ODD SEMESTER

SCHEME AND SOLUTION

SET B

Semester : I
Course Type / Code : Integrated/BMATE101
Degree : B.E
Date : 27/03/2023
Branch - Stream : ECE-EEE
Course Title : Mathematics for EEE stream-1
Max Marks : 20
Duration : 60 Minutes

Q.NO.	POINTS	MARKS
1 a)	$I = \int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz = 0$	$\boxed{4m}$
b)	$\beta(1/2, 1/2) = \Gamma(1/2).\Gamma(1/2)$, $\beta(1/2, 1/2) = 2\int_0^{\pi/2}\sin^0\theta\cos^0\theta\,d\theta = \pi$ $\therefore \pi = \{\Gamma(1/2)\}^2 \Rightarrow \Gamma(1/2) = \sqrt{\pi}$	$\boxed{2m}$ $\boxed{2m}$
c)	$I_1 = \int_0^{\pi/2}\sin^{-1/2}\theta.\cos^0\theta\,d\theta = 1/2\,\beta(1/4, 1/2)$ $I_2 = \int_0^{\pi/2}\sin^{1/2}\theta\cos^0\theta\,d\theta = 1/2\,\beta(3/4, 1/2)$ $I_1 \times I_2 = 1/4\,\beta(3/4, 1/2).\beta(1/4, 1/2) = \pi$	$\boxed{1m}$ $\boxed{3m}$
	$\boxed{OR}$	
2 a)	$\beta(m,n) = 2\int_0^{\pi/2}\sin^{2m-1}\theta\cos^{2n-1}\theta\,d\theta$, $\Gamma(n) = 2\int_0^{\infty}e^{-x^2}x^{2n-1}\,dx$ $\Gamma(m) = 2\int_0^{\infty}e^{-y^2}y^{2m-1}\,dy$, $\Gamma(m).\Gamma(n) = 4\int_0^{\infty}\int_0^{\infty}e^{-(x^2+y^2)}x^{2n-1}y^{2m-1}\,dx\,dy$ $\Gamma(m).\Gamma(n) = \Gamma(m+n).\beta(m,n) \Rightarrow \beta(m,n) = \frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$	$\boxed{1m}$ $\boxed{2m}$ $\boxed{1m}$ $\boxed{2m}$
b)	we have $x = r\cos\theta$, $y = r\sin\theta$ $\therefore x^2+y^2 = r^2$ & $dx\,dy = r\,dr\,d\theta$, $I = \int_{\theta=0}^{\pi/2}\int_{r=0}^{\infty}e^{-r^2}r\,dr\,d\theta = \pi/4$ x, y varies from 0 to ∞,	$\boxed{2m}$
c)	$I = \int_0^{\pi/2}\sqrt{\cot\theta}\,d\theta = \int_0^{\pi/2}\sin^{-1/2}\theta\cos^{1/2}\theta\,d\theta$ $= 1/2\,\beta(3/4, 1/4) = 1/2\,\frac{\Gamma(1/4)\Gamma(3/4)}{\Gamma(1)} = \pi/\sqrt{2}$	$\boxed{1m}$ $\boxed{3m}$

Q.NO.	POINTS	MARKS
	Part - B	
3 a)	1st iteration; $x^{(1)} = 2.4$, $y^{(1)} = 3.15$, $z^{(1)} = 2.26$	1m
	2nd iteration; $x^{(2)} = 0.688$, $y^{(2)} = 2.448$, $z^{(2)} = 2.8832$	
	3rd iteration; $x^{(3)} = 0.8441$, $y^{(3)} = 2.0973$, $z^{(3)} = 2.9922$	1m
	4th iteration; $x^{(4)} = 0.9626$, $y^{(4)} = 2.0132$, $z^{(4)} = 3.0022$	1m
	5th iteration; $x^{(5)} = 0.9942$, $y^{(5)} = 2.0003$, $z^{(5)} = 3.0010$	
	6th iteration; $x^{(6)} = 0.9996$, $y^{(6)} = 1.9996$, $z^{(6)} = 3.0002$	1m
b)	1st iteration; $Ax^{(0)} = 4\begin{bmatrix}1\\0.5\\-0.5\end{bmatrix}$, 2nd iteration; $Ax^{(1)} = 5\begin{bmatrix}1\\0.8\\-0.8\end{bmatrix}$	2m
	3rd iteration; $Ax^{(2)} = 5.6\begin{bmatrix}1\\0.92\\-0.92\end{bmatrix}$ 4th iteration; $Ax^{(3)} = 5.84\begin{bmatrix}1\\0.97\\-0.97\end{bmatrix}$	1m
	5th iteration; $Ax^{(4)} = 5.94\begin{bmatrix}1\\0.98\\-0.98\end{bmatrix}$ 6th iteration; $5.96\begin{bmatrix}1\\0.99\\-0.99\end{bmatrix}$	1m
	OR	
4a)	$[A:B] \sim \begin{bmatrix}1 & -2 & 3 & : & 2\\ 0 & 5 & -5 & : & -2\\ 0 & 0 & 3 & : & -3\end{bmatrix}$ $\rho(A) = 3 = \rho(A:B)$	2m
	$\therefore r = n$	2m
	$\therefore x = 11/5$, $y = -7/5$, $z = -1$	
b)	$[A:B] \sim \begin{bmatrix}2 & 1 & 4 & : & 12\\ 0 & 1 & -1 & : & 1\\ 0 & 0 & -3 & : & -3\end{bmatrix}$ $\rho(A) = \rho(A:B) = 3$	2m
	$\therefore x = 3$, $y = 2$, $z = 1$	2m

Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

USN ☐☐☐☐☐☐☐☐☐☐

SET: A

Degree : B.E
Branch - Stream : Mechanical - ME
Course Title : Mathematics - 1 for ME Stream
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/22MATM11
Date : 18/01/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** exterior angle property of a triangle and find the angle between the radius vector and tangent.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = 4sec^2\left(\frac{\theta}{2}\right)$ and $r = 9cosec^2\left(\frac{\theta}{2}\right)$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ/r is a constant for the curve $r = ae^{\theta cot\propto}$	4	CO1	K3
	OR			
2(a)	**Make use of** arc length and find the expression for radius of curvature in Cartesian form.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = a(1 + sin\theta)$ and $r = a(1 - sin\theta)$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ varies inversely as r^{n-1} for the curve $r^n = a^n cosn\theta$	4	CO1	K3
	PART –B			
3(a)	**Utilize** the Maclaurin's series to expand $\log(\sec x)$	4	CO2	K3
(b)	**Solve** $\lim_{x\to 0}\left(\frac{a^x+b^x+c^x}{3}\right)^{\frac{1}{x}}$	4	CO2	K3
	OR			
4(a)	**Utilize** the Maclaurin's series to expand $\log(1+\sin x)$ upto the term containing x^4	4	CO2	K3
(b)	**Solve** $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{\frac{1}{x}}$	4	CO2	K3

Name & Signature of Course In charge:
(NAVEEN.V)

Name & Signature of Module Coordinator:
(Dr. VENKATA RAMANA R.S)

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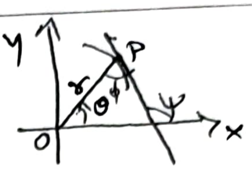
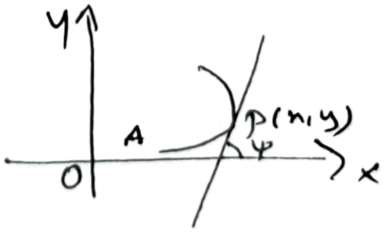
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

I SESSIONAL TEST 2022-23 ODD SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : Mechanical - ME
Course Title : Mathematics -1 for ME Stream
Duration : 60 Minutes
Semester : I
Course Type / Code : Integrated/ 22MATM11
Date : 18/01/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
① a.	$\psi = \phi + \theta$ $\tan\phi = r\left(\frac{d\theta}{dr}\right)$ 	1 + 1 -2-
b.	$\cot\phi_1 = \tan(\theta/2)$ $\cot\phi_2 = -\cot(\theta/2)$ $\phi_1 = \pi/2 - \theta/2$ $\phi_2 = -\theta/2$ $\lvert\phi_1 - \phi_2\rvert = \pi/2$.	2 + 1 -1-
c.	$\cot\phi = \cot\alpha \rightarrow \phi = \alpha$ $p = r\sin\alpha$ $\rho = r\frac{dr}{dp}$ $\frac{dp}{dr} = \sin\alpha$ $\frac{\rho}{r} = \operatorname{cosec}\alpha$.	-1- 2 + 1
② a.	$\widehat{AP} = s$ $\tan\psi = dy/dx$ $\rho = \frac{(1+y_1^2)^{3/2}}{y_2}$ 	-1- -1- -2-
b.	$\cot\phi_1 = \frac{\cos\theta}{1+\sin\theta}$ $\cot\phi_2 = \frac{-\cos\theta}{1-\sin\theta}$ $\tan\phi_1 \cdot \tan\phi_2 = -1 \rightarrow \phi_1 - \phi_2 = \pi/2$	-2- -2-

Q.NO.	POINTS	MARKS
c.	$\phi = \pi/_2 + n\theta$ $\rho = r\frac{dr}{dp}$	1+1
	$p = r\sin\phi$	-1-
	$p = r\cos n\theta$ $\rho = \left(\frac{a^n}{1+n}\right)\frac{1}{r^{n-1}}$	-1-
	$p = \frac{r^{n+1}}{an}$ $\rho \propto \frac{1}{r^{n-1}}$	
③ a.	$y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) + \dots$	-1-
	$y(0) = 0$ $y_1(0) = 1$ $y_2(0) = 1$	-2-
	$y_3(0) = 0$ $y_4(0) = 2$ $y_5(0) = 0$ $y_6(0) = 16$	
	$\log(\sec x) = \frac{x^2}{2} + \frac{x^4}{12} + \frac{x^6}{45} + \dots$	-1-
b.	$\lim_{x\to 0}\left(\frac{a^x+b^x+c^x}{3}\right)^{1/x} = (abc)^{1/3}$	-4-
④ a.	$y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) + \dots$	-1-
	$y(0) = 0$, $y_1(0) = 1$, $y_2(0) = -1$	-2-
	$y_3(0) = 1$, $y_4(0) = -2$	
	$\log(1+\sin x) = x - \frac{x^2}{2} + \frac{x^3}{6} - \frac{x^4}{12} + \dots$	-1-
b.	$K = \lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{1/x} \longrightarrow 1^\infty$	-1-
	$\log_e K = \lim_{x\to 0} \sec^2 x \tan x = 0$	-2-
	$K = e^0 = 1$	-1-

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Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: B

USN										

Degree : B.E
Branch - Stream : Mechanical - ME
Course Title : Mathematics - 1 for ME Stream
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/22MATM11
Date : 18/01/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** exterior angle property of a triangle and find the angle between the radius vector and tangent.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r = a\theta$ and $r = a/\theta$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ^2 varies as r^3 for the curve $r(1 - cos\theta) = 2a$	4	CO1	K3
	OR			
2(a)	**Make use of** arc length and find the expression for radius of curvature in polar form.	4	CO1	K3
(b)	**Choose** the appropriate formula and find the angle between $r^n = a^n cosn\theta$ and $r^n = a^n sinn\theta$	4	CO1	K3
(c)	**Make use of** radius of curvature and show that ρ^2/r is a constant for the curve $r = a(1 + cos\theta)$	4	CO1	K3
	PART –B			
3(a)	Utilize the Maclaurin's series to expand $\sqrt{1+\sin 2x}$	4	CO2	K3
(b)	Solve $\lim_{x\to 0}\left(\frac{a^x+b^x}{2}\right)^{\frac{1}{x}}$	4	CO2	K3
	OR			
4(a)	Utilize the Maclaurin's series to expand $e^{\sin x}$ upto the term containing x^4	4	CO2	K3
(b)	Solve $\lim_{x\to\infty}\left(1+\frac{a}{x}\right)^x$	4	CO2	K3

Name & Signature of Course In charge:
(Lakshmi.c)

Name & Signature of Module Coordinator:
(Dr. VENKATARAMANA B.S)

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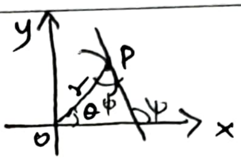
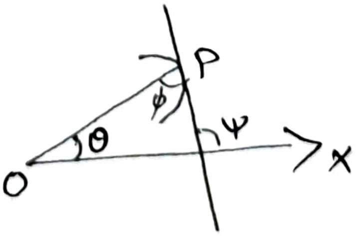
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

I SESSIONAL TEST 2022-23 ODD SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : mechanical -ME
Course Title : Mathematics -1 For ME stream
Duration : 60 Minutes
Semester : I
Course Type / Code : Integrated/ 22MATM11
Date : 18/01/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
① a.	$\psi = \theta + \phi$ $\tan\phi = r\left(\frac{d\theta}{dr}\right)$ 	1+1 2
b.	$\tan\phi_1 = \theta$ $\tan\phi_2 = -\theta$. $\theta = \pm 1$ $\tan\phi_1 \cdot \tan\phi_2 = -1 \Rightarrow \phi_1 - \phi_2 = \pi/2$	2 1 1
c.	$\cot\phi = -\cot(\theta/2) \Rightarrow \phi = -\theta/2$ $p = r\sin\phi$ $\rho = r\frac{dr}{dp}$. $p^2 = ar$ $2p\frac{dp}{dr} = a$ $\rho^2 = 4r^3/a$ $\rho^2 \propto r^3$	1 2+1
② a.	$\psi = \theta + \phi$ $\rho = \frac{ds/d\theta}{1 + d\phi/d\theta}$ $\rho = \frac{(r^2 + r_1^2)^{3/2}}{r^2 + 2r_1^2 - rr_2}$ 	1 3
b.	$\cot\phi_1 = \cot(\pi/2 + n\theta)$ $\cot\phi_2 = \cot n\theta$. $\phi_1 = \pi/2 + n\theta$ $\phi_2 = n\theta$ $\lvert\phi_1 - \phi_2\rvert = \pi/2$.	1+1 2

Q.NO.	POINTS	MARKS
c.	$\phi = \pi/_2 + \theta/_2$ $\quad \rho = r \frac{dr}{dp}$	1+1
	$p = r \sin\phi$	
	$p = r \cos\theta/_2$ $\quad \frac{\rho^2}{r} = \frac{8a}{9}$	1+1
	$p^2 = \frac{r^3}{2a}$	
③ a.	$y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) + \dots$	-1-
	$y = \cos x + \sin x$	
	$y(0) = 1 \quad y_1(0) = +1 \quad y_2(0) = -1$	-2-
	$y_3(0) = -1 \quad y_4(0) = 1.$	
	$\sqrt{1+\sin 2x} = 1 + x - \frac{x^2}{2} - \frac{x^3}{6} + \frac{x^4}{24} \dots$	-1-
b.	$\lim_{x \to 0} \left(\frac{a^x + b^x}{2}\right)^{1/x} = (ab)^{1/2}$	-4-
④ a.	$y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) + \dots$	-1-
	$y(0) = 1, \quad y_1(0) = 1, \quad y_2(0) = 1$	-2-
	$y_3(0) = 0 \quad y_4(0) = -3$	
	$e^{\sin x} = 1 + x + \frac{x^2}{2} - \frac{x^4}{8}.$	-1-
b.	$K = \lim_{x \to \infty} (1 + a/x)^x \to 1^\infty$	-1-
	$\log K = a \Rightarrow K = e^a$	-3-

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Module Coordinator

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SECOND INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E
Branch - Stream : ME - ME
Course Title : Mathematics for ME stream-1
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/BMATM101
Date : 01/03/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	Solve $(y^3-3x^2y)dx-(x^3-3xy^2)dy=0$.	4	CO3	K3
(b)	Solve $y(2xy+1)dx-xdy=0$	4	CO3	K3
(c)	Make use of the differentiation find the orthogonal trajectory of the curve $r^n=a^n\sin n\theta$	4	CO3	K3
	OR			
2(a)	Solve $\frac{dy}{dx}-y\tan x=y^2\sec x$	4	CO3	K3
(b)	Solve $(5x^4+3x^2y^2-2xy^3)dx+(2x^3y-3x^2y^2-5y^4)dy=0$	4	CO3	K3
(c)	Make use of the differentiation find the orthogonal trajectory of the curve $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$ where λ is parameter.	4	CO3	K3
	PART –B			
3(a)	Make use of $u=x^2+y^2+z^2,\ v=xy+yz+zx,\ w=x+y+z$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$	4	CO2	K3
(b)	Make use of row operation find the rank of the matrix $\begin{pmatrix}0 & 1 & -3 & -1\\ 1 & 0 & 1 & 1\\ 3 & 1 & 0 & 2\\ 1 & 1 & -2 & 0\end{pmatrix}$	4	CO4	K3
	OR			
4(a)	Utilize $u=f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$ find $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}$	4	CO2	K3
(b)	Make use of row operation find the rank of the matrix $\begin{pmatrix}4 & 0 & 2 & 1\\ 2 & 1 & 3 & 4\\ 2 & 3 & 4 & 7\\ 2 & 3 & 1 & 4\end{pmatrix}$	4	CO4	K3

NAVEEN. V
Name & Signature of
Course In charge:

Name & Signature of
Module Coordinator:
(Dr Venkataraman BS

HOD AS&H

Kumar. G
Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 ODD SEMESTER

SCHEME AND SOLUTION

SET A

Degree : B.E
Branch - Stream : ME-ME
Course Title : Mathematics
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/ BMATM101
Date : 01/03/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
1-a)	$\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x} = 3y^2-3x^2$, exact D.E. ∴ Solution is $\underset{y\ const}{\int M\,dx} + \underset{not\ containing\ x}{\int N\,dy} = c$ ∴ $\int (y^3-3x^2y)\,dx + \int 0\,dy = c$ $\Rightarrow \underline{\underline{xy^3 - x^3y = c}}$	1 2 1 4
1-b)	$\frac{\partial M}{\partial y} = 4xy+1$, $\frac{\partial N}{\partial x} = -1$, not exact. $\frac{1}{M}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) = \frac{1}{y(2xy+1)} \cdot 2(2xy+1) = \frac{2}{y} = g(y)$ $IF = e^{-\int g(y)dy} = 1/y^2$ ∴ solution is $x^2 + x/y = c$ //	1 2 1 4
1-c)	$\frac{1}{r}\frac{dr}{d\theta} = \cot n\theta$ $\frac{1}{r}\left(-r^2\frac{d\theta}{dr}\right) = \cot n\theta \Rightarrow \int \frac{dr}{r} = \int \tan n\theta\, d\theta$ $\Rightarrow \log r = -\log \frac{\sec n\theta}{n} + \log b$ $\Rightarrow \underline{\underline{r^n = b^n \cos n\theta}}$	2 2 4
2.a)	$\div y^2$ on B.S $\Rightarrow \frac{1}{y^2}\frac{dy}{dx} \frac{1}{y}\tan x = \sec x \rightarrow ①$ $\Rightarrow 1/y = t \Rightarrow -1/y^2\, dy/dt = dt/dx$ $① \Rightarrow dt/dx + \tan x \cdot t = -\sec x$, linear in t. $IF = \sec x$, solution is, $\frac{1}{y}\sec x = \underline{\underline{-\tan x + c}}$	2 2 4

Q.NO.	POINTS	MARKS
2. b)	$\frac{\partial M}{\partial y} = 6x^2y - 6xy^2 = \frac{\partial N}{\partial x}$, exact. $\therefore$ solution is $x^5 + x^3y^2 - x^2y^3 - y^5 = c$	2 2 4
2. c)	Diff wrt $x \Rightarrow \frac{2x}{a^2} + \frac{2y\, dy/dx}{a^2+\lambda} = 0$ $\frac{1}{a^2+\lambda} = \frac{x}{a^2(-y\, dy/dx)}$ Given eqn becomes, $x^2 - \frac{xy}{dy/dx} = a^2$ Replace dy/dx by $(-dx/dy)$, $x^2 + xy\frac{dy}{dx} = a^2$ $\Rightarrow \int y\, dy = \int \frac{a^2-x^2}{x}\, dx$ solution is, $x^2+y^2 - 2a^2 \log x = 2c$.	1 1 1 1 4
3. a)	$u_x = 2x$, $u_y = 2y$, $u_z = 2z$, $v_x = y+z$, $v_y = x+z$ $v_z = y+x$, $w_x = 1$, $w_y = 1$, $w_z = 1$. $J = \frac{\partial(u,v,w)}{\partial(x,y,z)} = \begin{vmatrix} 2x & 2y & 2z \\ y+z & x+z & y+x \\ 1 & 1 & 1 \end{vmatrix} = 0$	1 2 1 4
3.b)	$R_1 \leftrightarrow R_2$ $A \sim \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 1 \end{bmatrix} \Rightarrow A \simeq \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 0 & 1 & -3 & -1 \\ 0 & 1 & -3 & 1 \end{bmatrix} \Rightarrow A \simeq \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & -3 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ $R_3 \to R_3 - 3R_1$, $R_4 \to R_4 - R_1$ $\Rightarrow \rho(A) = 2$.	3 1 4
4a)	$x\frac{\partial u}{\partial x} = \frac{x}{y}\frac{\partial u}{\partial p} - \frac{z}{x}\frac{\partial u}{\partial r}$, $y\frac{\partial u}{\partial y} = \frac{y}{z}\frac{\partial u}{\partial q} - \frac{x}{y}\frac{\partial u}{\partial p}$ $z\frac{\partial u}{\partial z} = \frac{z}{x}\frac{\partial u}{\partial r} - y/z \frac{\partial u}{\partial q}$ $\Rightarrow x\,\cancel{u_x} + yu_y + zu_z = 0$	2 2 4
4 b)	$R_1 \leftrightarrow R_2$ $\begin{bmatrix} 2 & 1 & 3 & 4 \\ 4 & 0 & 2 & 1 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix} \Rightarrow A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 0 & -3 & -4 \\ 0 & 0 & 0 & 1 \end{bmatrix} \Rightarrow \rho(A) = 4$	2+2=4

Nani

Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
SECOND INTERNAL TEST QUESTION PAPER 2022-23 ODD SEMESTER

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E
Branch - Stream : ME-ME
Course Title : Mathematics for ME stream-1
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/BMATM101
Date : 01/03/2023
Max Marks : 20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	Solve $(y^2-x^2)dx+2xydy=0$.	4	CO3	K3
(b)	Solve $\frac{dy}{dx}+\frac{y}{x}=y^2x$	4	CO3	K3
(c)	Make use of the differentiation find the orthogonal trajectory of the curve $r=a(1+\cos\theta)$	4	CO3	K3
	OR			
2(a)	Solve $(x^2+y^2+x)dx+xydy=0$	4	CO3	K3
(b)	Solve $[y\left(1+\frac{1}{x}\right)+cosy]dx+(x+log\ x-xsiny)dy=0$	4	CO3	K3
(c)	Make use of differential equation prove that $y^2=4a(x+a)$ is self orthogonal.	4	CO3	K3
	PART –B			
3(a)	Make use of $u=\frac{yz}{x}, v=\frac{zx}{y}, w=\frac{xy}{z}$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$	4	CO2	K3
(b)	Make use of row operation find the rank of the matrix $\begin{pmatrix}4&0&2&1\\2&1&3&4\\2&3&4&7\\2&3&1&4\end{pmatrix}$	4	CO4	K3
	OR			
4(a)	Utilize the first order derivative find the extreme values of the function $f(x,y)=x^3+3xy^2-3y^2-3x^2+4$	4	CO2	K3
(b)	Make use of row operation find the rank of the matrix $\begin{pmatrix}0&1&-3&-1\\1&0&1&1\\3&1&0&2\\1&1&-2&0\end{pmatrix}$	4	CO4	K3

Lakshmi

Name & Signature of Course In charge:

(Lakshmi. C)

Name & Signature of Module Coordinator:

(Dr. Venkataraman RS)

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Kumar

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Selected.

