Department of A	pplied Science	en [fe		-		
B.Tech.	Semester	2nd				
(ITA,ITB,ITC,ECA,ECB)						
BSC-103	Subject Title	Math	ematics-I			
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	Coordinator (s)			_		
24	Time Duration					
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Guru Nanak Dev Engineering College, Ludhiana

	Lower Order 7	hinking Levels (	LOTS)	Higher Orde	r Thinking Lo	vels (HOTS)	
RBT Level Number	LI	L2	L3	L4	1.5	reis (HOTS)	
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	L6	

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	G	uru Nanak Dev Eng	ineering College, Ludhiana	1	1	
		Department (	of Applied Science		and a	
ogran	and the	B.Tech. (ECA,ECB,ITC)	Semester	2nd	1	-
bject		BSC-103	Subject Title	Mathe	matics-I	
	nester Test (MST) No.	2	Course Coordinator(s)		chminder Sin	gh
ax. M		24	Time Duration		30 minutes	0
ate of	•	22-5-2023	Roll Number	11041	20	
ote: A	ttempt all questions.	No.		.5.		
.No.		Question		1	CO's, RBT Jevel	Marks
1)	Using Cayley Hamilton	n theorem, find the inv	erse of $\begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$ .	5-1	CO1, L2,L3,L5	2
2	Evaluate the improper	CO2, L2,L3,L5	2			
23	Expand $\cos x$ in power $\cos x = \frac{1}{12} \left( \frac{x}{12} \right)$	CO3, L2,L3,L5	4			
24	For what values of $k$ , $4x + v + 10z = k^2$ hay	the equations $x + y + x$ we a solution and solve			CO4, L2, L3,L5	4
25	Test the convergence of	of the series $\sum_{n=1}^{\infty} \frac{1}{n(n+1)}$	- using Cauchy integral test		CO6, L2,L3,L5	3010
26)	Diagonalize the matrix	$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ and obtain	in the modal matrix.	•	CO4, L2,L3,L5	8
C <b>ours</b> e Student	e Outcomes (CO)			*		
	Analyze the use of calc	culus and linear algebra	to Engineering problems			
	Apply the concept of in	nproper integrals to stu	idy Beta and Gamma functions	S		
	TE Is in whility of Toyle	ar's theorem in error and	alvsis	2	matrices	
	Apply the concept of ra	ank to solve system of l	linear equations and diagonaliz	zation of	maurices.	
5	Recognize and solve or	rdinary and linear differ	rential equations.		7 7 1-5	
	Infer the convergence	0. 0 .				

RBT	Lower Order	Thinking Levels (	LOTS)	Higher Orde	r Thinking Lev	els (HOTS)
Classification RBT Level	L1	L2	t L3	L4	L5	L6
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MATH Math

