Math

Guru Nanak Dev Engineering College, Ludhiana

Department of Applied Science

Program	B.Tech. (ITA,ITB,ITC,ECA,ECB)	**Semester**	2nd
Subject Code	BSC-103	**Subject Title**	Mathematics-I
Mid Semester Test (MST) No.	1	**Course Coordinator(s)**	Pf. Rajbir Kaur Pf. Sukhminder Singh Dr. Sandeep chauhan
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	31-3-2023	**Roll Number**	

Note: Attempt all questions.

Q.No.	Question	CO's, RBT level	Marks
Q1	Solve the differential equation: $p = \log(px - y)$ $y = cx - e^{c}$	CO5, L2,L3,L5	2
Q2	Solve : $y'' - 4y' + y = 0$ $c_1 e^{(2-\sqrt{3})x} + c_2 e^{(2-\sqrt{3})x}$	CO5, L2,L3,L5	2
Q3	Solve the differential equation $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ by method of variation of parameters. $c_1 e^{3x} + c_2 e^{3x} x + \log x \cdot e^{3x} - e^{3x}$	CO5, L2,L3,L5	4
Q4	Solve : $yp^2 + (x-y)p - x = 0$ $\left(\frac{y^2}{2} + \frac{x^2}{2} - c_1\right)(y - x - c_2) = 0$	CO5, L2, L3,L5	4
Q5	Solve : $(y^4 + 2y)dx + (xy^3 + 2y^4 - 4x)dy = 0$ $xy + \frac{2x}{y^2} + y^2 = c$	CO5, L2,L3,L5	4
Q6	Solve : $x^2 \frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 8y = 4x^3 + 2\sin(\log x)$ $c_1x + c_2x^4 + 2x^3 + \frac{5}{37}\cos(\log x) + \frac{7}{37}\sin(\log x)$	CO5, L2,L3,L5	8

Course Outcomes (CO)
Students will be able to

1	Analyze the use of calculus and linear algebra to Engineering problems
2	Apply the concept of improper integrals to study Beta and Gamma functions.
3	Explain utility of Taylor's theorem in error analysis.
4	Apply the concept of rank to solve system of linear equations and diagonalization of matrices.
5	Recognize and solve ordinary and linear differential equations.
6	Infer the convergence of infinite series.

RBT Classification	**Lower Order Thinking Levels (LOTS)**			**Higher Order Thinking Levels (HOTS)**		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

$$\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + y = 0$$

k^2

$\log \infty =$

Guru Nanak Dev Engineering College, Ludhiana

Department of Applied Science

Program	B.Tech. (ECA,ECB,ITC)	**Semester**	2nd
Subject Code	BSC-103	**Subject Title**	Mathematics-I
Mid Semester Test (MST) No.	2	**Course Coordinator(s)**	Pf. Sukhminder Singh
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	22-5-2023	**Roll Number**	

Note: Attempt all questions.

Q.No.	Question	CO's, RBT level	Marks
Q1	Using Cayley Hamilton theorem, find the inverse of $\begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$. $A^{-1} = \frac{1}{6}\begin{bmatrix} -4 & -2 \\ -5 & -1 \end{bmatrix}$	CO1, L2,L3,L5	2
Q2	Evaluate the improper integral $\int_0^{\pi/2} \cot x \, dx$. 100 sin -1, finite	CO2, L2,L3,L5	2
Q3	Expand $\cos x$ in powers of $\left(x-\frac{\pi}{4}\right)$ using Taylor's theorem. $\cos x = \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}\left(\frac{x-\pi/4}{1!}\right) - \frac{1}{\sqrt{2}}\frac{(x-\frac{\pi}{4})^2}{2!} + \frac{1}{\sqrt{2}}\left(\frac{(x-\frac{\pi}{4})^3}{3!}\right) + \cdots$	CO3, L2,L3,L5	4
Q4	For what values of k, the equations $x+y+z=1$, $2x+y+4z=k$, $4x+y+10z=k^2$ have a solution and solve them completely in each case. $x_1=-3k, x_2=2k+1, x_3=k$, $x_1=1-3k, x_2=2k, x_3=k$	CO4, L2, L3,L5	4
Q5	Test the convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n(n+1)}$ using Cauchy integral test. $= \frac{1}{x} - \frac{1}{(x+1)} \rightarrow$ ~~...~~ $0.3010 \rightarrow$ C.T	CO6, L2,L3,L5	4
Q6	Diagonalize the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ and obtain the modal matrix. $P = \begin{bmatrix} -1 & 1 & 1 \\ 0 & -1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$	CO4, L2,L3,L5	8

Course Outcomes (CO)
Students will be able to

1	Analyze the use of calculus and linear algebra to Engineering problems
2	Apply the concept of improper integrals to study Beta and Gamma functions.
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4	Apply the concept of rank to solve system of linear equations and diagonalization of matrices.
5	Recognize and solve ordinary and linear differential equations.
6	Infer the convergence of infinite series.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

MATH Math

Guru Nanak Dev Engineering College, Ludhiana			
Department of Applied Science			
Program	B.Tech. (CSE B,C,D, CE A,B EE-A,B)	**Semester**	I
Subject Code	BSC-103	**Subject Title**	Mathematics I
Mid Semester Test No.	2	**Course Coordinator**	Prof Rajbir Kaur, Dr. Sandeep Kaur Chouhan, Dr. Gagandeep Kaur
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	20-12-2020	**Roll Number**	