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 ODD SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ME- ME
Course Title : Mathematics
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/ BMATM101
Date : 01/03/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
1.a)	$\frac{\partial M}{\partial y} = 2y = \frac{\partial N}{\partial x}$, eqn is exact. $\therefore$ Solution is $\int M\,dx + \int N\,dy = c$ $\Rightarrow xy^2 - \frac{x^3}{3} = C$.	2 2 4
1.b)	$\frac{dy}{dx} + y/x = y^2 x \Rightarrow \div y^2$ on BS $\frac{1}{y^2}\,dy/dx + \frac{1}{yx} = x$ → ① put $1/y = t \Rightarrow -1/y^2 \frac{dy}{dt} = \frac{dt}{dx}$ $\Rightarrow \frac{dt}{dx} - t \cdot 1/x = -x$, & IF $= 1/x$ $\therefore$ Soln is $\frac{1}{xy} = -x + c$	1 1 2 4
1.c)	$\log r = \log a + \log(1+\cos\theta)$, Replace $\frac{dr}{d\theta}$ by $\left(-r^2 \frac{d\theta}{dr}\right)$ $\Rightarrow \frac{1}{r}\frac{dr}{d\theta} = -\frac{\sin\theta}{1+\cos\theta}$. $\int \frac{dr}{r} = \int \cot\theta/2\,d\theta \Rightarrow r = b\left(\frac{1-\cos\theta}{2}\right)$ is the required OT.	2 2 4
2.a)	$\frac{\partial m}{\partial y} = 2y \neq \frac{\partial N}{\partial x} = y$. $\frac{\partial m}{\partial y} - \frac{\partial N}{\partial x} = y$, near to N. $\therefore \frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) = \frac{y}{xy} = 1/x = f(x)$ & IF $= x$ $\therefore$ Given eqn becomes $M = x^3 + xy^2 + x^2$, $N = x^2 y$ solution is $\frac{x^4}{4} + \frac{x^2y^2}{2} + \frac{x^3}{3} = c$ //	1 1 2 4
2 b)	$\frac{\partial M}{\partial y} = 1 + 1/x - \sin y = \frac{\partial N}{\partial x}$, eqn is exact. $\therefore$ solution is $y(x + \log x) + x\cos y = C$ //	2 2 4

Q.NO.	POINTS	MARKS
2.c)	$y^2 = 4a(x+a) \to ①$ Diff wrt x, $y\frac{dy}{dx} = 4a(1)$ $\Rightarrow a = y/2\, dy/dx \to ②$, use ② in ① ① $\Rightarrow y = 2x\, dy/dx + y\,(dy/dx)^2 \to ③$, is the DE of given curve. Replace dy/dx by $(-dx/dy)$ $\Rightarrow y = y(dy/dx)^2 + 2x\, dy/dx \to ④$, is the DE of required OT. $\therefore$ ③ & ④ same, given curve is self orthogonal.	1 1 1 1 1 4
3.a)	$J = \frac{\partial(u,v,w)}{\partial(x,y,z)} = \begin{vmatrix} -\frac{yz}{x^2} & z/x & y/x \\ z/y & -\frac{zx}{y^2} & x/y \\ y/z & x/z & -xy/z^2 \end{vmatrix} = 4.$	2 2 4
3.b)	$R_1 \leftrightarrow R_2 \Rightarrow A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 4 & 0 & 2 & 1 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix} \xrightarrow{R_2-2R_1,\ R_3-R_1,\ R_4-R_1} A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 2 & 1 & 3 \\ 0 & 2 & -2 & 0 \end{bmatrix}$ $\Rightarrow A \simeq \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & -2 & -4 & -7 \\ 0 & 0 & -3 & -4 \\ 0 & 0 & 0 & 1 \end{bmatrix} \Rightarrow \rho(A) = 4.$	3 1 4
4a)	$f_x = 3x^2 + 3y^2 - 6x$, $f_y = 6xy - 6y$ critical points are $(0,0)$, $(2,0)$, $(1,1)$, $(1,-1)$ $A = 6x-6$, $B = 6y$, $C = 6x-6$, at $(0,0)$, $A = -6$, $B = 0$, $C = -6$, $AC - B^2 = 36$, maximum. at $(2,1)$, $A = 6$, $B = 0$, $C = 6$, $AC - B^2 = 36$, minimum at $(1,1)$ & $(1,-1)$ saddle point, $f_{min} = 0$, $f_{max} = 4$.	1 1 2 4
4b)	$\rho(A) = 2$	2+2=4

Lakshmi C
Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

THIRD INTERNAL TEST QUESTION PAPER 2022-23ODDSEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree	:	B.E	**Semester**	:	I
Branch - Stream	:	ME - ME	**Course Type / Code**	:	Integrated/BMATM101
Course Title	:	Mathematics for ME stream-1	**Date**	:	27/03/2023
Duration	:	60 Minutes	**Max Marks**	:	20

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Solve** $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$	4	CO5	K3
(b)	**Solve** $(6D^2 + 17D + 12)y = e^{-x}$	4	CO5	K3
(c)	**Solve** $x\frac{d^2y}{dx^2} - \frac{2y}{x} = x + \frac{1}{x^2}$	4	CO5	K3
	OR			
2(a)	**Solve**$(D^2 + D + 1)y = x^2 + 1$	4	CO5	K3
(b)	**Solve** $(D^3 - 1)y = 3cos2x$	4	CO5	K3
(c)	**Solve** by the method of variation of parameter $\frac{d^2y}{dx^2} + y = secx$	4	CO5	K3
	PART –B			
3(a)	**Utilise** the Gauss-Seidel iteration method, solve the system of equations $20x + y - 2z = 17, 3x + 20y - z = -18, 2x - 3y + 20z = 25$	4	CO4	K3
(b)	**Utilise** Rayleigh's power method, find the largest eigen value and corresponding eigen vector of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking the initial eigen vector as$[1,1,1]'$	4	CO4	K3
	OR			
4(a)	**Identify** the value of λ *and* μ such that the system of equations $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$, may have a) Unique solution b) Infinite solution c) No solution	4	CO4	K3
(b)	**Solve** the system of equations by Gauss –Jordan method $x + y + z = 10, 2x - y + 3z = 19, x + 2y + 3z = 22.$	4	CO4	K3

Name & Signature of Course In charge:

Naveen. V

Name & Signature of Module Coordinator

(Dr VENKATARAMANA DS)

HOD AS&H

Principal

Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 ODD SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ME-ME
Course Title : Mathematics for ME stream-1
Duration : 60 Minutes

Semester : I
Course Type / Code : Integrated/BMATM101
Date : 27/03/2023
Max Marks : 20

Q.NO.	POINTS	MARKS
	Part – A	
1a)	A.E $4m^4-4m^3-23m^2+12m+36=0$ $\Big\} \longrightarrow$ roots are $2, 2, -3/2, -3/2$ $\longrightarrow$ $y=[c_1+c_2x]e^{2x}+[c_3+c_4x)e^{-3/2x}$	$\boxed{2m}$ $\boxed{2m}$
b)	A.E $6m^2+17m+12=0$ $m=-4/3, -3/2$ $\Big\} \longrightarrow$ $y_c=c_1e^{-4/3x}+c_2e^{-3/2x}$ $\longrightarrow$ $y_p=e^{-x}$, $y=y_c+y_p$	$\boxed{2m}$ $\boxed{2m}$
c)	$xy''-\frac{2y}{x}=x+\frac{1}{x^2}$ $\times^{ly}$ x, $x^2y''-2y=x^2+\frac{1}{x}$ put $t=\log x$ or $e^t=x$, $(D^2-D-2)y=e^{2t}+e^{-t}$ $\Big\} \longrightarrow$ $m=2,-1$ $y_c=c_1e^{2t}+c_2e^{-t}$ $y_p=\frac{te^{2t}}{3}-\frac{te^{-t}}{3}$ $\Big\} \longrightarrow$ $\therefore y=c_1x^2+\frac{c_2}{x}+\frac{\log x}{3}[x^2-1/x)$	$\boxed{2m}$ $\boxed{2m}$
	$\boxed{OR}$	
2a)	A.E $m^2+m+1=0$ $m=-1/2+i\sqrt{3}/2$ $y_c=e^{-1/2x}[c_1\cos(\sqrt{3}/2)x+c_2\sin(\sqrt{3}/2)x]$	
b)	A.E $m^3-1=0$, $m=1, -1/2+\sqrt{3}/2i$ $\Big\} \longrightarrow$ $y_c=e^{-x/2}[c_1\cos(\sqrt{3}/2)x+c_2\sin(\sqrt{3}/2)x)$ $y_p=x^2-2x+1$, $y=y_c+y_p$ $\longrightarrow$	$\boxed{2m}$ $\boxed{2m}$

Q.NO.	POINTS	MARKS
c)	$m = \pm i$ $y_c = c_1\cos x + c_2\sin x$, $y = Ay_1 + By_2$ $y_1 = \cos x$, $y_2 = \sin x$, $y_1' = -\sin x$, $y_2' = \cos x$ $\rightarrow$	1m
	$W = 1$, $A = -\int \frac{y_2\,\phi(x)}{W}\,dx + k_1 = \log(\cos x) + k_1$ $\rightarrow$	1m
	$\rightarrow$	1m
	$B = \int \frac{y_1\,\phi(x)}{W}\,dx + k_2 = x + k_2$ $y = Ay_1 + By_2 = [\log(\cos x) + k_1]\cos x + [x + k_2]\sin x$ $\rightarrow$	1m
	Part - B	
	$z^{(1)} = 1.0108$ $\rightarrow$	2m
3a)	1st iteration; $x^{(1)} = 0.8$, $y^{(1)} = 1.0275$, $z^{(2)} = 0.9997$ 2nd iteration; $x^{(2)} = 1.0024$, $y^{(2)} = -0.9998$, $z^{(3)} = 1.00001$ $\rightarrow$	2m
	3rd iteration; $x^{(3)} = 0.9999$ $y^{(3)} = -1.0003$,	
b)	1st iteration; $AX^{(0)} = 6\begin{bmatrix}1\\0\\0.66\end{bmatrix}$ 2nd iteration; $AX^{(1)} = 7.32\begin{bmatrix}1\\-0.36\\0.54\end{bmatrix}$ $\rightarrow$	2m
	3rd iteration; $AX^{(2)} = 7.8\begin{bmatrix}1\\-0.46\\0.50\end{bmatrix}$ 4th iteration; $AX^{(3)} = 7.96\begin{bmatrix}1\\-0.49\\0.5\end{bmatrix}$ $\rightarrow$	1m
		1m
	5th iteration; $AX^{(4)} = 7.98\begin{bmatrix}1\\\cancel{2}0.49\\0.5\end{bmatrix}$ 6th iteration; $AX^{(5)} = 8\begin{bmatrix}1.0\\-0.5\\0.5\end{bmatrix}$ $\rightarrow$	
4a)	$[A:B] \sim \begin{bmatrix}1 & 1 & 1 & : & 6\\0 & 1 & 2 & : & 4\\0 & 0 & \lambda-3 & : & \mu-10\end{bmatrix}$ $\rightarrow$	1m
	a) unique Sol^n; $\lambda - 3 \neq 0$, $\mu - 10 \neq 0$ $\rho(A) = \rho(A:B) = 3$ $\rightarrow$	1m
	b) Infinite Sol^n; $\rho(A) = \rho(A:B) = 2$, $\lambda - 3 = 0$ & $\mu - 10 = 0$ $\rightarrow$	1m
	c) No Sol^n; $\underset{2 \neq 3}{\rho(A) \neq \rho(A:B)}$, $\lambda - 3 = 0$, $\mu - 10 \neq 0$ $\rightarrow$	1m
b)	$[A:B] \sim \begin{bmatrix}9 & 0 & 0 & : & 43\\0 & -9 & 0 & : & -14\\0 & 0 & -3 & : & -11\end{bmatrix}$ $\rightarrow$	2m
	$x = \frac{43}{9}$, $y = \frac{14}{9}$, $z = \frac{11}{3}$ $\rightarrow$	2m

Course Incharge **Module Coordinator** **HOD**

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
THIRD INTERNAL TEST QUESTION PAPER 2022-23ODDSEMESTER

SET: B

USN

Degree : **B.E**
Branch - Stream : **ME - ME**
Course Title : **Mathematics for ME stream-1**
Duration : **60 Minutes**

Semester : **I**
Course Type Code : **Integrated/BMATM101**
Date : **27/03/2023**
Max Marks : **20**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Solve** $(D^3-6D^2+11D-6)y=e^{2x}$	4	CO5	K3
(b)	**Solve** $(D^3+2D^2+D)y=sin2x$	4	CO5	K3
(c)	**Solve** $(1+x^2)y''+(1+x)y'+y=sin2log(1+x)$	4	CO5	K3
	OR			
2(a)	**Solve**$(D^3+D^2-4D-4)y=0$	4	CO5	K3
(b)	**Solve** $(D^3+D^2+4D+4)y=x^2-4x-6$	4	CO5	K3
(c)	**Solve** by the method of variation of parameter $\frac{d^2y}{dx^2}+y=secxtanx.$	4	CO5	K3
	PART –B			
3(a)	**Utilise** the Gauss-Seidel iteration method, solve the system of equations $83x+11y-4z=9,3x+8y+29z=71,7x+52y+13z=104$. Carryout 4 iterations.	4	CO4	K3
(b)	**Utilise** Rayleigh's power method, find the largest eigen value and corresponding eigen vector of the matrix $\begin{bmatrix}25 & 1 & 2\\ 1 & 3 & 0\\ 2 & 0 & -4\end{bmatrix}$ by taking the initial eigen vector as$[1,0,0]'$	4	CO4	K3
	OR			
4(a)	**Make use of** row operations, test for consistency to the system of equations $x-4y+7z=14,3x+8y-2z=13,7x-8y+26z=5.$	4	CO4	K3
(b)	**Solve** the system of equations by Gauss –elimination method $3x+y+2z=3,2x-3y-z=-3,x+2y+z=4.$	4	CO4	K3

Mamatha

Name & Signature of Course In charge:
Mamatha. N

Name & Signature of Module Coordinator
(Dr. VENKATARAMANA BS)

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Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 ODD SEMESTER

SET B

SCHEME AND SOLUTION

Degree : **B.E**
Branch - Stream : **ME-ME**
Course Title : **Mathematics for ME stream-1**
Duration : **60 Minutes**

Semester : **I**
Course Type / Code : **Integrated/BMATM101**
Date : **27/03/2023**
Max Marks : **20**

Q.NO.	POINTS	MARKS
	Part - A	
1a)	A.E $m^3-6m^2+11m-6=0$ $m=1,2,3$	2m
	$y_c=c_1e^{x}+c_2e^{2x}+c_3e^{3x}$ $y_p=-xe^{2x}$ $\therefore y=y_c+y_p=c_1e^{x}+c_2e^{2x}+c_3e^{3x}-xe^{2x}$	2m
b)	$(D^3+2D^2+D)y=\sin 2x$, A.E $m^3+2m^2+m=0$ $m=-1,\pm i$	2m
	$y_c=c_1e^{-x}+[c_2\cos x+c_3\sin x]$ $y_p=\frac{\cos 2x}{14}$ $y=y_c+y_p$	1+1m
c)	put $t=\log(1+x)$ or $e^{t}=1+x$ $y_c=c_1\cos t+c_2\sin$	2m
	$(D^2+1)y=\sin 2t \Rightarrow m=\pm i$	1m
	$y_p=-\frac{\sin 2t}{3}$ $y=y_c+y_p=c_1\cos[\log(1+x)]+c_2\sin[\log(1+x))-\frac{\sin 2[\log(1+x))}{3}$	1m
	$\boxed{\text{OR}}$	
2a)	A.E $m^3+m^2-4m-4=0$	3m
	$m=-1,-2,2$ $y_c=c_1e^{-x}+c_2e^{-2x}+c_3e^{2x}$	1m
b)	A.E $m^3+m^2+4m+4=0$ $m=-1,\pm 2i$ $y_c=c_1e^{-x}+(c_2\cos 2x+c_3\sin 2x)$	2m
	$y_p=x^2/4-6/4x-25/8$ $y=y_c+y_p=$	1+1 m

Q.NO.	POINTS	MARKS
c)	A.E $m^2+1=0$ $m=\pm i$ $y=c_1\cos x+c_2\sin x$ $y=A\cos x+B\sin x$	1m
	$A'=-\int\frac{y_2\phi(x)}{W}dx=1-\sec^2 x$ $B'=\int\frac{y_1\phi(x)}{W}dx=\tan x$ $A=x-\tan x+k_1$ $B=\log(\sec x)+k_2$	2m
	$y=k_1\cos x+k_2\sin x+x\cos x+\sin x\log(\sec x)$	1m
	Part-B	
3a)	Rearrange the system of eq^n $y^{(1)}=1.9854$ $z^{(1)}=1.8893$	1m
	1st iteration: $x^{(1)}=0.1084$ $z^{(2)}=2.0310$	1m
	2nd iteration; $x^{(2)}=-0.0636$ $y^{(2)}=1.5362$ $z^{(3)}=$	1m
	3rd iteration $x^{(3)}=0.0027$ $y^{(3)}=1.4918$ $z^{(4)}=$	1m
	4th iteration; $x^{(4)}=$ $y^{(4)}=$	
b)	1st iteration: $Ax^{(0)}=25\begin{pmatrix}1\\0.04\\0.08\end{pmatrix}$ 2nd $Ax^{(1)}=25.2\begin{pmatrix}1\\0.044\\0.066\end{pmatrix}$	3m
	3rd iteration: $Ax^{(2)}=25.16\begin{pmatrix}1\\0.04\\0.066\end{pmatrix}$	1m
	OR	
4a)	$[A:B]\sim\left[\begin{array}{ccc:c}1&-4&7&14\\0&20&-23&-29\\0&0&0&64\end{array}\right]$ $\rho(A)=2$, $\rho(A:B)=3$ $\rho(A)\neq\rho(A:B)$ The system is inconsistent	2+2M
b)	$[A:B]\sim\left[\begin{array}{ccc:c}3&1&2&3\\0&11&7&15\\0&0&1&-1\end{array}\right]$	2m
	$x=1$, $y=2$, $z=-1$	2m

Mamatha.L
Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

FIRST INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

USN

SET: A

Degree :	**B.E**	**Semester** :	**II**
Branch - Stream :	**ME - ME**	**Course Type / Code** :	**Integrated/BMATM201**
Course Title :	**Mathematics – II for ME stream**	**Date** :	**26/06/2023**
Duration :	**60 Minutes**	**Max Marks** :	**25**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

<table>
<tr><th>Q No.</th><th>Questions</th><th>Marks</th><th>CO</th><th>K-Level</th></tr>
<tr><td colspan="5">PART-A</td></tr>
<tr><td>1(a)</td><td>Make use of Regula falsi method, find the real root of the equation $\cos x = 3x - 1$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Newton forward interpolation formulae to find the values of f(38)
<table>
<tr><td>x</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td><td>90</td></tr>
<tr><td>f(x)</td><td>184</td><td>204</td><td>226</td><td>250</td><td>276</td><td>304</td></tr>
</table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's $\frac{3}{8}$th rule to solve $\int_{4}^{5.2} \log_e x$ dividing the interval into six equal parts.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>2(a)</td><td>Apply Newton - Raphson method, find a real root of the equation $x\sin x + \cos x = 0$ which lies near $x = \pi$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Lagrange's formula, find the value of y at x=10 from the following data
<table>
<tr><td>x</td><td>5</td><td>6</td><td>9</td><td>11</td></tr>
<tr><td>f(x)</td><td>12</td><td>13</td><td>14</td><td>16</td></tr>
</table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's $\frac{1}{3}$ rd rule to solve $\int_{0}^{6} 3x^2 dx$ dividing the interval into six equal parts.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">PART –B</td></tr>
<tr><td>3(a)</td><td>Make use of Taylor's series method to obtain the solution of $\frac{dy}{dx} = 2y + 3e^x$ y(0) = 0 at y (0.2).</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of modified Euler's method, Solve the initial value problem $\frac{dy}{dx} = 1 + \frac{y}{x}$, $y(1) = 2$.and find y(1.2) by taking h=0.2</td><td>5</td><td>CO2</td><td>K3</td></tr>
</table>

	OR			
4(a)	**Employ** Euler's modified method to find y(1.4) given $\frac{dy}{dx}=\log(x+y)$ y(1) = 2.	**5**	**CO2**	**K3**
(b)	**Make use of** Taylor's series method to solve $\frac{dy}{dx}=x-y^2$, $y(0)=1$, find y (0.1).	**5**	**CO2**	**K3**

Mamatha

Name & Signature of Course In charge:

Mamatha.N

Name & Signature of Module Coordinator:

D. VenkataramanBS

HOD

Principal

Selected.