			<b>K</b> Dev Engineering College, Legartment of Applied Science				
Program	· · · · · · · · · · · · · · · · · · ·	B.Tech. (CSE B,C,D,	Semester Science	TI			
Togram		CE A,B EE-A,B)	Semester	1			
Subject (	Code	BSC-103	Subject Title	Mathematic	s I		
Mid Sem		2	Course Coordinator	Prof Rajbir			
Test No.					Kaur Choul	nan	
				Dr. Gagandeep Kaur			
Max. Ma		24	Time Duration	1 hour 30 m	inutes		
Date of N	IST	20-12-2020	Roll Number				
Note: At	tempt a	all questions					
Q. No.			Question	1.5	COs,RBT level	Marks	
Q1	Examine the convergence of $\sum \left(\frac{1.2.3.4n}{3.5.72n+1}\right)^2$				CO6,	2	
<b>3</b>	$\frac{1}{3.5.72n+1}$				L1,L4		
22)	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,	2	
		L2, L4					
Q3	For w	CO4,	4				
	1		tem of equations x+y+z=1 , 2	, , , , , , , , , , , , , , , , , , , ,	L1,L3	-	
		+10z=k <sup>2</sup> have solution.			, , , ,		
Q4)	Exam	nine the convergence of	the series $\frac{\sqrt{2}-1}{3^3-1} + \frac{\sqrt{3}-1}{4^3-1} + \frac{\sqrt{4}-1}{5^3-1}$	-1 ,	CO6,		
					L2, L4	4	
Q5	Annly	Caylor Hamilton the	in to find $A^{-1}$ , where $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \\ 1 & -1 \end{bmatrix}$	1 1]	CO1,	4	
	Apply	Cayley Hamilton theoren	in to find $A^{-1}$ , where $A = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$	2 -1	L3		
			/ L1 -	1 2 J			
Q6			[1 1 3	31			
3	Cons	truct a matrix P which t	ransforms the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 3 \\ 3 & 1 & 3 \end{bmatrix}$	1 into a	CO4,	-8	
	diago	nal form.	l3 1 1	1]	L5	-0	
Course		nes (CO)Students will b	a abla ta			1	
2	Analy	the agreement C:	linear algebra to Engineering pro	blems.			
	Apply	in utility of Table 2 4	ntegrals to study Beta and Gamm	a functions.			
}  -	Applai	in utility of Taylor's theore	em in error analysis.				
	Apply	nize and solver all	ve system of linear equations and	diagonalization	of matrices.		
			d linear differential equation.		1		
	Inter th	he convergence of infinite	series.				

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

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Program		B.Tech. (CEA,CE B, CS B, CS C, CS D, EE A)	of Applied Science Semester	2nd	1.10	
Subject Mid Sen No.	Code nester Test (MST)	BSC-103	Subject Title Course Coordinator(s)	Mathematics 1 Prof. Rajbir Kaur, Dr. Gagandeep Kaur, Dr. Sandeep Chauhan		
Max. M	arks # 2	24	Time Duration		30 minutes	
Date of	MST	14 <sup>th</sup> Nov., 2022	Roll Number	-x -		
Note: A Q. No.	ttempt all questions	Questi	on the transfer	) - \	COs, RBT level	Mark
QI	Solve the differential of	equation: $(y - px)(p$	(p-1)=p.	1	CO5, L2,L3	2
(Q2)	State Necessary, and S $Mdx + Ndy = 0, \text{ to}$	ufficient condition for be exactwhere $M$ , $N$	or the differential equation $y$ are functions of $x$ , $y$ .	97	CO5, L2,L1	2
Q3	Solve the following di $(x^2 + y^2 + x)dx + x$	fferential equation: $ydy = 0.$	with method of variation of		CO5, L2,L5	4
	Solve the following di	Herential equation b	y the method of variation of $CF = C_1 e^{-3x} + C_2 x e^{-3x}$	- 3×	CO5,L2, L3,L5	4
1	Solve the differential	equation: $\frac{d^2y}{dx^2} - y$	$= x + \sin x + (1 + x^2)e^x.$		CO5, L2,L5	4
Q5		- d <sup>2</sup> 2.	$2x^{dy} - 20y - (x + 1)^2$		CO5,	8
Q5	Solve the differential		$\frac{2x \frac{1}{dx} - 20y - (x + 1)}{x^{9} + C_{2}u^{-5} - \frac{1}{18}u^{2} - \frac{1}{10}}$		L2,L3,L5	

RBT Classification	g Levels (LOTS)		Higher Order T	hinking Levels (HC	OTS)	
RBT Level Number	LI	L2	L3	L.4	L5	L6
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Program		B.Tech.(CE)	Semester 1/2		
Subject C	Code	BSC-103	Subject Title: Applied Maths	1 - 1	
Mid Sem No.	ester Test (MST)	1	Course Coordinator(s)		
Max. Ma	arks	24	Time Duration 90 min.		
Date of I	MST	Feb 2020	Roll Number 1914103		
Q. No.		Quest	tion	Marks	
(D)	Give an example of a non linear differential equation of second order and second degree.				
<b>Q2</b>	What is solution of differential equation give an example.				
Q3	Solve y logy dx+(x-lo	gy)dy = 0		4	
94)	Write the method for equation.	or finding complen	nentary function of a differential	4	
98)	Solve the differenti		ax	4	
ا	Solve $\frac{d^2y}{dx^2} + y = \cos \theta$	ecx, by the method	d of variation of parameters.	8	