Note: Attempt all questions

Q. No.	Question	COs,RBT level	Marks
Q1	Examine the convergence of $\sum\left(\frac{1.2.3.4......n}{3.5.7......\ 2n+1}\right)^2$	CO6, L1,L4	2
Q2	Check whether A is similar to B or not where A=$\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}$ and B=$\begin{bmatrix}1 & 1\\0 & 1\end{bmatrix}$	CO1, L2, L4	2
Q3	For what value of k, the system of equations x+y+z=1 , 2x+y+4z=k and 4x+y+10z=k^2 have solution.	CO4, L1,L3	4
Q4	Examine the convergence of the series $\frac{\sqrt{2}-1}{3^3-1}+\frac{\sqrt{3}-1}{4^3-1}+\frac{\sqrt{4}-1}{5^3-1}+\cdots\ldots\ldots$	CO6, L2, L4	4
Q5	Apply Cayley Hamilton theorem to find A^{-1}, where A = $\begin{bmatrix}2 & -1 & 1\\-1 & 2 & -1\\1 & -1 & 2\end{bmatrix}$	CO1, L3	4
Q6	Construct a matrix P which transforms the matrix $\begin{bmatrix}1 & 1 & 3\\1 & 5 & 1\\3 & 1 & 1\end{bmatrix}$ into a diagonal form.	CO4, L5	8

Course Outcomes (CO)*Students will be able to*

1	Analyze the use of calculus and linear algebra to Engineering problems.
2	Apply the concept of improper integrals to study Beta and Gamma functions.
3	Explain utility of Taylor's theorem in error analysis.
4	Apply the concept of rank to solve system of linear equations and diagonalization of matrices.
5	Recognize and solve ordinary and linear differential equation.
6	Infer the convergence of infinite series.

RBT Classification	Lower Order Thinking Levels			Higher Order Thinking Levels		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creatin

$\frac{1}{4}\begin{pmatrix}3 & 1 & -1\\1 & 3 & 1\\-1 & 1 & 3\end{pmatrix}$

27 − 63 + 36

63

$1-15+31$

$-(15-31) \quad -14+31$

$y = \cancel{c}\,c^{2} + f(p)$ MATH $3x^3x$ $12x^2y^2\,ab\,dx$

Type equation here. **Guru Nanak Dev Engineering College, Ludhiana**

Department of Applied Science

Program	B.Tech. (CEA,CE B, CS B, CS C, CS D, EE A)	**Semester**	2nd
Subject Code	BSC-103	**Subject Title**	Mathematics 1
Mid Semester Test (MST) No.	11	**Course Coordinator(s)**	Prof. Rajbir Kaur, Dr. Gagandeep Kaur, Dr. Sandeep Chauhan
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	14th Nov. , 2022	**Roll Number**	

Note: Attempt all questions

Q. No.	**Question**	**COs, RBT level**	**Marks**
Q1	Solve the differential equation: $(y - px)(p - 1) = p$.	CO5, L2,L3	2
Q2	State Necessary and Sufficient condition for the differential equation $Mdx + Ndy = 0$, to be exactwhere M , N are functions of x, y. $\frac{\partial M}{\partial y} =$	CO5, L2,L1	2
Q3	Solve the following differential equation: $(x^2 + y^2 + x)dx + xydy = 0$. $\frac{x^4}{4} + \frac{x^2y^2}{2} + \frac{x^3}{3} = c$	CO5, L2,L5	4
Q4	Solve the following differential equation by the method of variation of parameters: $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = \frac{1}{x^3}e^{-3x}$. $CF = C_1 e^{-3x} + C_2 x e^{-3x}$	CO5,L2, L3,L5	4
Q5	Solve the differential equation: $\frac{d^2y}{dx^2} - y = x + \sin x + (1 + x^2)e^x$.	CO5, L2,L5	4
Q6	Solve the differential equation: $x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 20y = (x + 1)^2$.	CO5, L2,L3,L5	8

$C_1x^4 + C_2x^{-5} - \frac{1}{18}x^2 - \frac{1}{10x}$

Course Outcomes (CO)
Students will be able to

1	Analyze the use of calculus and linear algebra to Engineering problems
2	Apply the concept of improper integrals to study Beta and Gamma functions.
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4	Apply the concept of rank to solve system of linear equations and diagonalization of matrices.
5	Recognize and solve ordinary and linear dilterential equalions.
6	Infer the convergence of infinite series.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

$F(x)\,dx + F(y)\,dx = 0$ | $2xy^2dx + 3x^2dy = 0$

$\frac{\partial F_1}{\partial y}$ | $\left(y - \frac{dy}{dx}\frac{d}{dx}x\right)($

Program	B.Tech.(CE)	Semester 1/2	
Subject Code	BSC-103	Subject Title: Applied Maths	
Mid Semester Test (MST) No.	1	Course Coordinator(s)	
Max. Marks	24	Time Duration 90 min.	
Date of MST	Feb 2020	Roll Number 1914103	

Q. No.	Question	Marks
Q1	Give an example of a non linear differential equation of second order and second degree.	2
Q2	What is solution of differential equation give an example.	2
Q3	Solve y logy dx+(x-logy)dy = 0	4
Q4	Write the method for finding complementary function of a differential equation.	4
Q5	Solve the differential equation $x^2\frac{d^2y}{dx^2}-2x\frac{dy}{dx}-4y=x^4$	4
Q6	Solve $\frac{d^2y}{dx^2}+y=\cos ecx$, by the method of variation of parameters.	8

MATHS-I

Guru Nanak Dev Engineering College, Ludhiana Department of Applied Science			
Program	B Tech (EE, ME, CE)	Semester	I
Subject Code	BSC-103	Subject Title	Mathematics-I
Mid Semester Test (MST) No.	I	Course Coordinator(s)	Rupinderjit Kaur
Max. Marks	24	Time Duration	1 hour 30 minutes
Date of MST	16th September, 2019	Roll Number	

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	Find the solution of $p^2 - 7p + 12 = 0$	CO5, L2	2
Q2	Define exact differential equation	CO5, L1	2
Q3	Solve $x^2 y dx - (x^3 + y^3)dy = 0$	CO5, L3	4
Q4	Solve $\frac{dy}{dx} + y = xy^3$	CO5, L3	4
Q5	Use method of variation of parameters to solve $\frac{d^2y}{dx^2} + y = \sec x$.	CO5, L5	4
Q6	Solve $(2x+3)^2\frac{d^2y}{dx^2} - 2(2x+3)\frac{dy}{dx} - 12y = 6x$	CO5, L5	8