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
FIRST INTERNAL TEST 2022 – 23 EVEN SEMESTER

SET- A

SCHEME AND SOLUTION

Degree	:B.E	**Semester**	: II
Branch - stream	: ME - ME	**Course Type / Code**	:Integrated/BMATM201
Course Title	:Mathematics for ME Stream-2	**Max Marks**	: 25

Q.NO.	PART-A POINTS	MARKS
1a)	$f(x) = \cos x + 1 - 3x$	
	root lies in $(0,1)$	
	$f(0.6) = 0.0253 > 0$ $f(0.7) = -0.3352 < 0$	$\boxed{1m}$
	$\therefore$ The root lies in $(0.6, 0.7)$	
	$\underline{1^{st}\text{ iteration}}$; $x_1 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.607$	$\boxed{2m}$
	$\underline{2^{nd}\text{ iteration}}$; $f(0.607) = 0.00036 > 0$	
	the root lies in $(0.607, 0.7)$	
	$x_2 = 0.607$ $\therefore$ The real root correct to 3 decimals is 0.607	$\boxed{2m}$
		5M
b)	$\Delta y_0 = 20$, $\Delta y_1 = 22$, $\Delta y_2 = 24$, $\Delta y_3 = 26$, $\Delta y_4 = 28$	
	$\Delta^2 y_0 = 2$, $\Delta^2 y_1 = 2$, $\Delta^2 y_2 = 2$, $\Delta^2 y_3 = 2$	$\boxed{3m}$
	$\Delta^3 y_0 = 0$, $\Delta^3 y_1 = 0$, $\Delta^3 y_2 = 0$	
	$y_r = y_0 + r\Delta y_0 + \frac{r(r-1)}{2!}\Delta^2 y_0 + \cdots$, $r = \frac{x - x_0}{h} = -0.2$	$\boxed{1M}$
		$\boxed{1m}$
	$f(38) = 180.24$	5M
c)	$h = 0.2$ $n = 6$	$\boxed{3m}$

x	4	4.2	4.4	4.6	4.8	5.0	5.2
y	1.3863	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

Q.NO.	PART-A POINTS	MARKS
	$I = \frac{3h}{8}[(y_0 + y_6) + 3(y_1 + y_2 + y_4 + y_5) + 2(y_3)] = 1.8279$	$\boxed{2m}$
		5M
	$\boxed{OR}$	
2a)	$f(x) = x\sin x + \cos x$; The root lies in $(-3, -2)$	
	Let $x_0 = \pi$; 1^{st} iteration; $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 2.8232$	$\boxed{2m}$
	$\underline{2^{nd}\text{ iteration}}$; $x_2 = 2.7987$, $\underline{3^{rd}\text{ iteration}}$; $x_3 = 2.7984$	
	$\underline{4^{th}\text{ iteration}}$; $x_4 = 2.7982$, $\underline{5^{th}\text{ iteration}}$; $x_5 = 2.7983$	$\boxed{3M}$
		5M

2b) $y = f(x) = \frac{(x-x_1)(x-x_2)(x-x_3)}{(x_0-x_1)(x_0-x_2)(x_0-x_3)}y_0 + \frac{(x-x_2)(x-x_2)(x-x_3)}{(x_1-x_0)(x_1-x_2)(x_1-x_3)}y_1 +$

$\frac{(x-x_0)(x-x_1)(x-x_3)}{(x_2-x_0)(x_2-x_1)(x_2-x_3)}y_2 + \frac{(x-x_0)(x-x_1)(x-x_2)}{(x_3-x_0)(x_3-x_1)(x_3-x_2)}y_3$ $\rightarrow$ $\boxed{2M}$

$\langle y = f(10) = 14.67 \rangle$ $\rightarrow$ $\boxed{3M}$

5M

2c) $h = 1$, $n = 6$ $\rightarrow$ $\boxed{3M}$

x	0	1	2	3	4	5	6
y	0	3	12	27	48	75	108

$I = \frac{h}{3}[(y_0+y_6)+4(y_1+y_3+y_5)+2(y_2+y_4)] = 216$ $\rightarrow$ $\boxed{1+1M}$

5M

Part-B

3a) $y(x) = y(x_0) + (x-x_0)y'(x_0) + \frac{(x-x_0)^2}{2!}y''(x_0) + \frac{(x-x_0)^3}{3!}y'''(x_0) + \cdots$ $\rightarrow$ $\boxed{1M}$

$y' = 2y + 3e^x \Rightarrow y'(0) = 3$, $y''' = 2y'' + 3e^x \Rightarrow y'''(0) = 21$

$y'' = 2y' + 3e^x \Rightarrow y''(0) = 9$ $y^{iv} = 2y''' + 3e^x \Rightarrow y^{iv}(0) = 45$ $\rightarrow$ $\boxed{3M}$

$y(x) = 3x + \frac{x^2}{2}(9) + \frac{x^3}{6}(21) + \frac{x^4}{24}(45)$ $\rightarrow$ $\boxed{1M}$

$\langle y(0.2) = 0.811 \rangle$ $\rightarrow$ $\boxed{1M}$

5M

3b) $f(x,y) = 1 + y/x$, $x_0 = 1$, $y_0 = 2$, $h = 0.2$ $\rightarrow$ $\boxed{2M}$

$y_1^{(0)} = y_0 + hf[x_0, y_0] = 2.6$

$y_1^{(1)} = y_0 + h/2[f(x_0,y_0) + f(x_1, y_1^{(0)})] = 2.6167$

$y_1^{(2)} = y_0 + h/2[f(x_0,y_0) + f(x_1, y_1^{(1)})] = 2.6181$

$y_1^{(3)} = y_0 + h/2[f(x_0,y_0) + f(x_1, y_1^{(2)})] = 2.6182$ $\rightarrow$ $\boxed{3M}$

5M

$\boxed{OR}$

4a) $f(x,y) = \log(x+y)$, $x_0 = 1$, $y_0 = 2$. Take $h = 0.4$ $\rightarrow$ $\boxed{2M}$

$y_1^{(0)} = 2.4394$

$y_1^{(1)} = 2.48878$

$y_1^{(2)} = 2.4913$

$y_1^{(3)} = 2.4914$ $\rightarrow$ $\boxed{3M}$

5M

4b) $y(x) = y(x_0) + (x-x_0)y'(x_0) + \frac{(x-x_0)^2}{2!}y''(x_0) + \cdots$. Given $x_0 = 0$, $y_0 = 1$ $\rightarrow$ $\boxed{1M}$

$y' = x - y^2 \Rightarrow y'(0) = -1$

$y'' = 1 - 2yy' \Rightarrow y''(0) = 3$

$y''' = 0 - 2[yy'' + (y')^2] \Rightarrow y'''(0) = -8$

$y^{iv} = 0 - 2[yy''' + y'y'' + 2y'y''] \Rightarrow y^{iv}(0) = \underline{-17}$ $\rightarrow$ $\boxed{3M}$

$y(x) = 1 - x + 3x^2/2 - \frac{4x^3}{3} - \frac{17x^4}{24}$ $\rightarrow$ $\boxed{1M}$

$y(0.1) = 0.9138$

5M

Mamatha

Course In-charge

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

SET: B

USN			
Degree	B.E	**Semester**	II
Branch - Stream	ME - ME	**Course Type / Code**	Integrated/BMATM201
Course Title	Mathematics – II for ME stream	**Date**	26/06/2023
Duration	60 Minutes	**Max Marks**	25

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

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<tr><td>(b)</td><td>Apply Newton's interpolation formula, to find y(1.4) using following data
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<tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Y</td><td>10</td><td>26</td><td>58</td><td>112</td><td>194</td></tr>
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<tr><td>(c)</td><td>Apply Simpson's 3/8th rule to evaluate $\int_0^{\frac{\pi}{2}} e^{\sin x} dx$ by taking 7 ordinates.</td><td>5</td><td>CO1</td><td>K3</td></tr>
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<tr><td>2(a)</td><td>Make use of Newton - Raphson method, find a real root of the equation $x \sin x + \cos x = 0$ which lies near $x = \pi$</td><td>5</td><td>CO1</td><td>K3</td></tr>
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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

FIRST INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E

Branch - Stream : ME - ME

Course Title : Mathematics – II for ME stream

Duration : 60 Minutes

Semester : II

Course Type / Code : Integrated/BMATM201

Date : 26/06/2023

Max Marks : 25

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

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<tr><td>3(a)</td><td>Make use of Taylor's series method to obtain the solution of $\frac{dy}{dx} = x + y^2, y(0) = 1$ at y (0.1).</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of modified Euler's method, solve $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$ at x = 0.1 by taking h=0.1</td><td>5</td><td>CO2</td><td>K3</td></tr>
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	OR			
4(a)	**Make use of** modified Euler's method, solve $\frac{dy}{dx} = 3x + \frac{y}{2}, y(0) = 1$ at x = 0.2 by taking h=0.2	**5**	**CO2**	**K3**
(b)	**Make use of** Taylor's series method to solve $\frac{dy}{dx} = xy - 1$ at x = 0.1 y(0) = 2.	**5**	**CO2**	**K3**

Name & Signature of
Course In charge
Sowmya Rani.C

Name & Signature of
Module Coordinator
Dr. Venkataramana B S

HOD

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
FIRST INTERNAL TEST 2022 – 23 EVEN SEMESTER

SET- B

SCHEME AND SOLUTION

Degree :B.E
Branch - stream : ME-ME
Course Title :Mathematics for MEStream-2
Semester : II
Course Type / Code :Integrated/ BMATM201
Max Marks : 25

<table>
<tr><th>Q.NO.</th><th>POINTS</th><th>MARKS</th></tr>
<tr><td>1a)</td><td>$f(x) = xe^{x} - \cos x$
The root lie in $(0.5, 0.6)$, $f(0.5) = -0.0532 < 0$
$f(0.6) = 0.2679 > 0$
1st iteration; $x_1 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.5165$
2nd iteration; $x_2 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.5176$ 3rd iteration $x_3 = 0.5177$</td><td>1M
2M
2M
5M</td></tr>
<tr><td>b)</td><td>$\Delta y_0 = 16,\ \Delta y_1 = 32,\ \Delta y_2 = 54,\ \Delta y_3 = 82$
$\Delta^2 y_0 = 16,\ \Delta^2 y_1 = 22,\ \Delta^2 y_2 = 28$
$\Delta^3 y_0 = 6,\ \Delta^3 y_1 = 6,\ \Delta^4 y_0 = 0$
$y_x = y_0 + r\Delta y_0 + \frac{r(r-1)}{2!}\Delta^2 y_0 + \frac{r(r-1)(r-2)}{3!}\Delta^3 y_0 + \dots$ $r = 0.4$
$y(1.4) = 14.864$</td><td>3M
1M
1M
5M</td></tr>
<tr><td>c)</td><td>$h = \pi/12$, $n = 6$
<table>
<tr><td>x</td><td>0</td><td>15°</td><td>30°</td><td>45°</td><td>60°</td><td>75°</td><td>90°</td></tr>
<tr><td>y</td><td>1</td><td>1.2953</td><td>[illegible]</td><td>2.0281</td><td>2.3774</td><td>2.6272</td><td>2.71828</td></tr>
</table>
$I = \frac{3h}{8}[(y_0 + y_6) + 3(y_1 + y_2 + y_4 + y_5) + 2(y_3)] = 3.1043$

OR</td><td>3M
1+1M
5M</td></tr>
<tr><td>2a)</td><td>$f(x) = x\sin x + \cos x$ Let $x_0 = \pi$
The root lie in $(-3, -2)$
1st iteration; $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 2.8232$
2nd iteration; $x_2 = 2.7987$
3rd iteration; $x_3 = 2.7984$
4th iteration; $x_4 = 2.7982$
5th iteration; $x_5 = 2.7983$</td><td>1M
1M
1M
1M
1M
5M</td></tr>
</table>

2b) $f(x_0, x_1) = 121$ $f(x_1, x_2) = 265$ $f(x_2, x_3) = 457$ $f(x_3, x_4) = 709$

$f(x_0, x_1, x_2) = 24$ $f(x_1, x_2, x_3) = 32$ $f(x_2, x_3, x_4) = 42$ $\Big] \rightarrow$ $\boxed{3M}$

$f(x_0, x_1, x_2, x_3) = 1$ $f(x_1, x_2, x_3, x_4) = 1$

$f(x) = f(x_0) + (x - x_0) f(x_0, x_1) + (x - x_0)(x - x_1) f(x_0, x_1, x_2) + \cdots\cdots \rightarrow$ $\boxed{1M}$

$f(9) = 810 \longrightarrow$ $\boxed{1M}$

5M

2c) $h = 1/6,\ n = 6$

x	0	1/6	1/3	1/2	2/3	5/6	1
y	0	6/37	3/10	2/5	6/13	30/61	1/2

$\longrightarrow$ $\boxed{3M}$

$I = \frac{h}{3}\left[(y_0 + y_6) + 4(y_1 + y_3 + y_5) + 2(y_2 + y_4)\right] = 0.3466 \longrightarrow$ $\boxed{1+1M}$

5M

PART-B

3a) $y(x) = y(x_0) + (x - x_0) y'(x_0) + \frac{(x - x_0)^2}{2!} y''(x_0) + \cdots \longrightarrow$ $\boxed{1M}$

$y' = x + y^2 \Rightarrow y'(0) = 1$ $y''' = 2[y y'' + (y')^2] \Rightarrow y'''(0) = 8$

$y'' = 1 + 2y y' \Rightarrow y''(0) = 3$ $y^{iv} = 2[y y''' + y' y'' + 2 y' y''] = 34$ $\Big\} \rightarrow$ $\boxed{3M}$

$y(x) = 1 + x + \frac{3}{2} x^2 + \frac{4}{3} x^3$

$y(0.1) = 1.1163$ $\Big] \longrightarrow$ $\boxed{1M}$

5M

3b) $f(x, y) = (x^2 + y^2),\ x_0 = 0,\ y_0 = 1\ h = 0.1$ $\Big] \longrightarrow$ $\boxed{2M}$

$y_1^{(0)} = y_0 + h f[x_0, y_0] = 1.1$

$y_1^{(1)} = y_0 + h/2 [f(x_0, y_0) + f(x_1, y_1^{(0)})] = 1.111$

$y_1^{(2)} = 1.1122$, $y_1^{(3)} = 1.1123$ $\therefore y(0.1) = 1.1123$ $\Big] \longrightarrow$ $\boxed{3M}$

5M

$\boxed{OR}$

4a) $f(x, y) = 3x + \frac{y}{2},\ x_0 = 0,\ y_0 = 1\ h = 0.2$

$y_1^{(0)} = 1.15$ $y_1^{(1)} = 1.1671$ $y_1^{(2)} = 1.1675$ $y_1^{(3)} = 1.1676$ $\Big] \longrightarrow$ $\boxed{2+3M}$

5M

$\therefore y(0.2) = 1.1676$

4b) $y(x) = y(x_0) + (x - x_0) y'(x_0) + \frac{(x - x_0)^2}{2!} y''(x_0) + \cdots \longrightarrow$ $\boxed{1M}$

$y' = xy - 1 \Rightarrow y'(0) = -1$ $y''' = x y'' + (1) y' + y' \Rightarrow y'''(0) = -2$

$y'' = x y' + (1) y - 0 \Rightarrow y''(0) = 2$ $y^{iv} = x y''' + (1) y'' + 2 y'' \Rightarrow y^{iv}(0) = 6$ $\Big] \rightarrow$ $\boxed{3M}$

$y(x) = 2 - x + x^2 - x^3/3 + x^4/4$

$y(0.1) = 1.9096$ $\Big] \longrightarrow$ $\boxed{1M}$

5M

Mamatha

Course In-charge

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

SECOND INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

USN ☐☐☐☐☐☐☐☐☐☐

SET: A

Degree : B.E
Branch - Stream : ME - ME
Course Title : Mathematics – II for ME stream
Duration : 60 Minutes

Semester : II
Course Type / Code : Integrated/BMATM201
Date : 31/07/2023
Max Marks : 25

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** $\emptyset = xyz$ find the directional derivative at $(1,1,1)$, in the direction of $3\hat{i} + 3\hat{j} + 3\hat{k}$.	5	CO3	K3
(b)	**Make use of** Vector Calculus, Find the constants a, b such that the vector $\vec{F} = (axy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (bxz^2 - y)\hat{k}$ is irrotational and hence find the scalar function $\emptyset$ such that $\vec{F} = \nabla\emptyset$	5	CO3	K3
(c)	**Make use of** Green's theorem, Evaluate $\oint_c (xy + y^2)dx + x^2dy$ where C is the closed curve bounded by $y = x \& y = x^2$.	5	CO3	K3
	OR			
2(a)	**Choose** the appropriate formula and find the angle between the surfaces $xlogz = y^2 - 1$ and $x^2y = 2 - z$ at the points $(1,1,1)$.	5	CO3	K3
(b)	**Make use of** vector Calculus, Show that the vector $\vec{F} = \frac{xi+yj}{x^2+y^2}$ is both solenoidal and irrotational.	5	CO3	K3
(c)	**Make use of** line integral, Evaluate $\int \vec{F}.\overrightarrow{dr}$ where $\vec{F}$= xy i + yz j + zx k and C is the curve represented by $x = t, y = t^2, z = t^3 - 1 \leq t \leq 1$	5	CO3	K3
	PART –B			
3(a)	**Apply** Runge-Kutta method of fourth order to find $y(0.2)$, given that $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$by taking $h = 0.2$	5	CO2	K3
(b)	**Solve** $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x + y + z)\,dydxdz$.	5	CO4	K3
	OR			
4(a)	**Apply** Milne's predictor-corrector method solve $\frac{dy}{dx} = x - y^2$ and the data$y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762$ compute y at $x = 0.8$.	5	CO2	K3
(b)	**Solve** $\int_{0}^{1}\int_{x}^{\sqrt{x}}(x^2 + y^2)dydx$.	5	CO4	K3

Name & Signature of Course In charge:

Saranya Rani.C

Name & Signature of Module Coordinator:

(Dr. Venkataraman BS)

HOD-

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

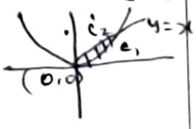
II SESSIONAL TEST 2022-23 EVEN SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ME-ME
Course Title : Mathematics-II for ME stream

Semester : II
Course Type / Code : Integrated/BMATM201
Max Marks : 25

Q.NO.	POINTS	MARKS
1 a)	$\nabla\phi = yz\hat{i} + xz\hat{k} + xy\hat{k}$, $(\nabla\phi)_{(1,1,1)} = \hat{i}+\hat{j}+\hat{k}$ $\nabla\phi\cdot\hat{D} = \frac{\vec{D}}{\lvert\vec{B}\rvert} = \frac{3i+3j+3k}{3\sqrt{3}}$. $\nabla\phi\cdot\hat{D} = \frac{3}{\sqrt{3}} = \sqrt{3}$	$\rightarrow \boxed{2M}$ $\boxed{1+2M}$ 5M
b)	$\nabla\times\vec{F}\ \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ axy+z^3 & 3x^2-z & bxz^2-y \end{vmatrix}$ if $a=6$, $b=3$ $\vec{F}$ is irrotational $\frac{\partial\phi}{\partial x} = 3x^2y + z^2x + f(y,z)$, $\frac{\partial\phi}{\partial y} = 3x^2y - zy + f(x,z)$ $\frac{\partial\phi}{\partial z} = xz^3 - yz + f(x,y)$ $\therefore \phi = 3x^2y - yz + xz^3$	$\rightarrow \boxed{2M}$ $\rightarrow \boxed{3M}$ 5M
c)	$\iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) dx.dy = \iint_R \{2x-(x+2y)\} dx\,dy$  $\int_0^1 (xy-y^2)_{x^2}^{x} \cdot dx = -\left[\frac{x^4}{4} - \frac{x^5}{5}\right]_0^1 = \frac{-1}{20}$	$\boxed{2M}$ $\boxed{2+1M}$ 5,,
2. a.	$\phi = x\log z - y^2+1$, $\nabla\phi = \log z\, i - 2y j + \frac{x}{z}k$, $(\nabla\phi)_{(1,1,1)} = -2j+k$ $\psi = x^2y+z-2$, $\nabla\psi = 2xy i + x^2 j + k$, $(\nabla\psi)_{(1,1,1)} = 2i+j+k$ $\cos\theta = \frac{\vec{a}\ \vec{b}}{\lvert\vec{a}\rvert\lvert\vec{b}\rvert} = \frac{-1}{\sqrt{30}} \Rightarrow \theta = \cos^{-1}(-1/\sqrt{30})$	$\rightarrow \boxed{3M}$ $\rightarrow \boxed{2M}$ 5,,
b.	$\nabla\cdot\vec{F} = \frac{x^2+y^2-2x^2}{(x^2+y^2)^2} + \frac{x^2+y^2-2y^2}{(x^2+y^2)^2} = 0$ $\vec{F}$ is solenoidal $\nabla\times\vec{F} = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ x/x^2+y^2 & y/x^2+y^2 & 0 \end{vmatrix} = 0$ $\therefore$ F is irrotational	$\rightarrow \boxed{2M}$ $\rightarrow \boxed{3M}$ 5M

Q.NO.	POINTS	MARKS
c.	$\vec{F} = xy\hat{i} + yz\hat{j} + zx\hat{k}$. $\vec{F}\cdot d\vec{r} = xy\,dx + yz\,dy + zx\,dz$	$\rightarrow$ 2M
	$\vec{F}\cdot d\vec{r} = (t^3 + 2t^6 + 3t^6)dt = (t^3 + 5t^6)dt$ $\int_c F\,d\vec{r} = \frac{10}{7}$	$\rightarrow$ 3M
3. a.	$k_1 = hf(x_0, y_0) = 0.2$, $k_2 = hf(x_0 + \frac{h}{2}, y_0 + \frac{k_1}{2}] = 0.1666$ $k_3 = 0.1661$, $k_4 = 0.1414$	$\rightarrow$ 4M
	$y(x) = y_0 + \frac{1}{6}[k_1 + 2k_2 + 2k_3 + k_4] = 1.1678$	$\rightarrow$ 1M 5M
b.	$I = \int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz = \int_{-1}^{1}\int_{0}^{z} \left. xy + \frac{y^2}{2} + yz \right]_{x-z}^{x+z} dx\,dz$	$\rightarrow$ 1M
	$I = 0$	$\rightarrow$ 3+1M 5M
	OR	
4a.	$\frac{dy_0}{dx} = x - y^2$ $y_0' = 0$ $y_1' = 0.1996$. $y_2' = 0.3937$ $y_3' = 0.5690$ $y_4^P = y_0 + \frac{4h}{3}[2y_1' - y_2' + 2y_3'] = 0.3049$	$\rightarrow$ 1M
	$y_4^c = y_2 + \frac{h}{3}(y_2' + 4y_3' + y_4') = 0.3046$	$\rightarrow$ 2M
	$y_4^c = 03046$	$\rightarrow$ 2M 5M
b)	$I = \int_0^1\int_x^{\sqrt{x}}(x^2+y^2)\,dy\,dx = \int_0^1 \left. x^2y + \frac{y^3}{3} \right]_x^{\sqrt{x}} dx$	$\rightarrow$ 1M
	$I = \int_0^1 \left\{ \left(x^{5/2} + \frac{x^{3/2}}{3}\right) - \left(x^3 + \frac{x^3}{3}\right) \right\} dx$ $I = 3/35$	$\rightarrow$ 3+1M 5

Course Incharge
Sowmya Rani.c

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

SECOND INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

USN

SET: B

Degree : B.E
Branch - Stream : ME - ME
Course Title : Mathematics – II for ME stream
Duration : 60 Minutes

Semester : II
Course Type / Code : Integrated/BMATM201
Date : 31/07/2023
Max Marks : 25

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

<table>
<tr><th>Q No.</th><th>Questions</th><th>Marks</th><th>CO</th><th>K-Level</th></tr>
<tr><td colspan="5">PART-A</td></tr>
<tr><td>1(a)</td><td>Make use of $\emptyset = x^2yz^3$find the directional derivative of at (1,1,1) in the direction of the vector $\hat{\imath} + \hat{\jmath} + 2\hat{k}$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of Vector Calculus, Find div$\vec{F}$ and curl$\vec{F}$ at (1,2,3) if $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(c)</td><td>Make use of line integral, Evaluate$\int \vec{F}.\vec{dr}$ where $\vec{F}= x^2$ i + xyj from(0,0) to(1,1) along the line $y = x$</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>2(a)</td><td>Choose the appropriate formula, Find the angle between the surfaces $x^2 + y^2 - z^2 = 4$ andz $= x^2 + y^2 - 13$ at the points (2,1, 2).</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of vector Calculus, Show that the vector $\vec{F} = (y + z)i + (z + x)j + (x + y)k$ is irrotational. Also find the scalar function $\emptyset$ such that $\vec{F} = \nabla\emptyset$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(c)</td><td>Make use of Green's theorem, $\int(3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td colspan="5">PART –B</td></tr>
<tr><td>3(a)</td><td>Apply Runge-Kutta method of fourth order, find $y(0.2)$, given that $\frac{dy}{dx} = \sqrt{x + y}, y(0) = 1$ taking $h = 0.2$</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Solve$\int_0^2 \int_1^2 (x^2 + y^2)\, dxdy$.</td><td>5</td><td>CO4</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>4(a)</td><td>Apply Milne's predictor -corrector method, solve the equation (y^2+1)dy-x^2dx=0 at x=1 given
<table>
<tr><td>x</td><td>0</td><td>0.25</td><td>0.5</td><td>0.75</td></tr>
<tr><td>y</td><td>1</td><td>1.0026</td><td>1.0206</td><td>1.0679</td></tr>
</table></td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Solve $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\, dzdydx$</td><td>5</td><td>CO4</td><td>K3</td></tr>
</table>