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Program	The same of the sa	In to have or	t of Applied Science	The second secon	and the second
Subject	Carried Comments of the Comments of the Carried Commen	B Jech (EE) CE BSC-103 E	Samola Complete	Market and the second of the second	and the same of the same
Mid Sey	mester Test (MST)	And the second section of the section of the second section of the section of the second section of the second section of the section of	Course Coordinator(*)	Mathematics-I Rupinderiit Kaur	
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Date of		16 September, 2019	Roll Number	ATTION OF THE STATE OF THE STAT	
Jule: V	tempt all questions	भवाक्षित्तं कार्याः भविष्यः प्रोत्तेक्षायाम् अते वः । भविष्यक्षात्रः स्व वर्षे क्षाव्यः स्व प्रकार विष्या स्वा स्व	real reparts one control terms are represented as a control of the		The Manager and confinence of the Telephone of
Carried and and and and and and and and and an		Questi	SH	CO., RBT lev	Marks
21	Find the solution of	$p^2 - 7p + 12 = 0$	und kirjand and market various and production of the design that the design temperature and production of the design of the desi	COS, L2	Photography and the comment of the c
罢.	Define exact differe	nual equation	detailed textend file committee たんだいが サンドロンドフィットから ない 時間	COS, LI	1 2
	Solve r'ydr - (r'			CO5, 1.3	4
(H)	Solve di . y	2 XX,	enter en mentre de la propositio de la companya de La companya de la companya del companya del companya de la companya del la companya de la	CO5, L3	
(S)	Use method of vani	ation of parameters	to solve $\frac{d^2y}{dx^2} + y = \sec x$ .	CO5, L5	
0.	Solve $(2x+3)^2 \frac{d^2}{dx}$	$\frac{y}{1} - 2(2x + 3) \frac{dy}{dx} -$	12y = 6x	CO5, L5	8
	Outcomes (CO) will be able to	ere et en de la mental de la me		- Anna Carlo	
1	Analyze the use of	calculus and linear	algebra to Engineering probl	icms.	NEW COLUMN TO THE THE PARTY OF
2			s to study Beta and Gamma		A THE RESERVE OF THE PARTY OF T
Simple class relaction activities — spirit	Explain utility of Ta	ylor's theorem in e	mor analysis.	The state of the s	
4	Apply the concept of	of rank to solve syst	em of linear equations and c	lagonalization of	matrices
*	Recognize and solve	e ordinary and linea	ir differential equations	Marketter of the following the second of the first of the	Christian Control of the Control
6	Infer the convergent	ce of infinite series.			

RHT Classification	Lower Order	Thinking Levels	(LOTS)	Higher Order Thinking Levels (HOTS)			
RBT Level Number	1.1	12	L3	LA	L5	L6	
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating	