Course Outcomes (CO)

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RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Type equation here.**Guru Nanak Dev Engineering College, Ludhiana**

Department of Applied Science

Program	B.Tech. (CEA,CE B, CS B, CS C, CS D, EE A)	**Semester**	2nd
Subject Code	BSC-103	**Subject Title**	Mathematics 1
Mid Semester Test (MST) No.	11	**Course Coordinator(s)**	Prof. Rajbir Kaur, Dr. Gagandeep Kaur, Dr. Sandeep Chauhan
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	14th Nov., 2022	**Roll Number**	2216058

Note: Attempt all questions

Q. No.	**Question**	**COs, RBT level**	**Marks**
Q1	Solve the differential equation: $(y-px)(p-1)=p$.	CO5, L2,L3	2
Q2	State Necessary and Sufficient condition for the differential equation $Mdx+Ndy=0$, to be exactwhere M , N are functions of x, y.	CO5, L2,L1	2
Q3	Solve the following differential equation: $(x^2+y^2+x)dx+xydy=0$.	CO5, L2,L5	4
Q4	Solve the following differential equation by the method of variation of parameters: $\frac{d^2y}{dx^2}+6\frac{dy}{dx}+9y=\frac{1}{x^3}e^{-3x}$.	CO5,L2, L3,L5	4
Q5	Solve the differential equation: $\frac{d^2y}{dx^2}-y=x+\sin x+(1+x^2)e^x$.	CO5, L2,L5	4
Q6	Solve the differential equation: $x^2\frac{d^2y}{dx^2}+2x\frac{dy}{dx}-20y=(x+1)^2$.	CO5, L2,L3,L5	8

Course Outcomes (CO)
Students will be able to

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3	Explain utility of Taytor's theorem in error analysis.
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RBT Classification	**Lower Order Thinking Levels (LOTS)**			**Higher Order Thinking Levels (HOTS)**		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

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Match कर के हल बनाओ ①

MORNING [redacted] Math

24 JUN 2022

Please check that this question paper contains 9 questions and 2 printed pages within first ten minutes.

[Total No. of Questions: 09] [Total No. of Pages: 2]

Uni. Roll No. ……………

Program: B.Tech. (Batch 2018 onward)
Semester: 2
Name of Subject: Mathematics I
Subject Code: BSC-103
Paper ID: 15927

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

a) Define Clairaut's equation and write its solution.

b) Test the convergence of the improper integral $\int_0^{\infty} e^{-x}dx$.

c) Evaluate $\lim_{x\to 0}\dfrac{x\cos x-\log(1+x)}{x^2}$.

d) Using Cayley Hamilton theorem, Find the inverse of the matrix $\begin{bmatrix}2 & 3\\ 1 & 2\end{bmatrix}$.

e) Examine the convergence of the series $\sum_{n=1}^{\infty}(-1)^{n-1}\dfrac{1}{\sqrt{n}}$.

f) Evaluate $\int_0^{\frac{\pi}{2}}\sqrt{\tan\theta}\,d\theta$. gama function

Part – B **[Marks: 04 each]**

Q2. Solve the differential equation $(x^2+y^2+2x)dx+2ydy=0$.

Q3. Expand $\log(1+x)$ using Maclaurin's Theorem.

Q4. Prove that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$.

P.T.O.

2

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24 JUN 2022

Q5. Test the convergence of the series $\sum_{n=1}^{\infty} ne^{-n^2}$ using Cauchy Integral test.

Q6. Discuss the consistency of the following system of equations. Find the solution if consistent.

$$4x-2y+6z=8,$$
$$x+y-3z=-1,$$
$$15x-3y+9z=21$$

Q7. Solve $\frac{d^2y}{dx^2}+4y=\sec 2x$ by variation of parameter method.

Part – C **[Marks: 12 each(06 for each subpart if any)]**

Q8. (a) Solve the differential equation $\frac{dy}{dx}+y=y^2$.

(b) Solve $y=2px+p^2y$. $y-p^2y=2px \Rightarrow y(1-p^2)=2px$ $y=2px-\frac{2px}{p^2}$

OR $y=2px-\frac{2x}{p}$

$y=2px-2p^{-1}x$

Solve $x^2\frac{d^2y}{dx^2}-4x\frac{dy}{dx}+8y=4x^3+2\sin(\log x)$.

$\boxed{y=2cx-2c^{-1}x}$

Q9. (i) Diagonalise the matrix $A=\begin{bmatrix}1&6&1\\1&2&0\\0&0&3\end{bmatrix}$ and obtain its modal matrix.

OR

(ii) Discuss the convergence of the series $x+\frac{2^2x^2}{2!}+\frac{3^3x^3}{3!}+\frac{4^4x^4}{4!}+\ldots\infty$.

****

$u_n=\frac{nx^n}{n!}$ $u_{n+1}=\frac{(n+1)x^{(n+1)}}{(n+1)!}$

$=\frac{nx^n}{n!}\times\frac{(n+1)!}{(n+1)(x^n)\cdot x}$ $=\frac{n(n+1)!}{n!(n+1)\cdot x}$

Math

3

Please check that this question paper contains 9 questions and 02 printed pages within first ten minutes.

[Total No. of Questions: 09]
Uni. Roll No. 2203347...