R. Tejaswini
Name & Signature of Course In charge:
[TEJASWINI. R]

Name & Signature of Module Coordinator:
Dr. Venkataramana B.S

HOD

Principal
Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 EVEN SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ME-ME
Course Title : Mathematics-II for ME stream
Semester : II
Course Type / Code : Integrated/BMATM201
Max Marks : 25

Q.NO.	POINTS	MARKS
1. a)	$\nabla\phi = 2xyz\hat{i} + x^2z^3\hat{j} + 3z^2x^2y\hat{k}$, $(\nabla\phi)_{(1,1,1)} = 2\hat{i}+\hat{j}+3\hat{k}$ $\hat{D} = \frac{\hat{i}+\hat{j}+2\hat{k}}{\sqrt{6}}$, $\nabla\phi\cdot\hat{D} = (2\hat{i}+\hat{j}+3\hat{k})\cdot\left(\frac{\hat{i}+\hat{j}+2\hat{k}}{\sqrt{6}}\right) = \frac{3\sqrt{6}}{2}$	→ 2M → $\boxed{1+2m}$ 5m
b)	$\operatorname{div}\vec{F} = 6x+6y+6z$ at $(1,2,3)$ $\operatorname{div}\vec{F} = 36$ $\operatorname{curl}\vec{F} = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 3x^2-3y^2 & 3y^2-3xz & 3z^2-3xy \end{vmatrix} = 0$ $\therefore$ $\vec{F}$ is irrotational	→ $\boxed{2m}$ → $\boxed{3m}$ 5m.
c.	$F\cdot dr = x^2dx + xy\,dy$ Along $y=x$ $dy = dx$ $F\cdot dr = 2x^2dx$ $\int_c \vec{F}\,dr = \frac{2}{3}$	→ $\boxed{1m}$ → $\boxed{1m}$ → $\boxed{3m}$
	$\boxed{OR}$	
2) a	$\phi = x^2-y^2-z^2-4$ $\nabla\phi = 2xi+2yj-2zK$ $(\nabla\phi)_{(2,1,2)} = 4i+2j-4K$ $\|\nabla\phi\| = 6 = \|a\|$ $\psi = x^2+y^2-z-13$ $(\nabla\psi)_{(2,1,2)} = 4i+2j-K$ $\|\nabla\psi\| = \sqrt{21} = \|b\|$ $\cos\theta = \frac{\vec{a}\cdot\vec{b}}{\|\vec{a}\|\|\vec{b}\|} = \frac{4}{\sqrt{21}} \Rightarrow \theta = \cos^{-1}\left(\frac{4}{\sqrt{21}}\right)$	→ $\boxed{3M}$ → $\boxed{2M}$ 5M
b)	$\nabla\times\vec{F} = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ y+z & z+x & x+y \end{vmatrix} = 0$. $\vec{F}$ is irrotational. $\frac{\partial\phi}{\partial x} = yx+zx+f(y,z)$, $\frac{\partial\phi}{\partial y} = zy+xy+f(x,z)$ $\frac{\partial\phi}{\partial z} = xz+yz+f(x,y)$ $\therefore \phi = xy+yz+zx$	→ $\boxed{2M}$ → $\boxed{3M}$ 5M

Q.NO.	POINTS	MARKS
c)	$\int (3x^2-8y^2)\,dx+(4y-6xy)\,dy$, $\int_C M\,dx+N\,dy=$	→ $\boxed{1m}$
	$\iint_R \left(\frac{\partial N}{\partial x}-\frac{\partial m}{\partial y}\right)dx.dy$, $\Rightarrow \int_{x=0}^{1}\int_{y=x^2}^{\sqrt{x}}(-6y+16y)\,dy\,dx$	$\boxed{3m}$
	$=5\int_0^1(x-x^4)\,dx$	
	$= 5\left[\frac{1}{2}-\frac{1}{5}\right]=\frac{3}{2}$	→ $\boxed{1m}$
		5m
3a)	$K_1=hf(x_0,y_0)=0.2$ $K_2=hf\left[x_0+\frac{h}{2},y_0+\frac{K_1}{2}\right]=0.219$	→ $\boxed{4M}$
	$K_3=hf\left[x_0+\frac{h}{2},y_0+\frac{K_2}{2}\right]=0.2199$, $K_4=hf[x_0+h,y_0+K_3]=0.2583$	
	$y(x)=y_0+\frac{1}{6}[K_1+2K_2+2K_3+K_4]=1.21935$	→ $\boxed{1M}$ 5M
b)	$I=\int_0^2\int_1^2(x^2+y^2)\,dx.dy=\int_0^2\left[\frac{x^3}{3}+y^2x\right]_1^2dy=\frac{22}{3}$	$\boxed{1+4M}$ 5M.
	OR	
4a	$y_0'=0$ $y_1'=0.0312$ $y_2'=0.1225$, $y_3'=0.2628$	→ $\boxed{1M}$
	$y_4^P=y_0+\frac{4h}{3}(2y_1'-y_2'+2y_3')=1.1552$, $y_4'=0.4284$	→ $\boxed{2M}$
	$y_4^c=y_2+\frac{h}{3}(y_2'+4y_3'+y_4')=1.1541$, $y_4^c=1.1541$	→ $\boxed{2M}$ 5M
b)	$I=\int_0^a\int_0^x\int_0^{x+y}e^{x+y+z}\,dz\,dy\,dx=\int_0^a\int_0^x e^{x+y}\left.e^z\right]_0^{x+y}dy\,dx$	→ $\boxed{1M}$
	$\int_0^a\left[\frac{e^{4x}}{2}-\frac{e^{2x}}{2}-e^{2x}+e^x\right]dx=\frac{e^{4a}}{8}-\frac{3e^{2a}}{4}+e^a-\frac{3}{8}$	→ $\boxed{3+1M}$
		$\boxed{5M}$

R. Tejaswini
Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

THIRD INTERNAL TEST QUESTION PAPER 2022-23EVENSEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree : **B.E**
Branch - Stream : **ME - ME**
Course Title : **Mathematics-II for ME Stream**
Duration : **60 Minutes**

Semester : **II**
Course Type / Code : **Integrated/BMATM201**
Date : **31.08.2023**
Max Marks : **25**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** partial differential equation , eliminate the arbitrary functions for the equation $z = y^2 + 2f(\frac{1}{x} + \log y)$.	5	CO5	K3
(b)	Solve$\frac{\partial^2 z}{\partial x \partial y} = sinx\ siny$ for which $\frac{\partial z}{\partial y} = -2siny$ when $x = 0$ and $z = 0$ if y is an odd multiple of$\frac{\pi}{2}$.	5	CO5	K3
(c)	Solve(mz-ny)p+(nx-lz)q = ly-mx .	5	CO5	K3
	OR			
2(a)	**Make use of** partial differential equation, eliminate the arbitrary functions for the equation $z = yf(x) + x\emptyset(y)$.	5	CO5	K3
(b)	Solve$\frac{\partial^2 z}{\partial x^2} = a^2 z$given that when $x = 0\ , z = 0\ and\ \frac{\partial z}{\partial x} = asiny$.	5	CO5	K3
(c)	**Make use of**theconcept ofpartial differential equation, derive one dimensional heat equation.	5	CO5	K3
	PART –B			
3(a)	**Make use of** double integration, find the area of the circle $x^2 + y^2 = a^2$.	5	CO4	K3
(b)	**Utilize** the concepts of beta and gamma functions, show that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$	5	CO4	K3
	OR			
4(a)	Solve$\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\, dx\, dy$ by changing into polar form.	5	CO4	K3
(b)	**Make use of** double integration; find the volume generated by the revolution of the cardioid $r = a(1 + \cos\theta)$ about the initial line.	5	CO4	K3

R. Tejaswini
(TEJASWINI. R)
Name & Signature of Course In charge:

Name & Signature of Module Coordinator:
(Dr. Venkataramana B S)

HOD

Principal

Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 EVEN SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ME-ME
Course Title : Mathematics-II for ME stream

Semester : II
Course Type / Code : Integrated/BMATM201
Max Marks : 25

Q.NO.	POINTS	MARKS
1.a.	$\frac{\partial z}{\partial x} = px^2 = 2f'\left(\frac{1}{x} + \log y\right)$ $(q - 2y)y = 2f'\left(\frac{1}{x} + \log y\right)$ $\therefore$ Solution is $px^2 + qy = 2y^2$	3 2 5
1.b.	$\frac{\partial z}{\partial y} = -\sin y \cdot \cos x + f(y)$ $z = \cos x \cos y + F(y) + g(x)$ $F(y) = \cos y \, , \; g(x) = 0$ $z = \cos y(\cos x + 1)$	2 3 5
1.c.	AE is $\frac{dx}{mz - ny} = \frac{dy}{nx - lz} = \frac{dz}{ly - mx}$ Multipliers $x, y, z \Rightarrow x^2 + y^2 + z^2 = c_1$ Multipliers $l, m, n \Rightarrow lx + my + nz = c_2$ $\therefore$ Solution is $\phi(x^2 + y^2 + z^2, lx + my + nz) = 0$	1 2 2 5
2.a.	$p = yf'(x) + \phi(y)$, $q = f(x) + x\phi'(y)$, $r = yf''(x)$, $s = f'(x) + \phi'(y)$, $t = x\phi''(y)$ $f'(x) = \frac{p - \phi(y)}{y}$, $\phi'(y) = \frac{q - f(x)}{x}$ $\therefore xy\frac{\partial^2 z}{\partial x \partial y} + z = x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}$	2 2 1 5
2.b.	Solution of PDE is $z = f(y)e^{ax} + g(y)e^{-ax}$ $f(y) = \frac{\sin y}{2}$, $g(y) = -\frac{\sin y}{2}$ $z = \sin y \sinh ax$ is the required solution	2 2 1 5

Q.NO.	POINTS	MARKS
2.c.	$R = (A\rho_s\,\delta x)\frac{\partial u}{\partial t}$, $R_I = -KA\left[\frac{\partial u}{\partial x}\right]_x$, $R_0 = -KA\left[\frac{\partial u}{\partial x}\right]_{x+\delta x}$ $R = R_I - R_0$. After simplification, $\frac{\partial u}{\partial t} = \frac{K}{\rho_s}\frac{\partial^2 u}{\partial x^2}$. $\therefore \frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ (or) $u_t = c^2 u_{xx}$.	1 2 2 5
3.a.	Equation of circle in polar form: r varies from 0 to a. θ varies from 0 to 2π. $A = \iint r\,dr\,d\theta = \int_{\theta=0}^{2\pi}\int_{r=0}^{a} r\,dr\,d\theta = \int_0^{2\pi}\frac{a^2}{2}d\theta$ $A = \pi a^2$ sq. units.	1 2 2 5
3.b.	$\beta(m,n) = 2\int_0^{\pi/2}\sin^{2m-1}\theta\cos^{2n-1}\theta\,d\theta$, $\Gamma(n) = 2\int_0^{\infty}e^{-x^2}x^{2n-1}dx$ $\Gamma(m)\Gamma(n) = 4\int_0^{\infty}\int_0^{\infty}e^{-(x^2+y^2)}x^{2n-1}y^{2m-1}dx\,dy$. WKT $x = r\cos\theta$, $y = r\sin\theta$, $dx\,dy = r\,dr\,d\theta$, $x^2+y^2=r^2$ $r \to 0$ to ∞, $\theta \to 0$ to $\pi/2$ $\Gamma(m)\Gamma(n) = 4\int_{\theta=0}^{\pi/2}\int_{r=0}^{\infty}e^{-r^2}r^{2(n+m)-1}\sin^{2m-1}\theta\cos^{2n-1}\theta\,dr\,d\theta$ $= \left(2\int_0^{\infty}e^{-r^2}r^{2(n+m)-1}dr\right)\left(2\int_0^{\pi/2}\sin^{2m-1}\theta\cos^{2n-1}\theta\,d\theta\right)$ $\Gamma(m)\Gamma(n) = \Gamma(m+n)\beta(m,n) \Rightarrow \beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$	2 1 1 1 5
4.a.	$x = r\cos\theta$, $y = r\sin\theta$, $x^2+y^2=r^2$, $dx\,dy = r\,dr\,d\theta$ $r \to 0$ to ∞, $\theta \to 0$ to $\pi/2$ $I = \int_{\theta=0}^{\pi/2}\int_{r=0}^{\infty}e^{-r^2}r\,dr\,d\theta$. Put $r^2 = t \Rightarrow r\,dr = \frac{dt}{2}$ $\therefore I = \int_0^{\pi/2}\int_0^{\infty}e^{-t}\frac{dt}{2}\,d\theta = \pi/4$	1 2 2 5
4.b.	$V = \int_{\theta=0}^{\pi}\int_{r=0}^{a(1+\cos\theta)} 2\pi r^2\sin\theta\,dr\,d\theta$ $V = \frac{2\pi a^3}{3}\int_0^{\pi}\sin\theta(1+\cos\theta)^3 d\theta = \frac{8\pi a^3}{3}$	2 2 1 5

R. Tejaswini
Course Incharge

Module Coordinator

HOD

KSIT

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

THIRD INTERNAL TEST QUESTION PAPER 2022-23EVEN SEMESTER

SET: B

USN										

Degree : B.E
Branch - Stream : ME - ME
Course Title : Mathematics-II for ME Stream
Duration : 60 Minutes

Semester : II
Course Type / Code : Integrated/BMATM201
Date : 31.08.2023
Max Marks : 25

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** partial differential equation , eliminate the arbitrary functions for the equation $\emptyset(xy + z^2, x + y + z)$.	5	CO5	K3
(b)	**Solve**$\frac{\partial^2 z}{\partial x^2} = xy$subject to the conditions that $\frac{\partial z}{\partial x} = \log(1 + y)$ when $x = 1$ and $z = 0$ when $x = 0$.	5	CO5	K3
(c)	**Make use of**theconcept ofpartial differential equation, derive one dimensional wave equation.	5	CO5	K3
	OR			
2(a)	**Make use of** partial differential equation , eliminate the arbitrary functions for the equation $z = y^2 + 2f(\frac{1}{x} + \log y)$.	5	CO5	K3
(b)	**Solve**$\frac{\partial^2 z}{\partial y^2} = z$ given that when $y = 0$, $z = e^x, \frac{\partial z}{\partial y} = e^{-x}$.	5	CO5	K3
(c)	**Solve**$(y^2 + z^2)p + x(yq - z) = 0$.	5	CO5	K3
	PART –B			
3(a)	**Make use of** double integration; find the area of the ellipse$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.	5	CO4	K3
(b)	**Utilize** the definition of gamma functions, prove that$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.	5	CO4	K3
	OR			
4(a)	**Solve**$\int_0^1 \int_x^{\sqrt{x}} xy\, dy\, dx$ by changing the order of integration.	5	CO4	K3
(b)	**Solve**$\int_{-a}^{a} \int_0^{\sqrt{a^2-x^2}} \sqrt{x^2 + y^2}\, dy\, dx$ by changing into polar form.	5	CO4	K3

28/8/23

Name & Signature of Course In charge:

Name & Signature of Module Coordinator:

(Dr. Venkataramana B.S)

HOD

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 EVEN SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ME-ME
Course Title : Mathematics-II for ME stream
Semester : II
Course Type / Code : Integrated/BMATM201
Max Marks : 25

Q.NO.	POINTS	MARKS
1.a.	$\frac{\partial u}{\partial x} = y + 2zp$, $\frac{\partial u}{\partial y} = x + 2zq$, $\frac{\partial v}{\partial x} = 1+p$, $\frac{\partial v}{\partial y} = 1+q$. $\frac{y+2zp}{x+2zq} = \frac{1+p}{1+q}$. $\therefore p(x-2z) - q(y-2z) + (x-y) = 0$ in the required PDE	2 2 1 5
1.b.	$\frac{\partial z}{\partial x} = \frac{x^2}{2}y + f(y)$, $z = \frac{x^3y}{6} + xf(y) + g(y)$ $f(y) = \log(1+y) - \frac{1}{2}y$, $g(y) = 0$. $\therefore$ The solution is $z = \frac{x^3y}{6} + x\left[\log(1+y) - \frac{y}{2}\right]$.	2 3 5
1.c.	$T_1 \cos\alpha = T_2 \cos\beta = T$ $\tan\beta - \tan\alpha = \frac{m}{T}\delta x \frac{\partial^2 u}{\partial t^2}$. After simplification, $\frac{\partial^2 u}{\partial x^2} = \frac{m}{T}\frac{\partial^2 u}{\partial x^2}$ $\therefore \frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ (or) $u_{tt} = c^2 u_{xx}$.	1 2 2 5
2.a.	$\frac{\partial z}{\partial x} = px^2 = -2f'\left(\frac{1}{x} + \log y\right)$ $(q-2y)y = 2f'\left(\frac{1}{x} + \log y\right)$ $\therefore$ Solution in $px^2 + qy = 2y^2$	1 2 2 5
2.b.	Solution of PDE is $z = f(x)e^{y} + g(x)e^{-y}$ $f(x) = \cosh x$, $g(x) = \sinh x$ $\therefore z = \cosh x\, e^{y} + \sinh x\, e^{-y}$ is the required solution	2 2 1 5

Q.NO.	POINTS	MARKS
2.c.	AE is $\frac{dx}{y^2+z^2} = \frac{dy}{xy} = \frac{dz}{xz}$ $C_1 = y/z$ Multipliers $x, -y, -z \Rightarrow x^2-y^2-z^2 = 2c_2$ $\therefore$ Solution is $\phi(y/z,\ x^2-y^2-z^2) = 0$	1 2 2 5
3.a.	$A = 4\iint\limits_R dx\,dy = 4\int_{y=0}^{b}\int_{x=0}^{a/b\sqrt{b^2-y^2}} dx\,dy.$ $A = 4\int_0^b \frac{a}{b}\sqrt{b^2-y^2}\,dy = \frac{4a}{b}\left[\frac{y}{2}\sqrt{b^2-y^2} + \frac{b^2}{2}\sin^{-1}\frac{y}{b}\right]_0^b$ $A = \pi ab$ sq. units.	2 2 1 5
3.b.	WKT $\Gamma n = 2\int_0^\infty e^{-x^2}x^{2n-1}dx.,\ \Gamma(1/2) = 2\int_0^\infty e^{-x^2}dx.$ $\|\|^{ly}$ $\Gamma(1/2) = 2\int_0^\infty e^{-y^2}dy \Rightarrow (\Gamma(1/2))^2 = 4\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}dx\,dy.$ $r \to 0$ to ∞, $\theta \to 0$ to $\pi/2$ $\therefore (\Gamma(1/2))^2 = 4\int_{\theta=0}^{\pi/2}\int_{t=0}^{\infty} e^{-t}\frac{dt}{2}d\theta \Rightarrow (\Gamma(1/2))^2 = \pi$ $\Gamma(1/2) = \sqrt{\pi}.$	1 2 2 5
4.a.	Given $x=0,\ x=1,\ y=x,\ y=\sqrt{x}$ $y^2=x.$ $(0,0)$ and $(1,1)$ are intersecting points. $\therefore I = \int_{y=0}^{1}\int_{x=y^2}^{y} xy\,dx\,dy = \frac{1}{24}.$	1 1 3 5
4.b.	$x = r\cos\theta,\ y = r\sin\theta,\ x^2+y^2=r^2,\ dx\,dy = r\,dr\,d\theta$ r varies from 0 to a, θ varies from 0 to π $I = \int_{\theta=0}^{\pi}\int_{r=0}^{a} r^2\,dr\,d\theta = \frac{\pi a^3}{3}.$	1 1 3 5

28/8/23

Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

FIRST INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

USN										

SET: A

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT - CSE
Course Title : Mathematics – II for CS stream
Duration : 60 Minutes

Semester : II
Course Type / Code : Integrated/BMATS201
Date : 26/06/2023
Max Marks : 25

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

<table>
<tr><th>Q No.</th><th>Questions</th><th>Marks</th><th>CO</th><th>K-Level</th></tr>
<tr><td colspan="5">PART-A</td></tr>
<tr><td>1(a)</td><td>Make use of Regula falsi method, find the real root of the equation $\cos x = 3x - 1$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Newton forward interpolation formulae to find the values of f(38)
<table>
<tr><td>x</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td><td>90</td></tr>
<tr><td>f(x)</td><td>184</td><td>204</td><td>226</td><td>250</td><td>276</td><td>304</td></tr>
</table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's $\frac{3}{8}$th rule to solve $\int_4^{5.2} \log_e x$ dividing the interval into six equal parts.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>2(a)</td><td>Apply Newton - Raphson method, find a real root of the equation $x\sin x + \cos x = 0$ which lies near $x = \pi$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Lagrange's formula, find the value of y at x=10 from the following data
<table>
<tr><td>x</td><td>5</td><td>6</td><td>9</td><td>11</td></tr>
<tr><td>f(x)</td><td>12</td><td>13</td><td>14</td><td>16</td></tr>
</table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's $\frac{1}{3}$ rd rule to solve $\int_0^6 3x^2 dx$ dividing the interval into six equal parts.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">PART –B</td></tr>
<tr><td>3(a)</td><td>Make use of Taylor's series method to obtain the solution of $\frac{dy}{dx} = 2y + 3e^x$ y(0) = 0 at y (0.2).</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of modified Euler's method, Solve the initial value problem $\frac{dy}{dx} = 1 + \frac{y}{x}$, $y(1) = 2$.and find y(1.2) by taking h=0.2</td><td>5</td><td>CO2</td><td>K3</td></tr>
</table>

OR				
4(a)	**Employ** Euler's modified method to find y(1.4) given $\frac{dy}{dx}=\log(x+y)$ y(1) = 2.	5	CO2	K3
(b)	**Make use of** Taylor's series method to solve $\frac{dy}{dx}=x-y^2$, $y(0)=1$, find y (0.1).	5	CO2	K3

Name & Signature of Course In charge:

(Dr. JALAJA P)

Name & Signature of Module Coordinator:

Dr. Venkataraman B.S

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Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
FIRST INTERNAL TEST 2022 – 23 EVEN SEMESTER

SET- A

SCHEME AND SOLUTION

Degree	:B.E	**Semester**	: II
Branch - stream	:CSE/AIML/IOT/CCE/CSD-CSE	**Course Type / Code**	:Integrated/BMATS201
Course Title	:Mathematics for CSE Stream - 2	**Max Marks**	: 25