	Trop equation	hara Curu Nanak	Day Engineering College	, Ludi	ATTEMPTER	
1617 1	Type equation	Donartment	Dev Engineering College		**************************************	$\ell$
			of Applied Science	2nd	137	
rogram	· CAR	B.Tech.	Semester			
		(CEA,CEB,			The state of the s	
		CS B, CS C,				
		CS D, EE A)			motics 1	
11: AC	a d a	BSC-103	Subject Title	Mathematics 1		WALL SHA
Subject C			Course Coordinator(s)	Prof.	Rajbir Kaur,	
Mid Semester Test (MST) No.		11	Course Cool dimator (5)	In C	agandeeD Na	LLL 9 HOLE TO
				Dr S	andeep Chaul	nan
				11.00	r 30 minutes	1.7
Max. Ma	rks	24	Time Duration			
Date of N		14th Nov., 2022	Roll Number	1221	60 5 <i>8</i> )	
Date of N	101	14 1101., 2022				
						135 1
	tempt alliquestions	0			COs,	Mark
Q.		Questi	on		RBT level	
No.			•			(0
Solve the differential equation: $(y - px)(p - 1) = p$ .					CO5,	\2
					L2,L3	~ 34.
	State Necessary and Sufficient condition for the differential equation				CO5,	-2
(Q2)	State Necessary and	Sufficient condition in	d are functions of x. V.		L2,L1	
	$\int Mdx + Ndy = 0,$	to be exactwhere $M$ , $N$	are functions of My.		,	. 1
	To the state of the state of	differential equation:	•••		CO5,	4
$Q_3$	Solve the following	differential equation:	(y		L2,L5	
	$\int (x^2 + y^2 + x) dx +$	-xvdv=0.				1.7
	1,					
Q4	Solve the following	differential equation b	by the method of variation of		CO5,L2,	4
(4)	' i				L3,L5	
- <b>}</b>	parameters: $\frac{d^2y}{dx^2}$	$+6\frac{dy}{dx} + 9y = \frac{1}{x^3}e^{-3x}.$				
1.0		70				
Q5	Solve the different	ial equation: $\frac{d^2y}{dt^2} - y$	$=x+\sin x+(1+x^2)e^x.$		CO5,	4
	Solve the different	$dx^2$			L2,L5	
(Q6)	1000	interpolations and d <sup>2</sup> y	$2x\frac{dy}{dx} - 20y = (x+1)^2.$		CO5,	8
(10)	Solve the different	ial equation: $x^{-} \frac{dx^{2}}{dx^{2}}$	$2x\frac{d}{dx} - 20y = (x + 1).$		L2,L3,L5	
Course	Outcomes (CO)				, , , , , ,	
	will be able to					
		•		***************************************		
1	Analyze the use of calculu	and linear algebra to Engineer	ring problems			
3	Apply the concept of impr Explain utility of Taytor's t	oper integrals to study Beta an heorem in error analysis.	u Gamma functions.			
4	Apply the concept of rank	to solve system of linear equat	ions and diagonalization of matrices.			
5	Recognize and solve ordin	ary and linear dilterential equa				
6	Infer the convergence of in	nfinite series.				

RBT Classification	Lower Order Thinkin	g Levels (LOTS)		Higher Order Thinking Levels (HOTS)			
RBT Level Number	1.1	L2	L3	1.4	L5	L6	
RBT Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating	

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MORNING



Math

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]

01.

Define Clairaut's equation and write its solution.

Test the convergence of the improper integral  $\int_{0}^{\infty} e^{-x} dx$ .

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

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

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

Evaluate  $\int_{0}^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ . gamq finth on

Part-B

[Marks: 04 each]

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

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

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

Page 1 of 2

P.T.O.

# MORNING

24 JUN 2022

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

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

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

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

[Marks: 12 each(06 for each subpart if any)]

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

(b) Solve  $y = 2px + p^2y$ .  $y = py = 2px + y(1-p^2) = 2px + y = 2px - 2px$ OR y = 2px - 2px - 2pxSolve  $x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + 8y = 4x^3 + 2\sin(\log x)$ . y = 2px - 2px y = 2px - 2px y = 2px - 2px y = 2px - 2px

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



Discuss the convergence of the series  $x + \frac{2^2 x^2}{2!} + \frac{3^3 x^3}{3!} + \frac{4^4 x^4}{4!} + \dots \infty$ .  $= \frac{n\pi}{n!} \times \frac{(n+1)!}{(n+1)!}$   $= \frac{n\pi}{n!} \times \frac{(n+1)!}{(n+1)!}$   $= \frac{n\pi}{n!} \times \frac{(n+1)!}{(n+1)!}$   $= \frac{n\pi}{n!} \times \frac{(n+1)!}{(n+1)!}$ 

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

[Total No. of Questions: 09]

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Uni. Roll No. 22 033.4.7...