[Total No. of Pages: 02]

Program: B.Tech. (Batch 2018 onward)
Semester: 1/2
Name of Subject: Mathematics-I
Subject Code: BSC-103
Paper ID: 15927
Scientific calculator is Not Allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1

a) State Cayley Hamilton Theorem.

b) Evaluate $\lim_{x\to\infty}(1+x)^{1/x}$. ⇒ 1 Ans

1/2

c) Prove that $\frac{1}{D}X = \int X\,dx$ where $D = \frac{dy}{dx}$ and X is a function of x.

d) Give an example of a series which is conditionally convergent but not absolutely convergent.

e) Evaluate the improper integral $\int_0^\infty e^{-2x}x^5dx$.

f) Solve the equation $xp^2 - yp + a = 0$. $yp = xp^2 + a$ $y = xp + \frac{a}{p}$ $\boxed{y = cx + \frac{a}{c}}$

Part – B

[Marks: 04 each]

Q2. Expand $\log x$ in powers of $(x-1)$ using Taylor Theorem.

Q3. Using Cauchy Integral test, discuss the convergence of the series $\sum_{n=1}^{\infty}\frac{n}{(n^2+1)^2}$.

Q4. Find the general solution of the differential equation

1/2 $(3x^2y^3e^y + y^3 + y^2)dx + (x^3y^3e^y - xy)dy = 0$.

P.T.O.

4

(Q5.) Prove that $\int_0^{\pi/2} \sin^p\theta \cos^q\theta \, d\theta = \dfrac{\Gamma\left(\frac{p+1}{2}\right)\Gamma\left(\frac{q+1}{2}\right)}{2\,\Gamma\left(\frac{p+q+2}{2}\right)}$. Hence Evaluate $\Gamma\left(\frac{1}{2}\right)$.

(Q6.) Discusss the consistency of the following system of equations $2x+3y+4z=11$, $x+5y+7z=15$, $3x+11y+13z=25$. If found consistent, solve it. $x = 2, -3, 4$

$\rho(A)=\rho(A:B)=3$ unique sol

(Q7.) Solve by method of variation of parameter $\dfrac{d^2y}{dx^2}+y=\operatorname{cosec} x$. $\int \cot x$

$c_1\cos x + c_2\sin x - x\cos x + \log(\operatorname{cosec} x)\sin x$

Part – C **[Marks: 12 each(06 for each subpart if any)]**

(Q8.) Solve $x^2\dfrac{d^2y}{dx^2}-3x\dfrac{dy}{dx}+5y=\sin(\log x)$. $x^2(c_1\cos\log x + c_2\sin\log x) + \frac{1}{8}(\cos\log x + \sin\log x)$

OR

(b)

(i) Solve the differential equation $xy(1+xy^2)\dfrac{dy}{dx}=1$

(ii) Solve $p(p+y)=x(x+y)$.

(Q9.) Discuss for what values of x does the series $\sum_{n=1}^{\infty}\dfrac{(n!)^2}{(2n)!}x^{2n}$ converge/ diverge?

OR

(b) Find a matrix P which transforms the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ into a diagonal form.

Ans – $\begin{bmatrix} 1 & -1 & 1 \\ 0 & 1 & 2 \\ -1 & -1 & 1 \end{bmatrix}$

****

$-5+\frac{19}{7}$ $-2+\frac{10}{7}$ $\frac{-35+19}{7}$ $\frac{-14+10}{7}$ $\frac{-4}{7}$ $\frac{-16}{7}$

25 − 45 11 − 30

$-8-7(-2)^2+36$

$-8-7(4)+36$ $1-7+36$ $-8\ 8-28+36$

$36+36\ 8+28$ $-1-7+36$ $-8-28+36$

45 25 (20)

5

Please check that this question paper contains______ questions and ______printed pages within first ten minutes.

[Total No. of Questions: 09] [Total No. of Pages: 2]

Uni. Roll No. ....

Program: B.TECH
Semester: .2
Name of Subject: Mathematics-1
Subject Code: BSC103
Paper ID: 15927

25-01-2022(E)

Time Allowed: 02 Hours **Max. Marks: 60**

NOTE:

1) Each question is of 10 marks.
2) Attempt any six questions out of nine
3) Any missing data may be assumed appropriately

1 Solve the differential equation $\frac{d^2x}{dt^2}+\frac{g}{l}x=\frac{g}{l}L$ where g,l,L are constants subject to the condition $x=a, \frac{dx}{dt}=0 \ at\ t=0$

2 Solve $(1+x)^2\frac{d^2y}{dx^2}+(1+x)\frac{dy}{dx}+y=\sin 2\{\log(1+x)\}$

3 Find rank of the matrix $\begin{bmatrix} 2 & 3 & -2 & 4 \\ 3 & -2 & 1 & -3 \\ 3 & 2 & 3 & 4 \\ -2 & 4 & 0 & 5 \end{bmatrix}$

4 Find all the Eigen valued and vectors the matrix A= $\begin{bmatrix} 2 & -1 & 1 \\ -2 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

5 Prove that $\int_0^\infty \frac{x^4(1+x^5)}{(1+x)^{15}}dx = 1/5005$ ...

6 Expand f(z)= a/bz+c about $z_0=0$

7 Find $Limit\, x \to 0(1/\sin x - 1/x)$

P.T.O.

6

8 Solve the initial value problem $e^y \frac{dy}{dx} = 2x, x \to \sqrt{3}, y(2) = 0$ Evaluate

9 $\int_2^{\infty} (x+3)/(x-1)(x^2+1)dx$

****

7

Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. ……………

Program: B.Tech

Semester: 1

Subject Code: BSC-103

Paper ID: 15927

01-03-2022(M)

Time Allowed: 02 Hours Max. Marks: 60

NOTE:

1) Each question is of 10 marks.
2) Attempt any six questions out of nine
3) Any missing data may be assumed appropriately

[Marks : 10 each, 05 marks for each sub-part if any]

Q1. Solve the differential equation $\tan y \frac{dy}{dx} + \tan x = \cos y \cos^3 x$.

Q2. (a) Expand $\sin x$ in ascending powers of $\left(x - \frac{\pi}{2}\right)$ using Taylor Theorem.

(b) Evaluate $\lim_{x \to 0} (\sin x)^{\tan x}$.