<table>
<tr><th>Q.NO.</th><th>PART-A POINTS</th><th>MARKS</th></tr>
<tr><td>1a)</td><td>
$f(x) = \cos x + 1 - 3x$
root lies in $(0, 1)$
$f(0.6) = 0.0253 > 0$ $f(0.7) = -0.3352 < 0$
∴ The root lies in $(0.6, 0.7)$
1st iteration; $x_1 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.607$
2nd iteration; $f(0.607) = 0.00036 > 0$
The root lies in $(0.607, 0.7)$
$x_2 = 0.607$ ∴ The real root correct to 3 decimals is 0.607
</td><td>
$\boxed{1m}$
$\boxed{2m}$
$\boxed{2m}$
5M
</td></tr>
<tr><td>b)</td><td>
$\Delta y_0 = 20, \Delta y_1 = 22, \Delta y_2 = 24, \Delta y_3 = 26, \Delta y_4 = 28$
$\Delta^2 y_0 = 2, \Delta^2 y_1 = 2, \Delta^2 y_2 = 2, \Delta^2 y_3 = 2$
$\Delta^3 y_0 = 0, \Delta^3 y_1 = 0, \Delta^3 y_2 = 0$
$y_r = y_0 + r\Delta y_0 + \frac{r(r-1)}{2!}\Delta^2 y_0 + \cdots$, $r = \frac{x - x_0}{h} = -0.2$
$f(38) = 180.24$
</td><td>
$\boxed{3M}$
$\boxed{1M}$
$\boxed{1M}$
5M
</td></tr>
<tr><td>c)</td><td>
$h = 0.2$ $n = 6$
<table>
<tr><td>x</td><td>4</td><td>4.2</td><td>4.4</td><td>4.6</td><td>4.8</td><td>5.0</td><td>5.2</td></tr>
<tr><td>y</td><td>1.3863</td><td>1.4351</td><td>1.4816</td><td>1.5261</td><td>1.5686</td><td>1.6094</td><td>1.6487</td></tr>
</table>
$I = \frac{3h}{8}[(y_0 + y_6) + 3(y_1 + y_2 + y_4 + y_5) + 2(y_3)] = 1.8279$
$\boxed{OR}$
</td><td>
$\boxed{3m}$
$\boxed{2m}$
5M
</td></tr>
<tr><td>2a)</td><td>
$f(x) = x\sin x + \cos x$; The root lies in $(-3, -2)$
Let $x_0 = \pi$; 1st iteration: $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 2.8232$
2nd iteration: $x_2 = 2.7987$, 3rd iteration: $x_3 = 2.7984$
4th iteration: $x_4 = 2.7982$, 5th iteration: $x_5 = 2.7983$
</td><td>
$\boxed{2m}$
$\boxed{3M}$
5M
</td></tr>
</table>

2b) $y=f(x)=\frac{(x-x_1)(x-x_2)(x-x_3)}{(x_0-x_1)(x_0-x_2)(x_0-x_3)}y_0+\frac{(x-x_0)(x-x_2)(x-x_3)}{(x_1-x_0)(x_1-x_2)(x_1-x_3)}y_1+$ → $\boxed{2m}$

$\frac{(x-x_0)(x-x_1)(x-x_3)}{(x_2-x_0)(x_2-x_1)(x_2-x_3)}y_2+\frac{(x-x_0)(x-x_1)(x-x_2)}{(x_3-x_0)(x_3-x_1)(x_3-x_2)}y_3$ → $\boxed{3m}$

$\langle y=f(10)=14.67\rangle$

5M

2c) $h=1$, $n=6$ → $\boxed{3m}$

x	0	1	2	3	4	5	6
y	0	3	12	27	48	75	108

$I=\frac{h}{3}[(y_0+y_6)+4(y_1+y_3+y_5)+2(y_2+y_4)]=216$ → $\boxed{1+1m}$

5M

Part-B

3a) $y(x)=y(x_0)+(x-x_0)y'(x_0)+\frac{(x-x_0)^2}{2!}y''(x_0)+\frac{(x-x_0)^3}{3!}y'''(x_0)+\cdots$ → $\boxed{1m}$

$y'=2y+3e^x \Rightarrow y'(0)=3$, $y'''=2y''+3e^x \Rightarrow y'''(0)=21$

$y''=2y'+3e^x \Rightarrow y''(0)=9$ $\quad y^{IV}=2y'''+3e^x \Rightarrow y^{IV}(0)=45$ → $\boxed{3m}$

$y(x)=3x+\frac{x^2}{2}(9)+\frac{x^3}{6}(21)+\frac{x^4}{24}(45)$ → $\boxed{1m}$

$\langle y(0.2)=0.811\rangle$ → $\boxed{1m}$

5M

3b) $f(x,y)=1+y/x$, $x_0=1$, $y_0=2$, $h=0.2$ → $\boxed{2m}$

$y_0+hf[x_0,y_0]=2.6$

$y_1^{(0)}=y_0+hf[x_0,y_0]$

$y_1^{(1)}=y_0+h/2[f(x_0,y_0)+f(x_1,y_1^{(0)})]=2.6167$

$y_1^{(2)}=y_0+h/2[f(x_0,y_0)+f(x_1,y_1^{(1)})]=2.6181$

$y_1^{(3)}=y_0+h/2[f(x_0,y_0)+f(x_1,y_1^{(2)})]=2.6182$ → $\boxed{3m}$

5M

$\boxed{OR}$

4a) $f(x,y)=\log(x+y)$, $x_0=1$, $y_0=2$. Take $h=0.4$ → $\boxed{2m}$

$y_1^{(0)}=2.4394$

$y_1^{(1)}=2.48878$

$y_1^{(2)}=2.4913$

$y_1^{(3)}=2.4914$ → $\boxed{3m}$

5M

4b) $y(x)=y(x_0)+(x-x_0)y'(x_0)+\frac{(x-x_0)^2}{2!}y''(x_0)+\cdots$. Given $x_0=0$, $y_0=1$ → $\boxed{1m}$

$y'=x-y^2 \Rightarrow y'(0)=-1$

$y''=1-2yy' \Rightarrow y''(0)=3$

$y'''=0-2[yy''+(y')^2] \Rightarrow y'''(0)=-8$ → $\boxed{3m}$

$y^{IV}=0-2[yy'''+y'y''+2y'y''] \Rightarrow y^{IV}(0)=\underline{-17}$

$y(x)=1-x+3x^2/2-\frac{4x^3}{3}-\frac{17x^4}{24}$

$y(0.1)=0.9138$ → $\boxed{1m}$

5M

Mamatha
Course In-charge

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT - CSE
Course Title : Mathematics – II for CS stream
Duration : 60 Minutes

Semester : II
Course Type / Code : Integrated/BMATS201
Date : 26/06/2023
Max Marks : 25

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

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<tr><td colspan="5">PART-A</td></tr>
<tr><td>1(a)</td><td>Make use of Regula falsi method, find the real root of the equation $xe^{x}-\cos x=0$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Newton's interpolation formula, to find y(1.4) using following data<table><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Y</td><td>10</td><td>26</td><td>58</td><td>112</td><td>194</td></tr></table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's 3/8th rule to evaluate $\int_0^{\frac{\pi}{2}} e^{sinx}dx$ by taking 7 ordinates.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>2(a)</td><td>Make use of Newton - Raphson method, find a real root of the equation $x\sin x+\cos x=0$ which lies near $x=\pi$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Newton's-divided difference formula to find f(9),given data<table><tr><td>X</td><td>5</td><td>7</td><td>11</td><td>13</td><td>17</td></tr><tr><td>f(x)</td><td>150</td><td>392</td><td>1452</td><td>2366</td><td>5202</td></tr></table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's $\frac{1}{3}$ rd rule to evaluate $\int_0^1 \frac{x}{1+x^2}dx$ by dividing the interval in to 6 equal parts.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">PART --B</td></tr>
<tr><td>3(a)</td><td>Make use of Taylor's series method to obtain the solution of $\frac{dy}{dx}=x+y^2, y(0)=1$ at y (0.1).</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of modified Euler's method, solve $\frac{dy}{dx}=x^2+y^2, y(0)=1$ at x = 0.1 by taking h=0.1</td><td>5</td><td>CO2</td><td>K3</td></tr>
</table>

	OR			
4(a)	**Make use of** modified Euler's method, solve $\frac{dy}{dx} = 3x + \frac{y}{2}, y(0) = 1$ at x = 0.2 by taking h=0.2	**5**	**CO2**	**K3**
(b)	**Make use of** Taylor's series method to solve $\frac{dy}{dx} = xy - 1$ at x = 0.1 y(0) = 2.	**5**	**CO2**	**K3**

Name & Signature of Course In charge

Dr. Venkataramana B.S.

Name & Signature of Module Coordinator

Dr. Venkataramana B.S

HOD

Kumar.G

Principal

Selected.

440

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
FIRST INTERNAL TEST 2022 – 23 EVEN SEMESTER

SET- B

SCHEME AND SOLUTION

Degree :B.E
Branch - stream :CSE/AIML/IOT/CCE/CSD-CSE
Course Title :Mathematics for cssStream - 2
Semester : II
Course Type / Code :Integrated/ BMATS 201
Max Marks : 25

Q.NO.	POINTS	MARKS
1 a)	$f(x) = xe^{x} - \cos x$	
	The root lies in $(0.5, 0.6)$, $f(0.5) = -0.05392 < 0$, $f(0.6) = 0.06772 > 0$	1M
	1st iteration; $x_1 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.5165$	2M
	2nd iteration; $x_2 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.5176$ 3rd iteration $x_3 = 0.5177$	2M
		5M
b)	$\Delta y_0 = 16$, $\Delta y_1 = 32$, $\Delta y_2 = 54$, $\Delta y_3 = 82$ $\Delta^2 y_0 = 16$, $\Delta^2 y_1 = 22$, $\Delta^2 y_2 = 28$ $\Delta^3 y_0 = 6$, $\Delta^3 y_1 = 6$, $\Delta^4 y_0 = 0$	3M
	$x = 0.4$	1M
	$y_x = y_0 + x\Delta y_0 + \frac{x(x-1)}{2!}\Delta^2 y_0 + \frac{x(x-1)(x-2)}{3!}\Delta^3 y_0 + \dots$	1M
	$y(1.4) = 14.864$	5M
c)	$h = \pi/12$, $n = 6$	3M
	$I = \frac{3h}{8}[(y_0 + y_6) + 3(y_1 + y_2 + y_4 + y_5) + 2(y_3)] = 3.1043$	1+1M
		5M

x	0	15°	30°	45°	60°	75°	90°
y	1	1.2953	1.6181	2.0281	2.3774	2.6272	2.71828

OR

Q.NO.	POINTS	MARKS
2 a)	$f(x) = x\sin x + \cos x$ The root lies in $(-3, -2)$ Let $x_0 = \pi$	1M
	1st iteration; $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 2.8232$	1M
	2nd iteration; $x_2 = 2.7987$	1M
	3rd iteration; $x_3 = 2.7984$	1M
	4th iteration; $x_4 = 2.7982$	1M
	5th iteration; $x_5 = 2.7983$	5M

2b) $f(x_0, x_1) = 121$ $f(x_1, x_2) = 265$ $f(x_2, x_3) = 457$ $f(x_3, x_4) = 709$
$f(x_1, x_2, x_3) = 32$ $f(x_2, x_3, x_4) = 42$ → 3M
$f(x_0, x, x_2) = 24$
$f(x_0, x_1, x_2, x_3) = 1$ $f(x_1, x_2, x_3, x_4) = 1$ → 1M
$f(x) = f(x_0) + (x - x_0) f(x_0, x_1) + (x - x_0)(x - x_1) f(x_0, x_1, x_2) + \dots$ → 1M
$f(9) = 810$
5M

2c) $h = 1/6$, $n = 6$ → 3M

x	0	$1/6$	$1/3$	$1/2$	$2/3$	$5/6$	1
y	0	$6/37$	$3/10$	$2/5$	$6/13$	$30/61$	$1/2$

$I = \frac{h}{3}\left[(y_0 + y_6) + 4(y_1 + y_3 + y_5) + 2(y_2 + y_4)\right] = 0.3466$ → 1+1M
5M

PART-B

3a) $y(x) = y(x_0) + (x - x_0) y'(x_0) + \frac{(x - x_0)^2}{2!} y''(x_0) + \dots$ → 1M
$y' = x + y^2 \Rightarrow y'(0) = 1$ $y''' = 2[yy'' + (y')^2] \Rightarrow y'''(0) = 8$
$y'' = 1 + 2yy' \Rightarrow y''(0) = 3$ $y^{iv} = 2[yy''' + y'y'' + 2y'y''] = 34$ → 3M
$y(x) = 1 + x + \frac{3}{2}x^2 + \frac{4}{3}x^3$ → 1M
$y(0.1) = 1.1163$
5M

3b) $f(x, y) = (x^2 + y^2)$, $x_0 = 0$, $y_0 = 1$ $h = 0.1$ → 2M
$y_1^{(0)} = y_0 + hf[x_0, y_0] = 1.11$
$y_1^{(1)} = y_0 + h/2\,[f(x_0, y_0) + f(x_1, y_1^{(0)})] = 1.111$ → 3M
$y_1^{(2)} = 1.1122$, $y_1^{(3)} = 1.1123$ $\therefore y(0.1) = 1.1123$
5M

OR

4a) $f(x, y) = 3x + \frac{y}{2}$, $x_0 = 0$, $y_0 = 1$ $h = 0.2$ → 2+3M
$y_1^{(0)} = 1.15$ $y_1^{(1)} = 1.1671$ $y_1^{(2)} = 1.1675$ $y_1^{(3)} = 1.1676$
$\therefore y(0.2) = 1.1676$
5M

4b) $y(x) = y(x_0) + (x - x_0) y'(x_0) + \frac{(x - x_0)^2}{2!} y''(x_0) + \dots$ → 1M
$y' = xy - 1 \Rightarrow y'(0) = -1$ $y''' = xy'' + (1)y' + y' \Rightarrow y'''(0) = -2$
$y'' = xy' + (1)y - 0 \Rightarrow y''(0) = 2$ $y^{iv} = xy''' + (1)y'' + 2y'' \Rightarrow y^{iv}(0) = 6$ → 3M
$y(x) = 2 - x + x^2 - x^3/3 + x^4/4$ → 1M
$y(0.1) = 1.9096$
5M

Mamatha
Course In-charge

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
SECOND INTERNAL TEST QUESTION PAPER 2022-23EVENSEMESTER

SET: A

USN										

Degree : **B.E**
Branch - Strean : **CSE/CSD/AIML/CCE/IOT-CSE**
Course Titl : **Mathematics-II for CSE stream**
Duration : **60 Minutes**

Semester : **II**
Course Type / Code : **Integrated/BMATS201**
Date : **31-07-2023**
Max Marks : **25**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** $\emptyset = xyz$ find the directional derivative at $(1,1,1)$, in the direction of $3\hat{\imath} + 3\hat{\jmath} + 3\hat{k}$.	5	CO3	K3
(b)	**Make use of** Vector Calculus ,Find the constants a, b such that the vector $\vec{F} = (axy + z^3)\hat{\imath} + (3x^2 - z)\hat{\jmath} + (bxz^2 - y)\hat{k}$ is irrotational and hence find the scalar function $\emptyset$ such that $\vec{F} = \nabla\emptyset$	5	CO3	K3
(c)	**Utilize** the Curvilinear coordinates, Prove that the spherical coordinate system is orthogonal.	5	CO3	K3
	OR			
2(a)	**Choose** the appropriate formula and find the angle between the surfaces $x\log z = y^2 - 1$ and $x^2y = 2 - z$ at the points $(1,1,1)$.	5	CO3	K3
(b)	**Make use of** vector Calculus, Showthat the vector $\vec{F} = \frac{xi+yj}{x^2+y^2}$is both Solenoidal and irrotational.	5	CO3	K3
(c)	**Make use of** the vector $\vec{A} = z\hat{\imath} - 2x\hat{\jmath} + y\hat{k}$ and express $\vec{A}$ in Cylindrical system.	5	CO3	K3
	PART –B			
3(a)	**Apply** Runge-Kutta method of fourth order to find $y(0.2)$, given that $\frac{dy}{dx} = \frac{y-x}{y+x}$,$y(0) = 1$ by taking $h = 0.2$	5	CO2	K3
(b)	**Solve** $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x + y + z)\, dydxdz$.	5	CO4	K3
	OR			
4(a)	**Apply** Milnes predictor-corrector method given that $\frac{dy}{dx} = x - y^2$ and the data $y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762$. Compute y at $x = 0.8$.	5	CO2	K3
(b)	**Solve** $\int_{0}^{1}\int_{x}^{\sqrt{x}}(x^2 + y^2)dydx$.	5	CO4	K3

Mamatha.N
Name & Signature of Course In charge:
Mamatha

Name & Signature of Module-Coordinator
Dr. Venkataramana R

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Principal

Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 EVEN SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT-CSE
Course Title : Mathematics-II for CSE stream
Semester : II
Course Type / Code : Integrated/BMATS201
Max Marks : 25

Q.NO.	POINTS	MARKS
1a)	$\nabla\phi = yz\hat{i} + xz\hat{j} + xy\hat{k}$, $(\nabla\phi)_{(1,1,1)} = \hat{i} + \hat{j} + \hat{k} \rightarrow$	$\boxed{2m}$
	$\nabla\phi\cdot\hat{D} = \frac{\vec{D}}{\lvert\vec{B}\rvert} = \frac{3i+3j+3k}{3\sqrt{3}}$, $\nabla\phi\cdot\hat{D} = \frac{3}{\sqrt{3}} = \sqrt{3} \rightarrow$	$\boxed{1+2m}$ 5M
b)	$\nabla\times\vec{F} = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ axy+z^3 & 3x^2-z & bxz^2-y \end{vmatrix}$ if $a=6, b=3$ $\vec{F}$ is irrotational $\rightarrow$	$\boxed{2m}$
	$\frac{\partial\phi}{\partial x} = 3x^2y + z^3x + f(y,z)$, $\frac{\partial\phi}{\partial y} = 3x^2y - zy + f(x,z)$ $\frac{\partial\phi}{\partial z} = xz^3 - yz + f(x,y)$ ∴ $\phi = 3x^2y - yz + xz^3$ $\rightarrow$	$\boxed{3m}$ 5M
c)	$\vec{r} = r\sin\theta\cos\phi\, i + r\sin\theta\sin\phi\, j + r\cos\theta\, k$ $\rightarrow$	$\boxed{1m}$
	$\hat{e}_r = \sin\theta\cos\phi\, i + \sin\theta\sin\phi\, j + \cos\theta\, k$, $\hat{e}_\theta = \cos\theta\cos\phi\, i + \cos\theta\sin\phi\, j - \sin\theta\, k$ $\rightarrow$	$\boxed{2m}$
	$\hat{e}_\phi = -\sin\phi\, i + \cos\phi\, j$ ∴ $\hat{e}_r\cdot\hat{e}_\theta = 0$, $\hat{e}_\theta\cdot\hat{e}_\phi = 0$, $\hat{e}_\phi\cdot\hat{e}_r = 0$ $\rightarrow$	$\boxed{2m}$ 5M
	$\boxed{OR}$	
2a)	$\phi = x\log z - y^2 + 1$, $\nabla\phi = \log z\, i - 2yj + \frac{x}{z}k$, $(\nabla\phi)_{(1,1,1)} = -2j + k \rightarrow \lvert a\rvert$ $\psi = x^2y + z - 2$, $\nabla\psi = 2xyi + x^2j + k$, $(\nabla\psi)_{(1,1,1)} = 2i + j + k \ldots \lvert b\rvert$ $\rightarrow$	$\boxed{3m}$
	$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{\lvert\vec{a}\rvert\lvert\vec{b}\rvert} = \frac{-1}{\sqrt{30}} \Rightarrow \theta = \cos^{-1}\left[-1/\sqrt{30}\right]$ $\rightarrow$	$\boxed{2m}$ 5M
b)	$\nabla\cdot\vec{F} = \frac{x^2+y^2-2x^2}{(x^2+y^2)^2} + \frac{(x^2+y^2-2y^2)}{(x^2+y^2)^2} = 0$ ∴ $\vec{F}$ is Solenoidal $\rightarrow$	$\boxed{2m}$
	$\nabla\times\vec{F} = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ x/x^2+y^2{}^2 & y/x^2+y^2{}^2 & 0 \end{vmatrix} = 0$ ∴ $\vec{F}$ is irrotational $\rightarrow$	$\boxed{3m}$ 5M

Q.NO.	POINTS	MARKS
c)	Let $\vec{A} = A_1\hat{e}_\rho + A_2\hat{e}_\phi + A_3\hat{e}_z$ where $A_1 = \vec{A}\cdot\hat{e}_\rho$, $A_2 = \vec{A}\cdot\hat{e}_\phi$ $A_3 = \vec{A}\cdot\hat{e}_z$ $\rightarrow$	$\boxed{2m}$
	$h_1 = 1, h_2 = \rho, h_3 = 1$	
	$\hat{e}_\rho = \cos\phi i + \sin\phi j$, $\hat{e}_\phi = -\sin\phi i + \cos\phi j$, $\hat{e}_z = k$	
	$A_1 = z\cos\phi - \rho\sin 2\phi$, $A_2 = -(z\sin\phi + 2\rho\cos^2\phi)$, $A_3 = \rho\sin\phi$ $\rightarrow$	$\boxed{2m}$
	$\vec{A} = (z\cos\phi - \rho\sin\phi)\hat{e}_\rho - (z\sin\phi + 2\rho\cos^2\phi)\hat{e}_\phi + \rho\sin\phi\hat{e}_z$ $\rightarrow$	$\boxed{1m}$
	<u>Part-B</u>	
3a)	$k_1 = hf(x_0, y_0) = 0.2$, $k_2 = hf[x_0 + \frac{h}{2}, y_0 + \frac{k_1}{2}] = 0.1666$ $\rightarrow$	$\boxed{4m}$
	$k_3 = hf[x_0 + \frac{h}{2}, y_0 + \frac{k_2}{2}] = 0.1661$, $k_4 = hf[x_0 + h, y_0 + k_3] = 0.1414$	
	$y(x_0+h) = y_0 + 1/6[k_1 + 2k_2 + 2k_3 + k_4] = 1.1678$ $\rightarrow$	$\boxed{1m}$
b)	$I = \int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz = \int_{-1}^{1}\int_{0}^{z}\left[xy + \frac{y^2}{2} + yz\right]_{x-z}^{x+z}dx\,dz$ $\rightarrow$	$\boxed{1m}$
	on simplification $\rightarrow$	$\boxed{3+1m}$
	$I = 0$	
	$\boxed{OR}$	
4a)	$f_0 = 0$, $f_1 = 0.1996$, $f_2 = 0.3936$, $f_3 = 0.5689$ $\rightarrow$	$\boxed{2m}$
	$y_4^{(P)} = y_0 + \frac{4h}{3}[2f_1 - f_2 + 2f_3] = 0.3049$ $\rightarrow$	$\boxed{1m}$
	$y_4^{(C)} = y_2 + \frac{h}{3}[f_2 + 4f_3 + f_4^{(P)}] = 0.3045$, $_4^{(P)} = 0.7070$ $\rightarrow$	$\boxed{1m}$
	again apply corrector formula, $y_4^{(C)} = 0.3045$ $\therefore y(0.8) = 0.3045$ $\rightarrow$	$\boxed{1m}$
		5m
b)	$I = \int_0^1\int_x^{\sqrt{x}}(x^2+y^2)\,dy\,dx = \int_0^1\left[x^2y + \frac{y^3}{3}\right]_x^{\sqrt{x}}dx$ $\rightarrow$	$\boxed{1m}$
	on simplification we get $\rightarrow$	$\boxed{3+1m}$
	$I = 3/35$	5m