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. Evaluate  $\lim_{x\to\infty} (1+x)^{1/x}$ .  $\rightarrow 1$  my

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

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

Evaluate the improper integral  $\int_{0}^{\infty} e^{-2x} x^{5} dx$ .

Solve the equation  $xp^{2} - yp + a = 0$ .  $yp = 2p^{2} + 9$  y = 2p + pq y = cx + cq

Part - B

Marks: 04 eachl

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

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

Q5. Prove that 
$$\int_{0}^{\pi/2} \sin^{p} \theta \cos^{q} \theta d\theta = \frac{\sqrt{\frac{p+1}{2}} \sqrt{\frac{q+1}{2}}}{2\sqrt{\frac{p+q+2}{2}}}.$$
 Hence Evaluate  $\sqrt{\frac{1}{2}}$ .

Discuss the consistency of the following system of equations 2x + 3y + 4z = 11,  $\begin{cases} 2x + 3y + 4z = 11, \\ 2x + 5y + 7z = 15, 3x + 11y + 13z = 25. \text{ If found consistent, solve it.} \end{cases}$   $\begin{cases} 2x + 3y + 4z = 11, \\ 2x + 3y + 4z = 11, \\ 2x + 3y + 4z = 11, \end{cases}$ 

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

parameter 
$$\frac{d^2y}{dx^2} + y = \cos ecx$$
.  
 $C_1 \cos x + C_2 \sin x - x \cos x + \log (\cos ecx) \sin x$ 

Part - C

[Marks: 12 each(06 for each subpart if any)]

Solve  $x^2 \frac{d^2 y}{dx^2} - 3x \frac{dy}{dx} + 5y = \sin(\log x)$ .  $n^2 (C, \omega_s \log x) + C_2 \sin(\log x) + \frac{1}{8} (\cos(\log x))$ (i) Solve the differential equation  $xy(1+xy^2)\frac{dy}{dx} = 1$ 

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



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



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.

Page 2 of 2

8 -7(-2)2+34  $-8 - 7(4) + 36 \qquad 1 - 7 + 36 \qquad -8 \qquad 8 - 28 + 36$   $36) + 36 \qquad 5 + 28 \qquad -1 - 7 + 36 \qquad -8 - 28 + 36$ 

Please check that this question paper contains	questions and	_printed pages within first ten minutes.
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[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

Time Allowed: 02 Hours

Max. Marks: 60

25-01-2022(E)

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,I,L are constants subject to the

condition 
$$x = a$$
,  $\frac{dx}{dt} = 0$  at  $t = 0$ 

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

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

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 
$$\int_{0}^{\infty} \frac{x^4 (1+x^5)}{(1+x)^{15}} dx = 1/5005 \dots$$

- 6 Expand f(z) = a/bz + c about  $z_0 = 0$
- 7 Find Limit  $x \to 0 (1/\sin x 1/x)$

- 8 Solve the initial value problem  $e^y \frac{dy}{dx} = 2x, x \rightarrow \sqrt{3}, y(2) = 0$  Evaluate
- $9 \int_{2}^{\infty} (x+3)/(x-1)(x^2+1)dx$

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. .....

Program: B.Tech

Semester: 1

Subject Code: BSC-103

Paper ID: 15927

01-03-2022(M)

Max. Marks: 60

Time Allowed: 02 Hours

# NOTE:

1) Each question is of 10 marks.

- 2) Attempt any six questions out of nine
- 3) Any missing data may be assumed appropriately

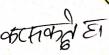
[Marks: 10 each, 05 marks for each sub-part if any]



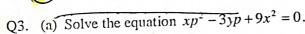
Solve the differential equation  $\tan y \frac{dy}{dx} + \tan x = \cos y \cos^3 x$ .



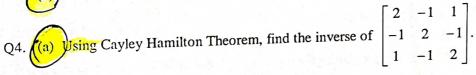
Q2. (a) Expand  $\sin x$  in ascending powers of  $\left(x - \frac{\pi}{2}\right)$  using Taylor Theorem.