Q3. (a) Solve the equation $xp^2 - 3yp + 9x^2 = 0$.

(b) Solve $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$

Q4. (a) Using Cayley Hamilton Theorem, find the inverse of $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.

(b) For what values of λ and μ do the system of equations $x + 3y + 2z = 2$, $3x + 3y + 2z = 5$, $2x + 12y + \lambda z = \mu$ have (i) no solution (ii) unique solution (iii) more than one solution ?

Q5. Solve the differential equation $\frac{d^2y}{dx^2} + 4y = \sec x$ by method of variation of parameter.

P.T.O.

8

Q6. Discuss the convergence of the series $1+\frac{3}{7}x+\frac{3.6}{7.10}x^2+\frac{3.6.9}{7.10.13}x^3+\ldots\ldots$.

Q7. (a) Using Beta and Gamma functions, evaluate $\int_0^1 x^5(1-x^3)^3 dx$.

(b) Evaluate the improper integral $\int_0^1 \frac{dx}{\sqrt{1-x}}$.

Q8. Solve the differential equation $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+4y=\cos(\log x)+x\sin(\log x)$.

Q9. Show that the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ is diagonalizable.

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Please check that this question paper contains 9 questions and 2 printed pages within first ten minutes.

[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. ……………….

Program: B.Tech (Batch 2018 onward)

Semester: 2

Name of Subject: Mathematics I

Subject Code: BSC-103

Paper ID: 15927

16-07-21(M)

Time Allowed: 02 Hours **Max. Marks: 60**

NOTE:

1) Each question is of 10 marks.
2) Attempt any six questions out of nine
3) Any missing data may be assumed appropriately

Q1. Solve the differential equation $\frac{dy}{dx}+y=3e^{x}y^{3}$.

Q2. (a) For what values of λ and μ do the system of equations $x+2y+3z=6$, $x+3y+5z=9$ and $2x+5y+\lambda z=\mu$ have

(i) No solution (ii) a unique solution (iii) more than one solution ? (6 marks)

(b) Using Cayley Hamilton Theorem, Find the inverse of the matrix $\begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$. (4 marks)

Q3. (a) Solve $(x-y^{2})dx+2xydy=0$. (5 marks)

(b) Solve $y=2px+y^{2}p^{3}$ (5 marks)

Q4. (a) Test the convergence of the series $\sum_{n=1}^{\infty}\frac{n}{(n^{2}+1)^{2}}$ using Cauchy Integral test. (6 marks)

(b) Find the Maclaurin series for $f(x)=\cos x$. (4 marks)

Q5. Discuss the convergence of the series $\sum_{n=1}^{\infty}\frac{(n+1)}{n^{3}}x^{n}$.

Q6. (a) Evaluate the integral $\int_{0}^{1}\frac{x}{\sqrt{1-x^{5}}}dx$ in terms of gamma function. (6 marks)

$u_n = \frac{(n+1)x^n}{(n+1)^3}$

$u_{n+1} = \frac{(n+2)x^{n+1}}{(n+2)^3}$

$\frac{(n+1)x^n}{(n+1)^3} \times \frac{(n+2)^3}{(n+2)x^{n+1}}$

$\frac{x^n (n+2)^2}{(n+1)^2 x^{n+1}}$

$\frac{(n+2)^2}{(n+1)^2 x}$

P.T.O.

10

(b) Evaluate $\lim_{x \to 0} \frac{1-\cos x}{x^2}$. $= \frac{-\sin x}{2x} = \frac{-\cos x}{2} = \frac{-1}{2}$ limit (C)

(4 marks)

Q7. Solve by method of variation of parameter $y'' - 2y' + y = e^x \log x$.

Q8. Solve the differential equation $x^2 \frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = x^2 + \sin(\log x)$.

Q9. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$.

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MORNING

Please check that this question paper contains 9 questions and 2 printed pages within first ten minutes.

[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. ....

Program: B.Tech. (Batch 2018 onward)

Semester:1

Name of Subject: Mathematics I

Subject Code: BSC-103

Paper ID: 15927

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

a) Define Clairaut's equation.

b) For what values of p, does the series $\sum_{n=1}^{\infty}\frac{1}{n^p}$ converge or diverge?

c) Evaluate $\lim_{x\to 0}\frac{x-\sin x}{x^3}$.

d) Test the convergence or divergence of the improper integral $\int_0^{\infty} e^{-x}dx$.

e) Using Cayley Hamilton Theorem, Find the inverse of the matrix $A=\begin{bmatrix}2 & 3\\ 3 & 5\end{bmatrix}$.

f) Solve the differential equation $\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=0$. $(D^2-3D+2)y=0$

find Au, ~~x~~ C.f

Part – B **[Marks: 04 each]**

Q2. Find the Maclaurin series for $f(x)=\sin x$.

Q3. Solve the differential equation $(3xy^2-y^3)dx-(2x^2y-xy^2)dy=0$.

Q4. Prove that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$.

Q5. Solve $y''-6y'+9y=\frac{e^{3x}}{x^2}$ by variation of parameter method.

P.T.O.

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MORNING

08 MAR 2021

Q6. Use the rank method to test the consistency of the system of equations $2x+3y+4z=11$, $x+5y+7z=15$, $3x+11y+13z=25$.

Q7. Test the convergence or divergence of the series $\sum_{n=1}^{\infty}\frac{2n-1}{n(n+1)(n+2)}$. $= \frac{1}{(2)(3)} = \frac{1}{6}$

Part – C **[Marks: 12 each]**

Q8. Solve the differential equation $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+2y=x\log x$.

OR

(i) Solve $x\frac{dy}{dx}+y=x^3y^6$.

(ii) Solve the equation $3x^4p^2-px-y=0$.

Q9. Diagonalise the matrix $A=\begin{bmatrix}3 & 1 & -1\\ -2 & 1 & 2\\ 0 & 1 & 2\end{bmatrix}$ and obtain its modal matrix.