Namatha

Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
SECOND INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E
Branch -Stream : CSE/CSD/AIML/CCE/IOT-CSE
Course Title : Mathematics-II for CSE stream
Duration : 60 Minutes

Semester : II
Course Type / Code : Integrated/BMATS201
Date : 31-07-2023
Max Marks : 25

Note: Answer **ONE full** question from each part.
K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

<table>
<tr><th>Q No.</th><th>Questions</th><th>Marks</th><th>CO</th><th>K-Level</th></tr>
<tr><td colspan="5">PART-A</td></tr>
<tr><td>[illegible](a)</td><td>Make use of $\emptyset = x^2yz^3$ find the directional derivative at (1,1,1) in the direction of $\hat{\imath} + \hat{\jmath} + 2\hat{k}$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of Vector Calculus, Find div$\vec{F}$ and curl$\vec{F}$ at (1,2,3) if $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(c)</td><td>Utilise Curvilinear coordinates, Prove that the Cylindrical system coordinate is orthogonal.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>2(a)</td><td>Make use of Vector Calculus, Find the angle between the surfaces $x^2 + y^2 - z^2 = 4$ and $z = x^2 + y^2 - 13$ at the points $(2,1,2)$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of vector Calculus, Show that the vector $\vec{F} = (y+z)i + (z+x)j + (x+y)k$ is irrotational. Also find the scalar function $\emptyset$ such that $\vec{F} = \nabla\emptyset$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(c)</td><td>Make use of the vector $\vec{A} = 2x\hat{\imath} - 3y^2\hat{\jmath} + xz\hat{k}$ and express $\vec{A}$ in Cylindrical system.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td colspan="5">PART –B</td></tr>
<tr><td>3(a)</td><td>Apply Runge-Kutta method of fourth order, find $y(0.2)$, given that $\frac{dy}{dx} = \sqrt{x+y}, y(0) = 1$ taking $h = 0.2$</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Solve $\int_0^2 \int_1^2 (x^2 + y^2)\, dxdy.$</td><td>5</td><td>CO4</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>4(a)</td><td>Apply Milnes predictor -corrector method ,find $y(2.0)$ solve $\frac{dy}{dx} = \frac{1}{2}(x+y)$
<table>
<tr><td>x</td><td>0</td><td>0.5</td><td>1.0</td><td>1.5</td></tr>
<tr><td>y</td><td>2</td><td>2.636</td><td>3.595</td><td>4.968</td></tr>
</table></td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Solve $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\, dzdydx$</td><td>5</td><td>CO4</td><td>K3</td></tr>
</table>

Mamatha.N

Name & Signature of Course In charge:

Mamatha

Name & Signature of ModuleCoordinator:

Dr. Venkataramana BS

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Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 EVEN SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT-CSE
Course Title : Mathematics-II for CSE stream
Semester : II
Course Type / Code : Integrated/BMATS201
Max Marks : 25

Q.NO.	POINTS	MARKS
1a)	$\nabla\phi = 2xyz^3\hat{i} + x^2z^3\hat{j} + 3z^2x^2y\hat{k}$, $(\nabla\phi)_{(1,1,1)} = 2\hat{i}+\hat{j}+3\hat{k} \rightarrow$	$\boxed{2M}$
	$\hat{D} = \frac{\hat{i}+\hat{j}+2\hat{k}}{\sqrt{6}}$, $\nabla\phi\cdot\hat{D} = (2\hat{i}+\hat{j}+3\hat{k})\cdot\left(\frac{\hat{i}+\hat{j}+2\hat{k}}{\sqrt{6}}\right) = \frac{3\sqrt{6}}{2} \rightarrow$	$\boxed{1+2M}$
		5M
b)	$\left.\begin{array}{l} \text{div}\vec{F} = 6x+6y+6z \quad \text{at}(1,2,3) \end{array}\right] \longrightarrow$ $(\text{div}\vec{F})_{(1,2,3)} = 36$	$\boxed{2M}$
	$\text{curl}\vec{F} = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 3x^2-3yz & 3y^2-3xz & 3z^2-3xy \end{vmatrix} = 0 \quad \therefore \vec{F}$ is irrotational $\rightarrow$	$\boxed{3M}$
		5M
c)	$\vec{r} = \rho\cos\phi\, i + \rho\sin\phi\, j + zk$, $h=1$, $h_2=\rho$, $h_3=1 \rightarrow$	$\boxed{1M}$
	$\hat{e}_\rho = \cos\phi\, i + \sin\phi\, j + 0k$, $\hat{e}_\phi = -\sin\phi\, i + \cos\phi\, j$, $\hat{e}_z = 1k \rightarrow$	$\boxed{2M}$
	$\hat{e}_\rho\cdot\hat{e}_\phi = 0$, $\hat{e}_\phi\cdot\hat{e}_z = 0$, $\hat{e}_z\cdot\hat{e}_\rho = 0 \rightarrow$	$\boxed{2M}$
		5M
	$\boxed{OR}$	
2a)	$\phi = x^2+y^2-z^2-4$, $\nabla\phi = 2xi+2yj-2zk$, $(\nabla\phi)_{(2,1,2)} = 4i+2j-4k$ $\lvert\nabla\phi\rvert = 6, \ldots \lvert a\rvert$, $\psi = x^2+y^2-z-13$, $(\nabla\psi)_{(2,1,2)} = (4i+2j-k) \rightarrow$	$\boxed{3M}$
	$\lvert\nabla\psi\rvert = \sqrt{21} \ldots \lvert b\rvert$ $\cos\theta = \frac{\vec{a}\cdot\vec{b}}{\lvert\vec{a}\rvert\lvert\vec{b}\rvert} = \frac{(4i+2j-4k)\cdot(4i+2j-k)}{6\sqrt{21}} = \frac{4}{\sqrt{21}} \rightarrow \theta = \cos^{-1}\left(\frac{4}{\sqrt{21}}\right) \rightarrow$	$\boxed{2M}$
		5M
b)	$\nabla\times\vec{F} = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ y+z & z+x & x+y \end{vmatrix} = 0 \quad \therefore \vec{F}$ is irrotational $\longrightarrow$	$\boxed{2M}$
	$\frac{\partial\phi}{\partial x} = yx+zx+f(y,z)$, $\partial\phi/\partial y = zy+xy+f(x,z)$ $\partial\phi/\partial z = xz+yz+f(x,y)$ $\therefore \phi = xy+yz+zx \rightarrow$	$\boxed{3M}$ 5M

Q.NO.	POINTS	MARKS
c)	Let $\vec{A}=A_1\hat{e}_\rho+A_2\hat{e}_\phi+A_3\hat{e}_z$, $A_1=\vec{A}.\hat{e}_\rho$, $A_2=\vec{A}.\hat{e}_\phi$, $A_3=\vec{A}.\hat{e}_z$	2M
	$\hat{e}_\rho=\cos\phi i+\sin\phi j$, $\hat{e}_\phi=-\sin\phi i+\cos\phi j$, $\hat{e}_z=k$	
	$A_1=2\rho\cos^2\phi-3\rho^2\sin^3\phi$, $A_2=-2\rho\sin\phi\cos\phi-3\rho^2\sin^2\phi\cos\phi$	2+1M
	$A_3=(\rho\cos\phi z)\hat{e}_z$ $\therefore\vec{A}=(2\rho\cos^2\phi-3\rho^2\sin^3\phi)\hat{e}_\rho-(2\rho\sin\phi\cos\phi-3\rho^2\sin^2\phi\cos\phi)\hat{e}_\phi$ $+(\rho\cos\phi z)\hat{e}_z$	5M
	Part - B	
3a)	$k_1=hf(x_0,y_0)=0.2$, , $k_2=hf[x_0+\frac{h}{2}, y_0+\frac{k_1}{2}]=0.219$	4M
	$k_3=hf[x_0+\frac{h}{2}, y_0+\frac{k_2}{2}]=0.2199$, $k_4=hf[x_0+h, y_0+k_3]=0.2383$	
	$y(x_0+h)=y_0+\frac{1}{6}[k_1+2k_2+2k_3+k_4]=1.21935$	1M 5M
b)	$I=\int_0^2\int_1^2(x^2+y^2)dxdy=\int_0^2\left[\frac{x^3}{3}+y^2x\right]_1^2=\frac{22}{3}$	1+4M 5M
	OR	
4a)	$f_0=1$, $f_1=1.568$, $f_3=2.2975$, $f_4=3.234$	2M
	$y_4^{(p)}=y_0+\frac{4h}{3}[2f_1-f_2+2f_3]=6.872$	1M
	$y_4^{(c)}=y_2+\frac{h}{3}[f_2+4f_3+f_4^{(p)}]=6.8731$, $f_4^{(p)}=4.4355$	1M
	again apply corrector formula, $y_4^{(c)}=6.8733$, $f_4^{(c)}=4.4365$	1M 5M
	$\therefore\langle y(2.0)=6.8733\rangle$	
b)	$I=\int_0^a\int_0^x\int_0^{x+y}e^{x+y+z}dzdydx=\int_0^a\int_0^x e^{x+y}\left.e^z\right]_0^{x+y}dydx$	1M
	$=\int_0^a\left[\frac{e^{4x}}{2}-\frac{e^{2x}}{2}-e^{2x}+e^x\right]dx=\frac{e^{4a}}{8}-\frac{3e^{2a}}{4}+e^a-\frac{3}{8}$	3+1M 5M

Namatha

Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

THIRD INTERNAL TEST QUESTION PAPER 2022-23EVENSEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree : **B.E**
Branch - Stream : **CSE/CSD/AIML/CCE/IOT-CSE**
Course Title : **Mathematics-II for CSE stream**
Duration : **60 Minutes**

Semester : **II**
Course Type / Code : **Integrated/BMATS201**
Date : **31-08-2023**
Max Marks : **25**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** vector addition is defined by, $(x_1, x_2) + (y_1, y_2) = (x_1 + y_1, x_2 + y_2)$, for all $(x_1, x_2), (y_1, y_2) \in C$ and scalar multiplication is defined by, $\alpha(x_1, x_2) = (\alpha x_1, \alpha x_2)$, for all $\alpha \in R$, prove that the set C of all complex numbers is a vector space over the field R of all real numbers.	5	CO5	K3
(b)	**Make use of** $W = \left\{ \begin{bmatrix} x & y \\ z & 0 \end{bmatrix} : x, y, z \in R \right\}$, determine whether W is a subspace of V, where V is the vector space of all square matrices over R.	5	CO5	K3
(c)	**Make use of** the vectors $v_1 = (1,1,1), v_2(1,2,3), v_3 = (2,-1,1)$ in the vector space $R^3(R)$, express the vector $v = (1,-2,5)$ as a linear combination of v_1, v_2 and v_3.	5	CO5	K3
	OR			
2(a)	**Make use of** the transformation $T: R^3 \to R^3$ defined by $T(x, y, z) = (y, -x, -z)$, show that T is linear transformation.	5	CO5	K3
(b)	**Make use of** the vectors $u_1 = (1,2,0),\ u_2(1,3,2),\ u_3 = (0,1,3)$ which forms a basis S of R^3, find the change of basis matrix P from the usual basis $E = \{e_1, e_2, e_3\}$ of R_3 to the basis S. Also find the change of basis matrix Q from the above basis S back to the usual basis E of R^3.	5	CO5	K3
(c)	**Make use of** the polynomials $f(t) = t + 2,\ g(t) = 3t - 2$ and inner product $\langle f, g\rangle = \int_0^1 f(t)g(t)dt$, find $\langle f, g\rangle$ and $\|f\|$.	5	CO5	K3
	PART –B			
3(a)	**Make use of** double integration, find the area of the circle $x^2 + y^2 = a^2$.	5	CO4	K3
(b)	**Utilize** the concepts of beta and gamma functions, show that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$	5	CO4	K3
	OR			
4(a)	**Solve** $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\, dx\, dy$ by changing into polar form.	5	CO4	K3
(b)	**Make use of** double integration; find the volume generated by the revolution of the cardioid $r = a(1 + \cos\theta)$ about the initial line.	5	CO4	K3

Name & Signature of Course In charge:
(Sneha G Kulkarni)

Name & Signature of Module Coordinator:
(Dr. Venkataraman BS)

HOD

Kumar. L
Principal
Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 EVEN SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : CSE/AIML/CSD/CCE/IOT-CSE
Course Title : Mathematics-II for CSE stream
Semester : II
Course Type / Code : Integrated/BMATS201
Max Marks : 25

Q.NO.	POINTS	MARKS
1(a)	(i) Associativity: $(x_1,x_2)+[(y_1,y_2)+(z_1,z_2)]=[(x_1,x_2)+(y_1,y_2)]+(z_1,z_2)$	1
	(ii) Commutativity: $(x_1,x_2)+(y_1,y_2)=(y_1,y_2)+(x_1,x_2)$	1
	(iii) Existence of identity: $(0,0)+(x_1,x_2)=(x_1,x_2)=(x_1,x_2)+(0,0)$	1
	(iv) Existence of inverse: $(x_1,x_2)+(-x_1,-x_2)=(0,0)=(-x_1,-x_2)+(x_1,x_2)$	1
	(v) $\alpha[(x_1,x_2)+(y_1,y_2)]=\alpha(x_1,x_2)+\alpha(y_1,y_2)$, (vi) $1\cdot(x_1,x_2)=(x_1,x_2)$	1
	(vii) $(a+b)(x_1,x_2)=a(x_1,x_2)+b(x_1,x_2)$ (viii) $a(b(x_1,x_2))$ $=(ab)(x_1,x_2)$	1
(b)	$a,b\in R$ & $A,B\in W$. $aA+bB=a\begin{bmatrix}x_1 & y_1\\ z_1 & 0\end{bmatrix}+b\begin{bmatrix}x_2 & y_2\\ z_2 & 0\end{bmatrix}$	2
	$aA+bB=\begin{bmatrix}ax_1+bx_2 & ay_1+by_2\\ 0z_1+bz_2 & 0\end{bmatrix}\doteq\begin{bmatrix}x_3 & y_3\\ z_3 & 0\end{bmatrix}$, ax_1+bx_2 $ay_1+by_2\in R$ az_1+bz_2	2
	$\therefore W$ is a sub-space of V.	1
(c)	Let $V=a_1V_1+a_2V_2+a_3V_3$; $a_1,a_2,a_3\in R$.	1
	$(1,-2,5)=a_1(1,1,1)+a_2(1,2,3)+a_3(2,-1,1)$	
	$\Rightarrow a_1+a_2+2a_3=1$; $a_1+2a_2-a_3=-2$, $a_1+3a_2+a_3=5$	2
	Solving above equations, $a_1=-6$, $a_2=3$, $a_3=2$	1
	$(1,-2,5)=-6(1,1,1)+3(1,2,3)+2(2,-1,1)$	1
2(a)	$T(u)=T(x_1,y_1,z_1)=(y_1,-x_1,-z_1)$, $T(v)=T(x_2,y_2,z_2)$	
	$=(y_2,-x_2,-z_2)$. $T(u+v)=T(x_1+x_2,y_1+y_2,z_1+z_2)$	2
	$T(u+v)=(y_1+y_2,-x_1-x_2,-z_1-z_2)=(y_1,-x_1,-z_1)+(y_2,-x_2,-z_2)$	2
	$T(u+v)=T(u)+T(v)$.	
	$T(au)=T(ax_1,ay_1,az_1)=(ay_1,-ax_1,-az_1)=aT(u)$	1
(b)	E is a usual basis of R^3, $P=\begin{bmatrix}1 & 1 & 0\\ 2 & 3 & 1\\ 0 & 2 & 3\end{bmatrix}$ & $Q=P^{-1}=\begin{bmatrix}7 & -3 & 1\\ -6 & 3 & -1\\ 4 & -2 & 1\end{bmatrix}$	3 2

Q.NO.	POINTS	MARKS
(c)	$\langle f,g\rangle = \int_0^1 (t+2)(3t-2)\,dt = \int_0^1 (3t^2+4t-4)\,dt = -1$	2
	$\langle f,f\rangle = \int_0^1 (t+2)(t+2)\,dt = \int_0^1 (t^2+4t+4)\,dt = \frac{19}{3}$	2
	$\lVert f\rVert = \sqrt{\frac{19}{3}} = \frac{\sqrt{57}}{3}$	1
3(a)	Considering the Equation of circle in polar form: r varies from 0 to `a' and θ varies from 0 to 2π.	1
	$A = \iint r\,dr\,d\theta = \int_{\theta=0}^{2\pi}\int_{r=0}^{a} r\,dr\,d\theta = \int_{\theta=0}^{2\pi}\left[\frac{r^2}{2}\right]_0^a d\theta$	2
	$= \int_0^{2\pi} \frac{a^2}{2}\,d\theta = \frac{a^2}{2}\left[\theta\right]_0^{2\pi} = \frac{a^2}{2}(2\pi) = \pi a^2$ sq. unit	2
(b)	$B(m,n) = 2\int_0^{\pi/2} \sin^{2m-1}\theta\,\cos^{2n-1}\theta\,d\theta$, $\Gamma(n) = 2\int_0^{\infty} e^{-x^2} x^{2n-1}\,dx$	
	$\Gamma(m)\Gamma(n) = 4\int_0^{\infty}\int_0^{\infty} e^{-(x^2+y^2)} x^{2n-1} y^{2m-1}\,dx\,dy$	2
	wkt $x = r\cos\theta, y = r\sin\theta, dx\,dy = r\,dr\,d\theta, x^2+y^2 = r^2$	
	$r \to 0$ to ∞, $\theta \to 0$ to $\pi/2$.	
	$\Gamma(m)\Gamma(n) = 4\int_{\theta=0}^{\pi/2}\int_{r=0}^{\infty} e^{-r^2} r^{2(n+m)-1} \sin^{2m-1}\theta\cos^{2n-1}\theta\,dr\,d\theta$	1
	$= \left(2\int_0^{\infty} e^{-r^2} r^{2(n+m)-1}\,dr\right)\left(2\int_0^{\pi/2} \sin^{2m-1}\theta\cos^{2n-1}\theta\,d\theta\right)$	1
	$\Gamma(m)\Gamma(n) = \Gamma(m+n)\,\beta(m,n)$	1
	$\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n}$	
4(a)	$x = r\cos\theta, y = r\sin\theta, x^2+y^2 = r^2, dx\,dy = r\,dr\,d\theta$. $r \to 0$ to ∞	1
	$\theta \to 0$ to $\pi/2$. $I = \int_{\theta=0}^{\pi/2}\int_{r=0}^{\infty} e^{-r^2} r\,dr\,d\theta$. put $r^2 = t \Rightarrow r\,dr = \frac{dt}{2}$	2
	$\therefore I = \int_0^{\pi/2}\int_0^{\infty} e^{-t}\frac{dt}{2}\,d\theta = \pi/4$	2
(b)	$V = \int_{\theta=0}^{\pi}\int_{r=0}^{a(1+\cos\theta)} 2\pi r^2 \sin\theta\,dr\,d\theta = \frac{2\pi a^3}{3}\int_0^{\pi} \sin\theta(1+\cos\theta)^3\,d\theta = \frac{8\pi a^3}{3}$	2 2 1

Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
THIRD INTERNAL TEST QUESTION PAPER 2022-23EVENSEMESTER

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree : B.E
Branch - Stream : CSE/CSD/AIML/CCE/IOT-CSE
Course Title : Mathematics-II for CSE stream
Duration : 60 Minutes

Semester : II
Course Type / Code : Integrated/BMATS201
Date : 31-08-2023
Max Marks : 25

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** vector addition and scalar multiplication defined by, $(f_1 + f_2)x = f_1(x) + f_2(x)$ for all $f_1, f_2 \in V$ and $(\alpha f_1)x = \alpha f_1(x)$, for all $\alpha \in R, f_1 \in V$, prove that the set V of all real valued continuous functions of x defined on interval $[0,1]$ is a vector space over the field R of all real numbers.	5	CO5	K3
(b)	**Make use of** $W = \left\{\begin{bmatrix} x & 0 \\ 0 & y \end{bmatrix} : x, y \in R\right\}$, determine whether W is a subspace of V, where V is the vector space of all square matrices over R.	5	CO5	K3
(c)	**Make use of** the vectors $u_1 = (2,1,3), u_2(1,-1,1), u_3 = (3,1,5)$ in the vector space $R^3(R)$, express the vector $v = (1,3,9)$ as a linear combination of u_1, u_2 and u_3.	5	CO5	K3
	OR			
2(a)	**Make use of** the transformation $T: R^3 \to R^2$ defined by $T(x, y, z) = (2x - 3y, 7y + 2z)$, show that T is linear transformation.	5	CO5	K3
(b)	**Utilize** the Rank-nullity theorem, verify $T: R^3 \to R^3$ defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$.	5	CO5	K3
(c)	**Make use of** linear combination, determine whether the vectors $v_1 = (1,2,3)$, $v_2 = (3,1,7)$ and $v_3 = (2,5,8)$ are linearly independent.	5	CO5	K3
	PART –B			
3(a)	**Make use of** double integration; find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.	5	CO4	K3
(b)	**Utilize** the definition of gamma functions, prove that $\Gamma(1/2) = \sqrt{\pi}$	5	CO4	K3
	OR			
4(a)	**Solve** $\int_0^1 \int_x^{\sqrt{x}} xy \, dy \, dx$ by changing the order of integration.	5	CO4	K3
(b)	**Solve** $\int_{-a}^{a} \int_0^{\sqrt{a^2-x^2}} \sqrt{x^2 + y^2} \, dy \, dx$ by changing into polar form.	5	CO4	K3

Lakshmi.C

Name & Signature of Course In charge:

(Lakshmi.C)

Name & Signature of Module Coordinator:

(Dr. Venkataraman B S)

HOD

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 EVEN SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E

Branch - Stream : CSE/AIML/CSD/CCE/IOT-CSE

Course Title : Mathematics-II for CSE stream

Semester : II

Course Type / Code : Integrated/BMATS201

Max Marks : 25

Q.NO.	POINTS	MARKS
1(a)	Associativity : $[(f_1+f_2)+f_3] = f_1+(f_2+f_3)$	1
	Commutativity : $(f_1+f_2)(x) = (f_2+f_1)(x)$	1
	Existence of identity : $(0+f_1)(x) = f_1(x) = (f_1+0)(x)$	
	Existence of inverse : $[f_1+(-f_1)](x) = 0(x) = [-f_1+f_1](x)$	2
	$\alpha(f_1+f_2) = \alpha f_1+\alpha f_2$, $(a+b)f_1 = af_1+bf_1$,	1
	$a(bf_1) = (ab)f_1$, $1\cdot f_1 = f_1$	
(b)	$aA+bB = \begin{bmatrix} ax_1+bx_2 & 0 \\ 0 & ay_1+by_2 \end{bmatrix}$	4
	$\therefore aA+bB \in W$	1
	$\Rightarrow W$ is a subspace of V.	
(c)	$2x+y+3z=1$, $x-y+z=3$, $3x+y+5z=9$	2
	$\Rightarrow x=-12$, $y=-5$, $z=10$.	3
2(a)	$T(u+v) = T(x_1+x_2, y_1+y_2, z_1+z_2) = (2x_1+2x_2-3y_1-3y_2, 7y_1+7y_2+2z_1+2z_3)$	
	$= (2x_1-3y_1, 7y_1+2z_1) + (2x_2-3y_2, 7y_2+2z_2)$	3
	$= T(u)+T(v)$	
	$T(au) = (2ax_1-3ay_1, 7ay_1+2az_1) = a(2x_1-3y_1, 7ay_1+2z_1)$	2
	$= aT(u)$	
(b)	$\text{Rank}(T) = 2$, $\text{Nullity}(T) = 1$.	2 + 2
	$\text{Rank}(T) + \text{Nullity}(T) = 2+1 = 3 = \dim R^3$	1.