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

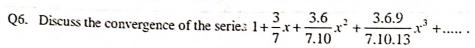


(b) Solve 
$$(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$$



- (b) For what values of  $\lambda$  and  $\mu$  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?
- Solve the differential equation  $\frac{d^2y}{dx^2} + 4y = \sec x$  by method of variation of parameter.





- 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  $x^2 \frac{d^2y}{dx^2} x \frac{dy}{dx} + 4y = \cos(\log x) + x \sin(\log x)$ .
- Show that the matrix  $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$  is diagonalizable.

\*\*\*\*\*\*\*\*

[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)

Max. Marks: 60

Time Allowed: 02 Hours

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  $\lambda$  and  $\mu$  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)

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

(5 marks) **O3.** (a) Solve  $(x - y^2)dx + 2xydy = 0$ .

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

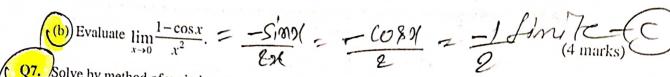
(a) Test the convergence of the series  $\sum_{n=1}^{\infty} \frac{n}{(n^2+1)^2}$  using Cauchy Integral test. (6 marks)

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

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

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

 $un = \frac{(n+1)^{2}}{(n+2)^{3}}$   $un+1 = \frac{(n+2)^{3}}{(n+2)^{3}} - \frac{(n+1)^{2}}{(n+2)^{3}}$ Page 1 of 2 P.T.O.



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

Faper ID: 15927

Time Allowed: 03 Hours

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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

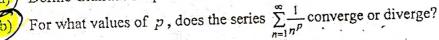
3) Any missing data may be assumed appropriately

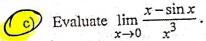
Part - A

[Marks: 02 each]

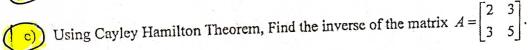
Q1.

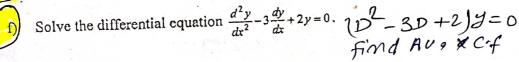
a) Define Clairaut's equation.





Test the convergence or divergence of the improper integral  $\int_{0}^{\infty} e^{-x} dx$ .





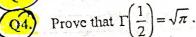
Part-B

[Marks: 04 each]



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

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



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

Page 1 of 2

0.8 MAR 2021.

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.

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]



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

OR



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

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



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

OR

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

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

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

MORNING

[Total No. of Pages: 02]

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  $\int_{0}^{\infty} \frac{dx}{9+x^2}$ 

Define Clairaut's equation and write its solution,

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

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

Test the convergence of the series  $\sum_{n=1}^{\infty} \left(\frac{n}{n+1}\right)^{n^2}$ . Qub  $\nearrow$ 

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

Part -B

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

Q3. Solve p(p+y) = x(x+y). Solve the following differential equation by method of variation of parameters:

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

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

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



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:  $\frac{dy}{dx} + y = xy^{3}.$ 
    - Solve the following differential equation:  $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0.$
- (Q9.) a) Discuss the convergence of the series:

$$1 + \frac{2x}{2!} + \frac{3^2 x^2}{3!} + \frac{4^3 x^3}{4!} + \frac{5^4 x^4}{5!} + \dots \infty.$$

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

Z 1 MAY 2019

[Total No. of Pages:02]

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:

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.

Prove that  $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} \, d\theta = \frac{\left[\frac{1}{2}\right]^{\frac{3}{2}}}{\frac{1}{2}}$ . Evaluate improper integral  $\int_0^{\infty} \frac{dx}{1+x^2}$ . Why is it convergent? Solve  $p = \sin(y - px)$ .

Test for convergence of  $\sum \left(\frac{n}{n+1}\right)^{n^2} 332 \cdot \sqrt{20}$ 

State Taylor and Maclaurian theorems

Define rank of a matrix.