OR

b) Discuss the convergence of the series $\sum_{n=1}^{\infty}\frac{4.7.10......(3n+1)}{1.2.3......n}x^n$.

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Please check that this question paper contains 9 questions and 2 printed pages within first ten minutes.

[Total No. of Questions: 09] MORNING [Total No. of Pages: 02]

Uni. Roll No. ....

04 DEC 2019

Program/Course: B.Tech.(Batch 2018 onward)
Semester: 1, 2
Name of Subject: Mathematics-I
Subject Code: BSC-103
Paper ID: 15927

Time Allowed: 03 Hours Max. Marks: 60

NOTE:

1) Parts A and B are compulsory.
2) Part -C has Two questions Q8 and Q9.Both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

Part -A

[Marks:02 each]

Q1.

a) Test the convergence or divergence of the improper integral $\int_0^\infty \frac{dx}{9+x^2}$.

b) Define Clairaut's equation and write its solution.

c) Evaluate $\lim_{x\to a}\frac{x^3-a^3}{x-a}$.

d) Find the rank of the matrix $\begin{bmatrix}1 & 4 & 5\\ 2 & 6 & 8\\ 3 & 7 & 22\end{bmatrix}$.

e) Test the convergence of the series $\sum_{n=1}^{\infty}\left(\frac{n}{n+1}\right)^{n^2}$ 306- A

f) Find the particular integral of $(D^3-3D^2+4)y=e^{2x}$.

Part -B

[Marks: 04 each]

Q2. Prove that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$.

Q3. Solve $p(p+y)=x(x+y)$.

Q4. Solve the following differential equation by method of variation of parameters:
$y''+4y=\tan 2x$.

Q5. Solve $2x-2y+z=1, x+2y+2z=2, 2x+y-2z=7$ by rank method.

Q6. Test the convergence of the series $\sum_{n=1}^{\infty}\frac{1}{(n+1)^2}$ using Cauchy integral test.

Q7. Expand $\tan x$ in powers of $\left(x-\frac{\pi}{4}\right)$ upto first four terms.

P.T.O

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Part -C

MORNING

04 DEC 2019

[Marks: 12 each]

Q8.(a) Solve $x^2y''-4xy'+8y=4x^3+2\sin(\log x)$.

OR

(b)(i) Solve the following differential equation :
$$\frac{dy}{dx}+y=xy^3.$$

(ii) Solve the following differential equation :
$$(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0.$$

Q9.(a) Discuss the convergence of the series :
$$1+\frac{2x}{2!}+\frac{3^2x^2}{3!}+\frac{4^3x^3}{4!}+\frac{5^4x^4}{5!}+\ldots\ldots\ldots\ldots\infty.$$

OR

(b) Diagonalize the matrix $\begin{bmatrix}1 & 1 & 3\\ 1 & 5 & 1\\ 3 & 1 & 1\end{bmatrix}$ and obtain its modal matrix.

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MORNING

[Total No. of Questions:09] 21 MAY 2019 [Total No. of Pages:02]

Uni. Roll No. ....

Program/ Course: B.Tech. (Sem. 1/2)

Name of Subject: Mathematics-I

Subject Code: BSC-103

Paper ID: 15927

Time Allowed: 03 Hours Max. Marks:60

NOTE:

1) Parts A and B are compulsory
2) Part-C has two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

a) Prove that $\int_0^{\frac{\pi}{2}} \sqrt{\tan\theta}\, d\theta = \frac{\left\lceil\frac{1}{4}\right.\left\lceil\frac{3}{4}\right.}{2}$.

b) Evaluate improper integral $\int_0^{\infty} \frac{dx}{1+x^2}$. Why is it convergent?

c) Solve $p = \sin(y - px)$.

d) Test for convergence of $\Sigma\left(\frac{n}{n+1}\right)^{n^2}$:332, 20 N

e) State Taylor and Maclaurian theorems.

f) Define rank of a matrix.

Part – B

[Marks: 04 each]

Q2. Evaluate $\int_0^{\infty} x^{\frac{1}{4}} e^{-\sqrt{x}}\, dx$.

Q3. Solve $(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0$.

Q4. Test the convergence of series $\sum_{n=1}^{\infty} \frac{1}{n^2+1}$ using Cauchy integral test.

Q5. Expand $\sin x$ in the powers of $\left(x - \frac{\pi}{2}\right)$.

Q6. Evaluate $\lim_{x\to\frac{\pi}{2}}(\sec x - \tan x)$.

Q7. Solve $x + y - z = 0, 2x - y + z = 3, 4x + 2y - 2z = 2$.

Part – C

[Marks: 12 each (06 each part)]

Q8. (i) Prove that $\int_0^{\frac{\pi}{2}} \sin^p x \cos^q x\, dx = \frac{\left\lceil\frac{p+1}{2}\right.\left\lceil\frac{q+1}{2}\right.}{2\left\lceil\frac{p+q+2}{2}\right.}$. Hence evaluate $\left\lceil\frac{1}{2}\right.$.

(ii) Solve $\frac{dy}{dx} + y = xy^3$.

or

Solve $x^2y'' - 4xy' + 8y = 4x^3 + 2\sin(\log x)$.

Q9. Discuss the convergence of the series

$$1 + \frac{\alpha.\beta}{1.\gamma}x + \frac{\alpha(\alpha+1)\beta(\beta+1)}{1.2.\gamma(\gamma+1)}x^2 + \frac{\alpha(\alpha+1)(\alpha+2)\beta(\beta+1)(\beta+2)}{1.2.3.\gamma(\gamma+1)(\gamma+2)}x^3 + \cdots$$

P.T.O

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MORNING

21 MAY 2019

or

* Show that the matrix $A=\begin{pmatrix} 3 & 1 & -1 \\ -2 & 1 & 2 \\ 0 & 1 & 2 \end{pmatrix}$ is diagonalizable. Hence find P such that $P^{-1}AP$ is a diagonal matrix, and then obtain the matrix $B = A^2 + 5A + 3I$.