Q.NO.	POINTS	MARKS
(C)	$x+3y+2z=0,\ 2x+y+5z=0,\ 3x+7y+8z=0$	3
	$\Rightarrow x=0,\ y=0,\ z=0$	2
	$\Rightarrow$ vectors V_1, V_2, V_3 are linearly independent	
3(a)	$A = 4\iint_R dx\,dy = 4\int_{y=0}^{b}\int_{x=0}^{a/b\sqrt{b^2-y^2}} dx\,dy$	3
	$= \frac{4a}{b}\left[\frac{y}{2}\sqrt{b^2-y^2}+\frac{b^2}{2}\sin^{-1}\left(\frac{y}{b}\right)\right]_0^b = \pi ab$ sq. unit	2
(b)	wkt $\Gamma n = 2\int_0^\infty e^{-x^2}x^{2n-1}dx$, $\Gamma(1/2) = 2\int_0^\infty e^{-x^2}dx$	1
	$[\Gamma(1/2)]^2 = 4\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}dx\,dy$, $r\to 0$ to ∞, $\theta\to 0$ to $\frac{\pi}{2}$	2
	$\therefore [\Gamma(1/2)]^2 = 4\int_{\theta=0}^{\pi/2}\int_{t=0}^{\infty} e^{-t}\frac{dt}{2}d\theta \Rightarrow [\Gamma(1/2)]^2 = \pi$	2
	$\Gamma(1/2) = \pi$	
4(a)	Given $x=0,\ x=1,\ y=x,\ y=\sqrt{x} \Rightarrow y^2=x$	1 1
	$(0,0), (1,1)$ are intersecting points.	3
	$\therefore I = \int_{y=0}^{1}\int_{x=y^2}^{y} xy\,dx\,dy = \frac{1}{24}$	
(b)	$x = r\cos\theta,\ y = r\sin\theta,\ x^2+y^2=r^2.$	1
	$dx\,dy = r\,dr\,d\theta$. r varies from 0 to a	1
	θ varies from 0 to π.	3
	$I = \int_{\theta=0}^{\pi}\int_{r=0}^{a} r^2\,dr\,d\theta = \frac{\pi a^3}{3}$	

Lakshmi

Course Incharge **Module Coordinator** **HOD**

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

FIRST INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

USN										

SET: A

Degree : B.E
Branch - Stream : ECE - EEE
Course Title : Mathematics – II for EEE stream
Duration : 60 Minutes

Semester : II
Course Type / Code : Integrated/BMATE201
Date : 26/06/2023
Max Marks : 25

Note: Answer **ONE full** question from each part.
K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

<table>
<tr><th>Q No.</th><th>Questions</th><th>Marks</th><th>CO</th><th>K-Level</th></tr>
<tr><td colspan="5">PART-A</td></tr>
<tr><td>1(a)</td><td>Make use of Regula falsi method, find the real root of the equation $\cos x = 3x - 1$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Newton forward interpolation formulae to find the values of f(38)
<table>
<tr><td>x</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td><td>90</td></tr>
<tr><td>f(x)</td><td>184</td><td>204</td><td>226</td><td>250</td><td>276</td><td>304</td></tr>
</table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's $\frac{3}{8}$th rule to solve $\int_4^{5.2} \log_e x$ dividing the interval into six equal parts.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>2(a)</td><td>Apply Newton - Raphson method, find a real root of the equation $x \sin x + \cos x = 0$ which lies near $x = \pi$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Lagrange's formula, find the value of y at x=10 from the following data
<table>
<tr><td>x</td><td>5</td><td>6</td><td>9</td><td>11</td></tr>
<tr><td>f(x)</td><td>12</td><td>13</td><td>14</td><td>16</td></tr>
</table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's $\frac{1}{3}$ rd rule to solve $\int_0^6 3x^2 dx$ dividing the interval into six equal parts.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">PART –B</td></tr>
<tr><td>3(a)</td><td>Make use of Taylor's series method to obtain the solution of $\frac{dy}{dx} = 2y + 3e^x$ y(0) = 0 at y (0.2).</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of modified Euler's method, Solve the initial value problem $\frac{dy}{dx} = 1 + \frac{y}{x}, y(1) = 2.$and find y(1.2) by taking h=0.2</td><td>5</td><td>CO2</td><td>K3</td></tr>
</table>

	OR			
4(a)	**Employ** Euler's modified method to find y(1.4) given $\frac{dy}{dx} = \log(x+y)$ y(1) = 2.	**5**	**CO2**	**K3**
(b)	**Make use of** Taylor's series method to solve $\frac{dy}{dx} = x - y^2$, $y(0) = 1$, find y (0.1).	**5**	**CO2**	**K3**

Name & Signature of Course In charge:

NAVEEN.V

Name & Signature of Module Coordinator:

Dr Venkataramana BS

HOD

Principal

130

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
FIRST INTERNAL TEST 2022 – 23 EVEN SEMESTER

SET- A

SCHEME AND SOLUTION

Degree :B.E
Branch - stream : ECE - EEE
Course Title :Mathematics for EES Stream - 2
Semester : II
Course Type / Code :Integrated/ BMATE201
Max Marks : 25

Q.NO.	PART-A POINTS	MARKS
1a)	$f(x) = \cos x + 1 - 3x$	
	root lies in $(0,1)$	
	$f(0.6) = 0.0253 > 0$ $f(0.7) = -0.3352 < 0$	$\xrightarrow{}$ 1m
	$\therefore$ The root lies in $(0.6, 0.7)$	
	1st iteration; $x_1 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.607$	$\xrightarrow{}$ 2m
	2nd iteration; $f(0.607) = 0.00036 > 0$	
	the root lies in $(0.607, 0.7)$	
	$x_2 = 0.607$ $\therefore$ The real root correct to 3 decimals is 0.607	$\xrightarrow{}$ 2m
		5M
b)	$\Delta y_0 = 20$, $\Delta y_1 = 22$, $\Delta y_2 = 24$, $\Delta y_3 = 26$, $\Delta y_4 = 28$	
	$\Delta^2 y_0 = 2$, $\Delta^2 y_1 = 2$, $\Delta^2 y_2 = 2$, $\Delta^2 y_3 = 2$	$\xrightarrow{}$ 3m
	$\Delta^3 y_0 = 0$, $\Delta^3 y_1 = 0$, $\Delta^3 y_2 = 0$, $r = \frac{x - x_0}{h} = -0.2$	$\xrightarrow{}$ 1m
	$y_r = y_0 + r\Delta y_0 + \frac{r(r-1)}{2!}\Delta^2 y_0 + \cdots$	$\xrightarrow{}$ 1m
		5M
	$f(38) = 180.24$	
c)	$h = 0.2$ $n = 6$	$\xrightarrow{}$ 3m

x	4	4.2	4.4	4.6	4.8	5.0	5.2
y	1.3863	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

	$I = \frac{3h}{8}[(y_0 + y_6) + 3(y_1 + y_2 + y_4 + y_5) + 2(y_3)] = 1.8279$	$\xrightarrow{}$ 2m
		5M
	OR	
2a)	$f(x) = x\sin x + \cos x$; The root lies in $(-3, -2)$	
	Let $x_0 = \pi$; 1st iteration: $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 2.8232$	$\xrightarrow{}$ 2m
	2nd iteration: $x_2 = 2.7987$, 3rd iteration: $x_3 = 2.7984$	
	4th iteration: $x_4 = 2.7982$, 5th iteration: $x_5 = 2.7983$	3M
		5M

2b) $y=f(x)=\frac{(x-x_1)(x-x_2)(x-x_3)}{(x_0-x_1)(x_0-x_2)(x_0-x_3)}y_0+\frac{(x-x_0)(x-x_2)(x-x_3)}{(x_1-x_0)(x_1-x_2)(x_1-x_3)}y_1+$ $\rightarrow \boxed{2m}$

$\frac{(x-x_0)(x-x_1)(x-x_3)}{(x_2-x_0)(x_2-x_1)(x_2-x_3)}y_2+\frac{(x-x_0)(x-x_1)(x-x_2)}{(x_3-x_0)(x_3-x_1)(x_3-x_2)}y_3$

$\langle y=f(10)=14.67\rangle$ $\rightarrow \boxed{3m}$

5M

2c) $h=1$, $n=6$ $\rightarrow \boxed{3m}$

x	0	1	2	3	4	5	6
y	0	3	12	27	48	75	108

$I=\frac{h}{3}[(y_0+y_6)+4(y_1+y_3+y_5)+2(y_2+y_4)]=216$ $\rightarrow \boxed{1+1m}$

5M

Part-B

3a) $y(x)=y(x_0)+(x-x_0)y'(x_0)+\frac{(x-x_0)^2}{2!}y''(x_0)+\frac{(x-x_0)^3}{3!}y'''(x_0)+\cdots$ $\rightarrow \boxed{1m}$

$y'=2y+3e^x \Rightarrow y'(0)=3$, $y'''=2y''+3e^x \Rightarrow y'''(0)=21$

$y''=2y'+3e^x \Rightarrow y''(0)=9$ $\quad y^{iv}=2y'''+3e^x \Rightarrow y^{iv}(0)=45$ $\rightarrow \boxed{3m}$

$y(x)=3x+\frac{x^2}{2}(9)+\frac{x^3}{6}(21)+\frac{x^4}{24}(45)$ $\rightarrow \boxed{1m}$

$\langle y(0.2)=0.811\rangle$ $\rightarrow \boxed{1m}$

5M

3b) $f(x,y)=1+y/x$, $x_0=1$, $y_0=2$, $h=0.2$ $\rightarrow \boxed{2m}$

$f[x_0,y_0]=2.6$

$y_1^{(0)}=y_0+hf[x_0,y_0]$

$y_1^{(1)}=y_0+h/2[f(x_0,y_0)+f(x_1,y_1^{(0)})]=2.6167$

$y_1^{(2)}=y_0+h/2[f(x_0,y_0)+f(x_1,y_1^{(1)})]=2.6181$ $\rightarrow \boxed{3m}$

$y_1^{(3)}=y_0+h/2[f(x_0,y_0)+f(x_1,y_1^{(2)})]=2.6182$

5M

OR

4a) $f(x,y)=\log(x+y)$, $x_0=1$, $y_0=2$. Take $h=0.4$ $\rightarrow \boxed{2m}$

$y_1^{(0)}=2.4394$

$y_1^{(1)}=2.48878$ $\rightarrow \boxed{3m}$

$y_1^{(2)}=2.4913$

$y_1^{(3)}=2.4914$

5M

4b) $y(x)=y(x_0)+(x-x_0)y'(x_0)+\frac{(x-x_0)^2}{2!}y''(x_0)+\cdots\cdots$. Given $x_0=0$, $y_0=1$ $\rightarrow \boxed{1m}$

$y'=x-y^2 \Rightarrow y'(0)=-1$

$y''=1-2yy' \Rightarrow y''(0)=3$ $\rightarrow \boxed{3m}$

$y'''=0-2[yy''+(y')^2] \Rightarrow y'''(0)=-8$

$y^{iv}=0-2[yy'''+y'y''+2y'y''] \Rightarrow y^{iv}(0)=\underline{-17}$

$y(x)=1-x+3x^2/2-\frac{4x^3}{3}-\frac{17x^4}{24}$ $\rightarrow \boxed{1m}$

$y(0.1)=0.9138$

5M

Mamatha

Course In-charge

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

FIRST INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

SET: B

USN | | | | | | | | | |

Degree :	**B.E**	**Semester** :	**II**
Branch - Stream :	**ECE - EEE**	**Course Type / Code** :	**Integrated/BMATE201**
Course Title :	**Mathematics – II for EEE stream**	**Date** :	**26/06/2023**
Duration :	**60 Minutes**	**Max Marks** :	**25**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

<table>
<tr><th>Q No.</th><th>Questions</th><th>Marks</th><th>CO</th><th>K-Level</th></tr>
<tr><td colspan="5">PART-A</td></tr>
<tr><td>1(a)</td><td>Make use of Regula falsi method, find the real root of the equation $xe^x - \cos x = 0$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Newton's interpolation formula, to find y(1.4) using following data
<table>
<tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Y</td><td>10</td><td>26</td><td>58</td><td>112</td><td>194</td></tr>
</table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's 3/8th rule to evaluate $\int_0^{\frac{\pi}{2}} e^{\sin x} dx$ by taking 7 ordinates.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>2(a)</td><td>Make use of Newton - Raphson method, find a real root of the equation $x\sin x + \cos x = 0$ which lies near $x = \pi$</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(b)</td><td>Apply Newton's-divided difference formula to find f(9),given data
<table>
<tr><td>X</td><td>5</td><td>7</td><td>11</td><td>13</td><td>17</td></tr>
<tr><td>f(x)</td><td>150</td><td>392</td><td>1452</td><td>2366</td><td>5202</td></tr>
</table></td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td>(c)</td><td>Apply Simpson's $\frac{1}{3}$ rd rule to evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by dividing the interval in to 6 equal parts.</td><td>5</td><td>CO1</td><td>K3</td></tr>
<tr><td colspan="5">PART –B</td></tr>
<tr><td>3(a)</td><td>Make use of Taylor's series method to obtain the solution of $\frac{dy}{dx} = x + y^2, y(0) = 1$ at y (0.1).</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of modified Euler's method, solve $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$ at x = 0.1 by taking h=0.1</td><td>5</td><td>CO2</td><td>K3</td></tr>
</table>

	OR			
4(a)	**Make use of** modified Euler's method, solve $\frac{dy}{dx} = 3x + \frac{y}{2}, y(0) = 1$ at x = 0.2 by taking h=0.2	5	CO2	K3
(b)	**Make use of** Taylor's series method to solve $\frac{dy}{dx} = xy - 1$ at x = 0.1 y(0) = 2.	5	CO2	K3

Lakshmi C

Name & Signature of
Course In charge

(Lakshmi C)

Name & Signature of
Module Coordinator

Dr. Venkataraman B.S

HOD

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
FIRST INTERNAL TEST 2022 – 23 EVEN SEMESTER

SET- B

SCHEME AND SOLUTION

Degree :B.E
Branch - stream : ECE - EEE
Course Title :Mathematics for EES Stream-2
Semester : II
Course Type / Code :Integrated/ BMATE201
Max Marks : 25

<table>
<tr><th>Q.NO.</th><th>POINTS</th><th>MARKS</th></tr>
<tr><td>1a)</td><td>$f(x) = xe^x - \cos x$
The root lie in $(0.5, 0.6)$, $f(0.5) = -0.0532 < 0$, $f(0.6) = 0.2679 > 0$ →
1st iteration; $x_1 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.5165$ →
2nd iteration; $x_2 = \frac{af(b) - bf(a)}{f(b) - f(a)} = 0.5176$ 3rd iteration $x_3 = 0.5177$ →</td><td>$\boxed{1M}$
$\boxed{2M}$
$\boxed{2M}$
5M</td></tr>
<tr><td>b)</td><td>$\Delta y_0 = 16$, $\Delta y_1 = 32$, $\Delta y_2 = 54$, $\Delta y_3 = 82$] →
$\Delta^2 y_0 = 16$, $\Delta^2 y_1 = 22$, $\Delta^2 y_2 = 28$
$\Delta^3 y_0 = 6$, $\Delta^3 y_1 = 6$, $\Delta^4 y_0 = 0$
$y_x = y_0 + r\Delta y_0 + \frac{r(r-1)}{2!}\Delta^2 y_0 + \frac{r(r-1)(r-2)}{3!}\Delta^3 y_0 + \dots$ $r = 0.4$ →
→
$y(1.4) = 14.864$</td><td>$\boxed{3M}$
$\boxed{1M}$
$\boxed{1M}$
5M</td></tr>
<tr><td>c)</td><td>$h = \pi/12$, $n = 6$] →
<table><tr><td>x</td><td>0</td><td>15°</td><td>30°</td><td>45°</td><td>60°</td><td>75°</td><td>90°</td></tr><tr><td>y</td><td>1</td><td>1.2953</td><td>1.6487</td><td>2.0281</td><td>2.3774</td><td>2.6272</td><td>2.71828</td></tr></table>$I = \frac{3h}{8}[(y_0 + y_6) + 3(y_1 + y_2 + y_4 + y_5) + 2(y_3)] = 3.1043$ →
$\boxed{OR}$</td><td>$\boxed{3M}$
$\boxed{1+1M}$
5M</td></tr>
<tr><td>2a)</td><td>$f(x) = x\sin x + \cos x$ Let $x_0 = \pi$
The root lie in $(-3, -2)$ →
1st iteration; $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 2.8232$ →
2nd iteration; $x_2 = 2.7987$ →
3rd iteration; $x_3 = 2.7984$ →
4th iteration; $x_4 = 2.7982$ →
5th iteration; $x_5 = 2.7983$ →</td><td>$\boxed{1M}$
$\boxed{1M}$
$\boxed{1M}$
$\boxed{1M}$
$\boxed{1M}$
5M</td></tr>
</table>

2b) $f(x_0,x_1)=121$ $f(x_1,x_2)=265$ $f(x_2,x_3)=457$ $f(x_3,x_4)=709$ → 3M

$f(x_0,x_1,x_2)=24$ $f(x_1,x_2,x_3)=32$ $f(x_2,x_3,x_4)=42$

$f(x_0,x_1,x_2,x_3)=1$ $f(x_1,x_2,x_3,x_4)=1$

$f(x)=f(x_0)+(x-x_0)f(x_0,x_1)+(x-x_0)(x-x_1)f(x_0,x_1,x_2)+\dots$ → 1M

$f(9)=810$ → 1M

5M

2c) $h=1/6$, $n=6$ → 3M

x	0	1/6	1/3	1/2	2/3	5/6	1
y	0	6/37	3/10	2/5	6/13	30/61	1/2

$I=\frac{h}{3}\left[(y_0+y_6)+4(y_1+y_3+y_5)+2(y_2+y_4)\right]=0.3466$ → 1+1M

5M

PART-B

3a) $y(x)=y(x_0)+(x-x_0)y'(x_0)+\frac{(x-x_0)^2}{2!}y''(x_0)+\dots$ → 1M

$y'=x+y^2 \Rightarrow y'(0)=1$ $y'''=2[yy''+(y')^2] \Rightarrow y'''(0)=8$ → 3M

$y''=1+2yy' \Rightarrow y''(0)=3$ $y^{iv}=2[yy'''+y'y''+2y'y'']=34$

$y(x)=1+x+\frac{3}{2}x^2+\frac{4}{3}x^3$ → 1M

$y(0.1)=1.1163$

5M

3b) $f(x,y)=(x^2+y^2)$, $x_0=0$, $y_0=1$ $h=0.1$ → 2M

$y_1^{(0)}=y_0+hf[x_0,y_0]=1.1$

$y_1^{(1)}=y_0+h/2[f(x_0,y_0)+f(x_1,y_1^{(0)})]=1.111$ → 3M

$y_1^{(2)}=1.1122$, $y_1^{(3)}=1.1123$ ∴ $y(0.1)=1.1123$

5M

OR

4a) $f(x,y)=3x+\frac{y}{2}$, $x_0=0$, $y_0=1$ $h=0.2$ → 2+3M

$y_1^{(0)}=1.15$ $y_1^{(1)}=1.1671$ $y_1^{(2)}=1.1675$ $y_1^{(3)}=1.1676$

∴ $y(0.2)=1.1676$

5M

4b) $y(x)=y(x_0)+(x-x_0)y'(x_0)+\frac{(x-x_0)^2}{2!}y''(x_0)+\dots$ → 1M

$y'=xy-1 \Rightarrow y'(0)=-1$ $y'''=xy''+(1)y'+y' \Rightarrow y'''(0)=-2$ → 3M

$y''=xy'+(1)y-0 \Rightarrow y''(0)=2$ $y^{iv}=xy'''+(1)y''+2y'' \Rightarrow y^{iv}(0)=6$

$y(x)=2-x+x^2-x^3/3+x^4/4$ → 1M

$y(0.1)=1.9096$

5M

Mamatha

Course In-charge

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
SECOND INTERNAL TEST QUESTION PAPER 2022-23 EVENSEMESTER

SET: A

USN ☐☐☐☐☐☐☐☐☐☐

Degree : **B.E**
Branch-Stream : **ECE - EES**
Course Title : **Mathematics-II for EE stream**
Duration : **60 Minutes**

Semester : **II**
Course Type / Code : **Integrated/BMATE201**
Date : **31-07-2023**
Max Marks : **25**

Note: Answer **ONE full** question from each part.
K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** $\emptyset = xyz$ find the directional derivative at $(1,1,1)$ in the direction of $3\hat{\imath} + 3\hat{\jmath} + 3\hat{k}$.	5	CO3	K3
(b)	**Make use of** Vector Calculus, Find the constants a & b such that the vector $\vec{F} = (axy + z^3)\hat{\imath} + (3x^2 - z)\hat{\jmath} + (bxz^2 - y)\hat{k}$ is irrotational and hence find the scalar function $\emptyset$ such that $\vec{F} = \nabla\emptyset$	5	CO3	K3
(c)	**Utilize** $\vec{F} = (3x^2 + 6y)\hat{\imath} - (14yz)\hat{\jmath} + (20xz^2)\hat{k}$ evaluate $\oint_c \vec{F}.\vec{dr}$ from (0,0,0) to (1,1,1) along the curve $x = t$, $y = t^2$ and $z = t^3$.	5	CO3	K3
	OR			
2(a)	**Choose** an appropriate formula and find the angle between the surfaces $xlogz = y^2 - 1$ & $x^2y = 2 - z$ at the point(1,1,1).	5	CO3	K3
(b)	**Make use of** vector Calculus, Show that the vector $\vec{F} = \frac{xi+yj}{x^2+y^2}$ is both solenoidal and irrotational.	5	CO3	K3
(c)	**Make use of** Green's theorem and evaluate $\oint(y - \sin x)dx + \cos x dy$ where c is a triangle in x-y plane bounded by the line y=0, x=π/2 and y=2x/π.	5	CO3	K3
	PART –B			
3(a)	**Apply** Runge-Kutta method of fourth order to find $y(0.2)$ given that $\frac{dy}{dx} = \frac{y-x}{y+x}$,$y(0) = 1$ By taking $h = 0.2$.	5	CO2	K3
(b)	**Solve** $L\left[\frac{1-\cos at}{t}\right]$.	5	CO4	K3
	OR			
4(a)	**Apply** Milne's predictor-corrector method solve $\frac{dy}{dx} = x - y^2$ and the data $y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762$ compute y at $x = 0.8$.	5	CO2	K3
(b)	**Solve** $L\left[\frac{\cos 2t - \cos 3t}{t} + t\sin at\right]$.	5	CO4	K3