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MORNING

27 NOV 2018

[Total No. of Questions: 9] [Total No. of Pages: 2]

Uni. Roll No. ....

Program/ Course:B.Tech.(Sem-1/2)
Name of Subject: Mathematics-I
Subject Code: BSC-18103
Paper ID: 15927

Time Allowed: 03 Hours Max. Marks: 60

NOTE:

1) Part – A & B are compulsory
2) Part- C has two Questions Q8 & Q9 and both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

Part – A

[Marks: 02 each]

Q1.

a) Test for convergence or divergence of the improper integral $\int_{-\infty}^{\infty} \frac{dx}{a^2+x^2}$.

b) Solve $p = \log(px - y)$, where $p = \frac{dy}{dx}$.

c) State Cauchy's Integral test for the convergence of an infinite series.

d) Evaluate $\lim_{x\to\infty}(e^x + x)^{\frac{1}{x}}$.

e) Prove that $\frac{1}{D-a} X = e^{ax} \int Xe^{-ax}dx$, where $D = \frac{dy}{dx}$ and X is a function of x .

f) State Cayley Hamilton theorem .

Part – B

[Marks: 04 each]

आसान है Q2. Derive the relation between Beta and Gamma functions .

Q3. Solve $(xy^2 + 2x^2y^3)dx + (x^2y - x^3y^2)dy = 0$.

Q4. Solve by the method of variation of parameters the following differential equation :
$$\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = \sin(e^x) .$$

Q5. Obtain the first four terms of Taylor's series of cos x about $x = \frac{\pi}{4}$.

PTO

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MORNING

27 NOV 2018

Q6. For what values of x the power series

$$1-\frac{1}{2}(x-2)+\frac{1}{4}(x-2)^2-\frac{1}{8}(x-2)^3+ - - -\infty$$

converges ? What is its sum ?

Q7. Find the value of k so that the equations x + y + 3z = 0 , 4x + 3y +kz = 0 , 2x + y + 2z = 0 have a non – trivial solution .

Part – C [Marks: 12 each]

Q8 State and prove the necessary and sufficient condition for the differential equation M(x,y)dx + N(x,y)dy = 0 to be exact.

OR

Solve $x^2\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+y=\frac{1}{(1-x)^2}$.

Q9. Discuss the convergence of the infinite series $\sum\frac{1}{(n\log n)(\log\log n)^p}$; $p>0$.

OR

Show that the matrix $A=\begin{bmatrix}3 & 1 & -1\\ -2 & 1 & 2\\ 0 & 1 & 2\end{bmatrix}$ is diagonalizable . Hence find the modal matix P such that $P^{-1}AP$ is a diagonal matirx .

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Guru Nanak Dev Engineering College, Ludhiana			
Department of Applied Science			
Program	B.Tech. (CE/ME/EE/ECE)	Semester	1st
Subject Code	BSC-103	Subject Title	Mathematics 1
Mid Semester Test (MST) No.	2nd	Course Coordinator(s)	Prof. Rajbir Kaur, Prof. Sukhminder Singh, Prof. Neeraj Kumar
Max. Marks	24	Time Duration	1 hour 30 minutes
Date of MST	6th Nov., 2023	Roll Number	

Note: All questions are compulsory

Q.No.	Question	COs, RBT level	Marks
Q1	Find the rank of the following matrix $\begin{bmatrix} 1 & -1 & 0 \\ 2 & -3 & 0 \\ 3 & -3 & 1 \end{bmatrix}$.	CO1, L2	2
Q2	Prove the necessary condition for the convergence of a positive term series $\sum_{n=1}^{\infty} u_n$.	CO6, L5	2
Q3	Test the convergence of the series: $1 + \frac{2x}{2!} + \frac{3^2x^2}{3!} + \frac{4^3x^3}{4!} ------- + \frac{(n+1)^n x^n}{(n+1)!} + ------- \infty$.	CO6, L3	4
Q4	Solve the following differential equation: $\frac{d^2y}{dx^2} + \frac{1}{x}\frac{dy}{dx} = \frac{1}{x^2} 12 \log x$.	CO5, L3	4
Q5	Determine, for what values of a and b do the equations $x + 2y + 3z = 6,\ x + 3y + 5z = 9,\ 2x + 5y + az = b$ have (i) no solution (ii) a unique solution (iii) more than one solution.	CO4, L5	4
Q6	Determine a matrix P which transforms the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ into a diagonal form.	CO4, L5	8

Course Outcomes (CO)
Students will be able to

1	Analyze the use of calculus and linear algebra to Engineering problems
2	Apply the concept of improper integrals to study Beta and Gamma functions.
3	Explain utility of Taytor's theorem in error analysis.
4	Apply the concept of rank to solve system of linear equations and diagonalization of matrices.
5	Recognize and solve ordinary and linear differential equations.
6	Infer the convergence of infinite series.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Guru Nanak Dev Engineering College, Ludhiana			
Department of Applied Science			
Program	B.Tech.(CE/ME/EE/ECE)	**Semester**	I
Subject Code	BSC-103	**Subject Title**	Mathematics-I
Mid Semester Test (MST) No.	1	**Course Coordinator(s)**	Sukhminder Singh Rajbir Kaur Neeraj Kumar
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	25-9-2023	**Roll Number**	

Note: Attempt all questions.

Q.No.	Question	CO's, RBT level	Marks
Q1	State Necessary and Sufficient conditions for the differential equation $Mdx+Ndy = 0$ to be exact.	CO5, L2/L3	2
Q2	Solve the differential equation: $p = \log(px - y)$	CO5, L3/L5	2
Q3	Solve: $(\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y)dy = 0$	CO5, L3/L5	4
Q4	Solve : $x^2 y dx - (x^3 + y^3)dy = 0$	CO5, L3/L5	4
Q5	Solve the differential equation $y'' - 6y' + 9y = \dfrac{e^{3x}}{x^2}$ by method of variation of parameters.	CO5, L3/L5	4
Q6	Solve: $(D-2)^2 y = 8(e^{2x} + \sin 2x + x^2)$	CO5, L3/L5	8

Course Outcomes (CO)
Students will be able to

CO5	Recognize and solve ordinary and linear differential equations.

RBT Classification	**Lower Order Thinking Levels (LOTS)**			**Higher Order Thinking Levels (HOTS)**		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Please check that this question paper contains___9___ questions and ___2___ printed pages within first ten minutes.

[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. ……………

Program: B.Tech. (Batch 2018 onward)

Semester: 1st/2nd

Name of Subject: Mathematics-I

Subject Code: BSC-103

Paper ID:15927

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

a) **Evaluate the improper integral** $\int_0^{\infty} \frac{1}{1+x^2}\, dx$.

b) Solve the differential equation $y = px + \sqrt{a^2p^2 + b^2}$, where $p = \frac{dy}{dx}$.

c) Prove the necessary condition for the convergence of a positive term series $\sum_{n=1}^{\infty} u_n$.

d) **Prove that** $\frac{1}{D-a}X = e^{ax}\int X\, e^{-ax}dx$, **where** $D = \frac{d}{dx}$ **and** X **is any function of x.**

e) Reduce the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \\ 3 & 0 & 5 & -10 \end{bmatrix}$ to normal form and hence find its rank.

f) Evaluate $\lim_{x \to 0} \left(\frac{\tan x}{x}\right)^{\frac{1}{x^2}}$

Part – B **[Marks: 04 each]**

Q2. Prove the following relation of beta and gamma functions:

$$\beta(m,n) = \frac{\gamma(m)\gamma(n)}{\gamma(m+n)}.$$

Q3. Solve the following differential equation:

P.T.O.

$$\left(1+e^{\frac{x}{y}}\right)dx + \left(1-\frac{x}{y}\right)e^{\frac{x}{y}}\,dy = 0.$$

Q4. Solve the following differential equation using the method of variation of parameter:

$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}.$$

Q5. Expand $log(1+x)$ in powers of x using Maclaurin's series.

Q6. Determine for what values of a and b do the equations

$$x+2y+3z=6,\ x+3y+5z=9,\ 2x+5y+az=b$$

have: (i) no solution (ii) a unique solution (iii) more than one solution.

Q7. Test the convergence of the series $\sum_{n=1}^{\infty}\frac{n!2^n}{n^n}$.

Part – C

[Marks: 12 each]

Q8. Solve the following differential equation:

$$(3x+2)^2\frac{d^2y}{dx^2} + 3(3x+2)\frac{dy}{dx} - 36y = 3x^2+4x+1.$$

OR

Solve the following differential equation:

(i) $3x^4p^2 - px - y = 0$, where $p = \frac{dy}{dx}$. (6)

(ii) $(2x^2y^2+y)dx + (3x - x^3y)\,dy = 0.$ (6)

Q9. Let A = $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$, then:

(i) Find eigen values of A (3)
(ii) Find eigen vectors corresponding to each eigen value (3)
(iii) Show that A is diagonalizable (3)
(iv) Find modal matrix P of A. (3)

OR

Prove that the series $x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots\infty$ is convergent for $-1 < x \le 1$.

Also write the interval of convergence.

.2, 3, 6

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Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. 2203787

52/60

Program: B.Tech. (Batch 2018 onward)
Semester: 1/2
Name of Subject: Mathematics-I
Subject Code: BSC-103
Paper ID: 15927
Scientific calculator is Not Allowed

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1

a) Define Legendre's linear equation.

b) Evaluate $\lim_{x \to 0} x \log x$. 1 c

c) If λ is an eigen value of a non-singular matrix A. Then prove that λ^{-1} is an eigen value of A^{-1}.

λ^{-1} value of A^{-1}

d) Evaluate the improper integral $\int_{-1}^{1} \frac{dx}{x^{2/3}}$.

e) Solve $p^2 - 7p + 12 = 0$, where $p = \frac{dy}{dx}$.

f) Show that $\sum \left(\frac{n+1}{3n}\right)^n$ is convergent. $\frac{1}{3}$

Part – B **[Marks: 04 each]**

Q2. Solve the differential equation $y\,dx - x\,dy + \log x\,dx = 0$. $-\frac{y}{x} - \frac{\log x}{x} - \frac{1}{x} = c$

Q3. Prove that $\gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.

Q4. For what value of k the system of equations $x + y + z = 2, x + 2y + z = -2,$ $x + y + (k-5)z = k$ has no solution.

P = 7
4
3

P.T.O.

Q5 Expand $\log(1+x)$ using Maclaurin's Theorem.

Q6. Test the convergence of the series $\sum \frac{n^2+1}{n^3+1}$.

Q7 Solve $\frac{d^2y}{dx^2}+y=\sec x$ by variation of parameter method.

Part – C **[Marks: 12 each(06 for each subpart if any)]**

Q8. Solve $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+2y=x\log x$. PI = z e^z

OR

(i) Solve $(px-y)(py+x)=2p$, where $p=\frac{dy}{dx}$.

(ii) Solve the differential equation $xy(1+xy^2)\frac{dy}{dx}=1$.

Q9. Show that the matrix $\begin{bmatrix}1 & 6 & 1\\ 1 & 2 & 0\\ 0 & 0 & 3\end{bmatrix}$ is diagonalizable. Hence find modal matrix P such that $P^{-1}AP$ is a diagonal matrix.

OR

For what value of x the power series

$$1-\frac{1}{2}(x-2)+\frac{1}{4}(x-2)^2-\frac{1}{8}(x-2)^3+\ldots\ldots+\left(-\frac{1}{2}\right)^n(x-2)^n+\ldots\ldots\infty$$

converges? What is its sum?

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