Name & Signature of Course In charge:
NAVEEN.V

Name & Signature of Module Coordinator:
Dr. Venkataramana B S

HOD

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 EVEN SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ECE-EEE
Course Title : Mathematics-II for EEE stream
Semester : II
Course Type / Code : Integrated/BMATE201
Max Marks : 25

Q.NO.	POINTS	MARKS
	PART-A	
① a	$\nabla\phi = yz\hat{i} + xz\hat{k} + xy\hat{k}$ $\quad \nabla\phi_{(1,1,1)} = \hat{i}+\hat{j}+\hat{k}$	2
	$\nabla\phi\cdot\hat{A} = \sqrt{3}$ $\quad \hat{A} = \frac{3\hat{i}+3\hat{j}+3\hat{k}}{3\sqrt{3}}$	2+1
b.	$\nabla\times\vec{F} = 0$	
	$a = 6 \quad b = 3$	3
	$\phi = 3x^2y - yz + xz^3 + c$	2
c.	$\int_C \vec{F}\cdot d\vec{r} = \int_0^1 (9t^2 - 28t^6 + 60t^9)\,dt$	4
	$= 5$	1
② a.	$\nabla\phi_1 = \log z\,\hat{i} - 2y\hat{j} + \frac{x}{z}\hat{k}$ $\quad \nabla\phi_{1(1,1,1)} = -2\hat{j}+\hat{k}$	2
	$\nabla\phi_2 = 2xy\hat{i} + x^2\hat{j} + \hat{k}$ $\quad \nabla\phi_{2(1,1,1)} = 2\hat{i}+\hat{j}+\hat{k}$	2
	$\cos\theta = \frac{\nabla\phi_1\cdot\nabla\phi_2}{\lvert\nabla\phi_1\rvert\lvert\nabla\phi_2\rvert} = -1/\sqrt{30}$	1
b.	$\nabla\cdot\vec{F} = \frac{x^2+y^2-2x^2}{(x^2+y^2)^2} + \frac{x^2+y^2-2y^2}{(x^2+y^2)^2} = 0$	2
	$\nabla\times\vec{F} = 0$	3
c.	$\iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right)dy\,dx = \int_{x=0}^{\pi/2}\int_{y=0}^{2x/\pi}(-\sin x - 1)\,dy\,dx$	3
	$= \int_{x=0}^{\pi/2} -\frac{2}{\pi}(x\sin x + x)\,dx = \frac{-2}{\pi} - \pi/4$	1+1

Q.NO.	POINTS	MARKS
③ a.	PART - B $K_1 = 0.2$ $K_2 = 0.1666$	-2-
	$K_3 = 0.1661$ $K_4 = 0.1414$	-2-
	$y_1 = y_0 + K = 1.1678$	-1-
b.	$L\left[\frac{1-\cos at}{t}\right] = \int_s^\infty \left(\frac{1}{s} - \frac{s}{s^2+a^2}\right) ds$	-2-
	$= \log s - \frac{1}{2}\log(s^2+a^2) \Big\|_s^\infty$	-1-
	$= -\log \frac{s}{\sqrt{s^2+a^2}}$	-2-
④ a.	$f_1 = 0.1996$ $f_2 = 0.3936$	-1-
	$f_3 = 0.5689$ $y_4^{(P)} = 0.3049$	-2-
	$f_4^{(P)} = 0.7070$ $y_4^{(C)} = 0.3045$ $y(0.8) = 0.3045$	-2-
b.	$L\left[\frac{\cos 2t - \cos 3t}{t} + t \sin at\right]$	
	$= -\frac{1}{2} \log\left(\frac{s^2+2^2}{s^2+3^2}\right) + \frac{2as}{(s^2+a^2)^2}$	-3+2-

Course Incharge

Module Coordinator

HOD

K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109
SECOND INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

SET: B

USN ☐☐☐☐☐☐☐☐☐☐

Degree	: **B.E**	**Semester**	: **II**
Branch-Stream	: **ECE - EES**	**Course Type / Code**	: **Integrated/BMATE201**
Course Title	: **Mathematics-II for EE stream**	**Date**	: **31-07-2023**
Duration	: **60 Minutes**	**Max Marks**	: **25**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

<table>
<tr><th>Q No.</th><th>Questions</th><th>Marks</th><th>CO</th><th>K-Level</th></tr>
<tr><td colspan="5">PART-A</td></tr>
<tr><td>1(a)</td><td>Make use of $\emptyset = x^2yz^3$ to find the directional derivative at $(1,1,1)$ in the direction of the vector $\hat{\imath} + \hat{\jmath} + 2\hat{k}$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of Vector Calculus, Find div$\vec{F}$ and curl$\vec{F}$ at $(1,2,3)$ if $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(c)</td><td>Utilize $\vec{F} = xy\hat{\imath} + yz\hat{\jmath} + zx\hat{k}$ evaluate $\oint_c \vec{F}.\vec{dr}$ where C is the curve $x = t$, $y = t^2$ and $z = t^3$ and $-1 \le t \le 1$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>2(a)</td><td>Make use of Vector Calculus, Find the angle between the surfaces $x^2 + y^2 - z^2 = 4$ And $z = x^2 + y^2 - 13$ at the point $(2,1,2)$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(b)</td><td>Make use of vector Calculus, Show that the vector $\vec{F} = (y + z)i + (z + x)j + (x + y)k$ is irrotational. Also find the scalar function $\emptyset$ such that $\vec{F} = \nabla\emptyset$.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td>(c)</td><td>Make use of Stokes theorem and evaluate $\oint_c \vec{F}.\vec{dr}$ where $\vec{F} = (x^2 + y^2)\hat{\imath} - 2xy\hat{\jmath}$ and c is the rectangle in the x-y plane bounded by x=0 , x=a, y=0 and y=b.</td><td>5</td><td>CO3</td><td>K3</td></tr>
<tr><td colspan="5">PART –B</td></tr>
<tr><td>3(a)</td><td>Apply Runge-Kutta method of fourth order find $y(0.2)$ given that $\frac{dy}{dx} = \sqrt{x + y}, y(0) = 1$ taking $h = 0.2$</td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Solve $L\left[\frac{\cos at - \cos bt}{t} + t\sin at\right]$.</td><td>5</td><td>CO4</td><td>K3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>4(a)</td><td>Apply Milne's predictor -corrector method , find $y(2.0)$ Given $\frac{dy}{dx} = \frac{1}{2}(x + y)$
<table>
<tr><td>x</td><td>0</td><td>0.5</td><td>1.0</td><td>1.5</td></tr>
<tr><td>y</td><td>2</td><td>2.636</td><td>3.595</td><td>4.968</td></tr>
</table></td><td>5</td><td>CO2</td><td>K3</td></tr>
<tr><td>(b)</td><td>Solve $L\left[te^{-4t}\sin 5t\right]$</td><td>5</td><td>CO4</td><td>K3</td></tr>
</table>

Name & Signature of Course In charge:

(Dr. Jalaja.P)

Name & Signature of Module Coordinator:

Dr. Venkataraman BS

HOD

Principal

Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

II SESSIONAL TEST 2022-23 EVEN SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ECE-EEE
Course Title : Mathematics-II for EEE stream
Semester : II
Course Type / Code : Integrated/BMATE201
Max Marks : 25

Q.NO.	POINTS	MARKS
	PART-A	
① a.	$\nabla\phi = 2xyz^3\hat{i} + x^2z^3\hat{j} + 3z^2x^2y\hat{k}$	2
	$\nabla\phi_{(1,1,1)} = 2\hat{i} + \hat{j} + 3\hat{k}$ $\hat{A} = \frac{\hat{i}+\hat{j}+2\hat{k}}{\sqrt{6}}$	1+1
	$\nabla\phi \cdot \hat{A} = \frac{3\sqrt{6}}{2}$	1
b.	$\nabla\cdot\vec{F} = 6x+6y+6z$ $\nabla\cdot\vec{F}_{(1,2,3)} = 36$	3
	$\nabla\times\vec{F} = \vec{0}$	2
c.	$\int_C \vec{F}\cdot d\vec{r} = \int_{-1}^{1} (t^3 + 5t^6)\,dt$	4
	$\int_C \vec{F}\cdot d\vec{r} = 10/7$	1
② a.	$\nabla\phi_1 = 2x\hat{i} + 2y\hat{j} + (-2z)\hat{k}$ $\nabla\phi_{1(2,1,2)} = 4\hat{i}+2\hat{j}-4\hat{k}$	2
	$\nabla\phi_2 = 2x\hat{i} + 2y\hat{j} - \hat{k}$ $\nabla\phi_{2(2,1,2)} = 4\hat{i}+2\hat{j}-\hat{k}$	2
	$\cos\theta = \frac{\nabla\phi_1\cdot\nabla\phi_2}{\lvert\nabla\phi_1\rvert\lvert\nabla\phi_2\rvert} = 4/\sqrt{21}$	1
b.	$\nabla\times\vec{F} = \vec{0}$	3
	$\phi = xy + yz + zx + c$	2
c.	$\nabla\times\vec{F} = -4y\hat{k}$ $(\nabla\times\vec{F})\cdot\hat{n}\,ds = -4y\,dx\,dy$	2
	$\int_C \vec{F}\cdot d\vec{r} = \int_{x=0}^{a}\int_{y=0}^{b} -4y\,dy\,dx = -2ab^2$	3

Q.NO.	POINTS	MARKS
	PART- B	
③a.	$K_1 = 0.2$ $K_2 = 0.219$ $k_3 = 0.2199$	-3-
	$K_4 = 0.2383$ $y_1 = y_0 + K = 1.21935$	-2-
b.	$L\left[\frac{\cos at - \cos bt}{t} + t\sin at\right]$	
	$= -\frac{1}{2}\log\left(\frac{s^2+a^2}{s^2+b^2}\right) + \frac{2as}{(s^2+a^2)^2}$	-3+2-
④a.	$f_1 = 1.568$ $f_2 = 2.2975$	-1-
	$f_3 = 3.234$ $y_4^{(p)} = 6.872$	-2-
	$f_4^{(p)} = 4.4355$ $y_4^{(c)} = 6.8731$	-2-
	$y(2.0) = 6.8733$	
b.	$L\left[te^{-4t}\sin 5t\right]$	-1-
	$= L\left[t\sin 5t\right]_{s\to s+4}$	
	$= \left[(-1)\frac{d}{ds}\left(\frac{5}{s^2+5^2}\right)\right]_{s\to s+4}$	-2-
	$= \frac{10(s+4)}{(s+4)^2+5^2}$	-2-

Course Incharge

Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BENGALURU - 560109

THIRD INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

SET: A

USN

Degree : **B.E**
Branch - Stream : **ECE - EEES**
Course Title : **Mathematics-II for EEE stream**
Duration : **60 Minutes**
Semester : **II**
Course Type / Code : **Integrated/BMATE201**
Date : **31-08-2023**
Max Marks : **25**

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** vector addition is defined by, $(x_1, x_2) + (y_1, y_2) = (x_1 + y_1, x_2 + y_2\ )$, for all $(x_1, x_2), (y_1, y_2) \in C$ and scalar multiplication is defined by, $\alpha(x_1, x_2\ ) = (\alpha x_1, \alpha x_2)$, for all $\alpha \in R$, prove that the set C of all complex numbers is a vector space over the field R of all real numbers.	5	CO5	K3
(b)	**Make use of**$W = \left\{\begin{bmatrix} x & y \\ z & 0 \end{bmatrix} : x, y, z \in R\right\}$; determine whether W is a subspace of V, where V is the vector space of all square matrices over$R$.	5	CO5	K3
(c)	**Make use of** the vectors $v_1 = (1,1,1), v_2(1,2,3), v_3 = (2,-1,1)$ in the vector space$R^3(R)$, express the vector $v = (1,-2,5)$ as a linear combination of v_1, v_2 andv_3.	5	CO5	K3
	OR			
2(a)	**Make use of** the transformation $T: R^3 \rightarrow R^3$ defined by$T(x, y, z) = (y, -x, -z)$, show that T is linear transformation.	5	CO5	K3
(b)	**Make use of** the vectors $u_1 = (1,2,0)$, $u_2(1,3,2)$, $u_3 = (0,1,3)$ which forms a basis S of R^3, find the change of basis matrix P from the usual basis $E = \{e_1, e_2, e_3\}$ Of R_3 to the basis$S$. Also find the change of basis matrix Q from the above basis S back to the usual basis EofR^3.	5	CO5	K3
(c)	**Make use of** the polynomials $f(t) = t + 2,\ g(t) = 3t - 2$ and inner product$\langle f, g\rangle = \int_0^1 f(t)g(t)dt$, find $\langle f, g\rangle$ and$\lVert f \rVert$.	5	CO5	K3
	PART –B			
3(a)	**Make use of** the Periodic function definition to find $L[f(t)]$ $f(t) = \begin{cases} E; 0 < t < a/2 \\ -E; a/2 < t < a \end{cases}.$	5	CO4	K3
(b)	**Solve** $L^{-1}\left[\dfrac{1}{s(s^2 + a^2)}\right]$.	5	CO4	K3
	OR			
4(a)	**Construct** Unit step function for $f(t) = \begin{cases} \cos t; 0 < t < \pi \\ \cos 2t; \pi < t < 2\pi \\ \cos 3t; t > 2\pi \end{cases}$ find $L[f(t)]$	5	CO4	K3
(b)	**Solve** $y^{11} + 6y^1 + 9y = 12t^2 e^{-3t}; y(0) = y^1(0) = 0.$	5	CO4	K3

Name & Signature of Course In charge:
(NAVEEN.V)

Name & Signature of Module Coordinator:
(Dr Venkataraman B.)

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 EVEN SEMESTER

SET A

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ECE-EEE
Course Title : Mathematics-II for EEE stream
Semester : II
Course Type / Code : Integrated/BMATE201
Max Marks : 25

Q.NO.	POINTS	MARKS
	PART- A	
① a.	(i) Associative law (iii) Existence of identity	1 + 1
	(ii) Commutative law (iv) Existence of Inverse	1
	(v) $\alpha[(x_1,x_2)+(y_1,y_2)] = \alpha(x_1,x_2)+\alpha(y_1,y_2)$	1
	(vi) $1\cdot(x_1,x_2)=(x_1,x_2)$	
	(vii) $(a+b)(x_1,x_2) = a(x_1,x_2)+b(x_1,x_2)$	
	(viii) $a(b(x_1,x_2)) = (ab)(x_1,x_2)$.	1
b.	$aA+bB=\begin{bmatrix} ax_1+bx_2 & ay_1+by_2 \\ az_1+bz_2 & 0 \end{bmatrix} = \begin{bmatrix} x_3 & y_3 \\ z_3 & 0 \end{bmatrix}$	5
	$\therefore$ W is a sub-space of V	
c.	Let $v=a_1v_1+a_2v_2+a_3v_3$; $a_1,a_2,a_3 \in R$	
	$(1,-2,5) = a_1(1,1,1)+a_2(1,2,3)+a_3(2,-1,1)$	2
	$\rightarrow a_1+a_2+2a_3=1$; $a_1+2a_2-a_3=-2$	
	$a_1+3a_2+a_3=5 \rightarrow a_1=-6,\ a_2=3,\ a_3=2$	3
② a.	$T(u+v)=(y_1+y_2,\ -x_1-x_2,\ -z_1-z_2)$	
	$T(u+v)=T(u)+T(v)$	3
	$T(au)=T(ax_1,ay_1,az_1)=aT(u)$	2
b.	$P=\begin{bmatrix} 1 & 1 & 0 \\ 2 & 3 & 1 \\ 0 & 2 & 3 \end{bmatrix}$ $P^{-1}=\begin{bmatrix} 7 & -3 & 1 \\ -6 & 3 & -1 \\ 4 & -2 & 1 \end{bmatrix}$	3 + 2

Q.NO.	POINTS	MARKS
c.	$\langle f, g \rangle = \int_0^1 (3t^2+4t-4)\,dt = -1$	2
	$\langle f, f \rangle = \int_0^1 (t^2+4t+4)\,dt = 19/3$	2
	$\|f\| = \frac{\sqrt{57}}{3}$	1
	PART-B	
③ a.	$L[f(t)] = E/s \tanh(as/4)$	5
b.	$L^{-1}\left[\frac{1}{s(s^2+a^2)}\right] = \frac{1-\cos at}{a^2}$	5
④ a.	$f(t) = \cos t + (\cos 2t - \cos t)\, u(t-\pi) + (\cos 3t - \cos 2t)\, u(t-2\pi)$	2
	$L[f(t)] = \frac{s}{s^2+1} + e^{-\pi s}\left(\frac{s}{s^2+4} + \frac{s}{s^2+1}\right) + e^{-2\pi s}\left(\frac{s}{s^2+9} - \frac{s}{s^2+4}\right)$	3
b.	$L[y(t)] = \frac{24}{(s+3)^5}$	4
	$y(t) = t^4 \cdot e^{-3t}$	1

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Module Coordinator

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THIRD INTERNAL TEST QUESTION PAPER 2022-23 EVEN SEMESTER

SET: B

USN | | | | | | | | | |

Semester : II
Course Type / Code : Integrated/BMATE201
Date : 31-08-2023
Max Marks : 25

Degree : B.E
Branch - Stream : ECE - EEES
Course Title : Mathematics-II for EEE stream
Duration : 60 Minutes

Note: Answer **ONE full** question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Questions	Marks	CO	K-Level
	PART-A			
1(a)	**Make use of** vector addition and scalar multiplication defined by, $(f_1+f_2)x = f_1(x)+f_2(x)$ For all $f_1, f_2 \in V$ and$(\alpha f_1)x = \alpha f_1(x)$, for all $\alpha \in R, f_1 \in V$, prove that the set V of all real valued continuous functions of x defined on interval $[0,1]$ is a vector space over the field R of all real numbers.	5	CO5	K3
(b)	**Make use of**$W = \left\{\begin{bmatrix} x & 0 \\ 0 & y \end{bmatrix} : x, y \in R\right\}$; determine whether W is a subspace of V, where V is the vector space of all square matrices over$R$.	5	CO5	K3
(c)	**Make use of** the vectors $u_1 = (2,1,3), u_2(1,-1,1), u_3 = (3,1,5)$ in the vector space$R^3(R)$, express the vector $v = (1,3,9)$ as a linear combination of u_1, u_2 andu_3.	5	CO5	K3
	OR			
2(a)	**Make use of** the transformation $T: R^3 \to R^3$ defined by$T(x,y,z) = (2x - 3y, 7y + 2z)$, show that T is linear transformation.	5	CO5	K3
(b)	**Utilize** the Rank-nullity theorem, verify $T: R^3 \to R^3$ defined by$T(x,y,z) = (x+2y-z, y+z, x+y-2z)$.	5	CO5	K3
(c)	**Make use of** linear combination, determine whether the vectors$v_1 = (1,2,3)$, $v_2 = (3,1,7)$ and $v_3 = (2,5,8)$ are linearly independent.	5	CO5	K3
	PART –B			
3(a)	**Make use of** the Periodic function definition to find $L[f(t)]$ $f(t) = \begin{cases} a; 0 < t < a/2 \\ -a; a/2 < t < a \end{cases}$.	5	CO4	K3
(b)	**Solve** $L^{-1}\left[\dfrac{s}{(s^2+a^2)^2}\right]$.	5	CO4	K3
	OR			
4(a)	**Construct** Unit step function for $f(t) = \begin{cases} t-1; 1 < t < 2 \\ -t-3; 2 < t < 3 \\ 0; otherwise \end{cases}$ find $L[f(t)]$	5	CO4	K3
(b)	**Solve** $y^{11} + 4y^{1} + 4y = e^{-t}; y(0) = y^{1}(0) = 0.$	5	CO4	K3

Name & Signature of Course In charge:
(Sneha G Kulkarni)

Name & Signature of Module Coordinator:
(Dr Venkataramana BS)

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST 2022-23 EVEN SEMESTER

SET B

SCHEME AND SOLUTION

Degree : B.E
Branch - Stream : ECE-EEE
Course Title : Mathematics-II for EEE stream
Semester : II
Course Type / Code : Integrated/BMATE201
Max Marks : 25

Q.NO.	POINTS	MARKS
	PART-A	
① a.	(i) Associative Law (ii) Commutative Law	-1-
	(iii) Identity Law (iv) Inverse Law	-1-
	(v) $\alpha(f_1+f_2) = \alpha f_1 + \alpha f_2$	-1-
	(vi) $(a+b)f_1 = af_1 + bf_1$	-1-
	(vii) $a(bf_1) = (ab)f_1$	-1-
	(viii) $1 \cdot f_1 = f_1$	
b.	$aA+bB = \begin{bmatrix} ax_1+bx_2 & 0 \\ 0 & ax_2+by_2 \end{bmatrix}$	-4-
	$\therefore aA+bB \in W$	-1-
	$\Rightarrow$ W is a subspace of V.	
c.	$2x+y+3z=1 \quad x-y+z=3$ $3x+y+5z=9$	-2-
	$\Rightarrow x=-12 \quad y=-5 \quad z=10$	-3-
② a.	$T(u+v) = T(u)+T(v)$	-3-
	$T(au) = aT(u)$.	-2-
b.	Rank $(T) = 2$, Nullity$(T)=1$	-2+2-
	$\Rightarrow$ Ran(T) + Nullity$(T) = 2+1 = 3$. dim R^3	-1-

Q.NO.	POINTS	MARKS
c.	$x + 3y + 2z = 0$ $2x + y + 5z = 0$	3
	$3x + 7y + 8z = 0$.	2
	$\rightarrow$ $x = 0$ $y = 0$ $z = 0$	
	$\rightarrow$ vectors V_1, V_2, V_3 are linearly independent	
	PART-B	
③ a.	$L[f(t)] = \frac{a}{s} \tanh(as/4)$	5
b.	$L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right] = \frac{t \sin at}{2a}$	5
④ a.	$f(t) = (t-1) + (-2t-2)u(t-2) + (t+3)u(t-3)$	1
	$L[f(t)] = \frac{1}{s^2} - \frac{1}{s} + e^{-2s}\left(\frac{-2}{s^2} - \frac{6}{s}\right) + e^{-3s}\left(\frac{1}{s^2} + \frac{6}{s}\right)$	4
b.	$L[y(t)] = \frac{1}{(s+1)(s+2)^2}$	3
	$y(t) = e^{-t} - e^{-2t} - te^{-2t}$	2

Course Incharge   Module Coordinator   HOD