[Marks: 04 each]

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

Solve  $(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0$ . 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  $\left(x - \frac{\pi}{2}\right)$ .

Evaluate  $\lim_{x\to \frac{\pi}{2}} (\sec x - \tan x)$ . Solve x + y - z = 0, 2x - y + z = 3, 4x + 2y - 2z = 2.

[Marks: 12 each (06 each part)]

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

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

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

Q9. Discuss the convergence of the series  $1 + \frac{\alpha \cdot \beta}{1 \cdot \gamma} x + \frac{\alpha(\alpha+1)\beta(\beta+1)}{1 \cdot 2 \cdot \gamma(\gamma+1)} x^2 + \frac{\alpha(\alpha+1)(\alpha+2)\beta(\beta+1)(\beta+2)}{1 \cdot 2 \cdot 3 \cdot \gamma(\gamma+1)(\gamma+2)} x^3 + \cdots$ 

GE 1 OF 2

P.T.O

# MORNING

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

[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:

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.

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

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

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

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

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.

5) State Cayley Hamilton theorem.

Part - B

[Marks: 04 each]

. Derive the relation between Beta and Gamma functions .

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

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



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



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?



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

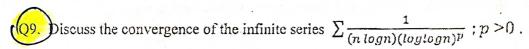
Part - C

[Marks: 12 each]



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

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





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

RBT Classification RBT Level Number RBT Level

		Department	ineering College, Ludhiana of Applied Science			
rogram	1	B.Tech. (CE/ME/EE/ECE)	Semester	lu.		
ubject (	Code	BSC-103	Subject Title	Mathematics 1 Prof. Rajbir Kaur, Prof. Sukhminder Singh, Prof. Neeraj Kumar 1 hour 30 minutes		
	nester Test (MST) No.	2 <sup>nd</sup>	Course Coordinator(s)			
lax. Ma	irks	24	Time Duration			
ate of N		6th Nov., 2023	Roll Number			
ote: All	questions are compulsory	,				
No.	Question			COs, RBT level	Marks	
)1	Find the rank of the following matrix $\begin{bmatrix} 1 & -1 & 0 \\ 2 & -3 & 0 \\ 3 & -3 & 1 \end{bmatrix}$ .				2	
22	Prove the necessary con	CO6, L5	2			
)3	Test the convergence o	f the series:	ne series:			
	$1 + \frac{2x}{2!} + \frac{3^2x^2}{3!} + \frac{4^3x^3}{4!}$					
1	Solve the following diffe	erential equation:		CO5, L3	4	
	$\frac{d^{2}y}{dx^{2}} + \frac{1}{x}\frac{dy}{dx} = \frac{1}{x^{2}} 12 \log x$				-	
	4.4		uations	CO4, L5	. 4	
5	Determine, for what val x + 2y + 3z = 6, $x + 3$					
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	Apply the concept of rank to solve system  Recognize and solve ordinary and linear differential equations.  Infer the convergence of infinite series.					
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Note: Attempt all questions.  Q.No. Question							CO's, RBT level	Mark	
Q1 State Necessary and Sufficient conditions for the differential equation Mdx+Ndy = 0 to be exact.							CO5. L2/L3	2	
Q22 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	Q4 Solve: $x^2 y dx - (x^3 + y^3) dy = 0$						CO5, L3/L5	4	
Solve the differential equation $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ by method of variation of L3/L5 parameters.						4			
Q6 Solve: $(D-2)^2 y = 8(e^{2x} + \sin 2x + x^2)$							CO5, L3/L5	8	
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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

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

[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:

Page 1 of 2

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

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

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

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

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

Solve the following differential equation:

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

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

Prove that the series  $x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + - - - \infty$  is convergent for  $-1 < x \le 1$ . 173,2

Also write the interval of convergence.

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Page 2 of 2

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[Total No. of Questions: 09	[Total]	No of Pages: 02]
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Um. Ron No.Cara. 4.4	Program: B.Tech. (Batch 2018 onward	1) (/52)
	Semester: 1/2	(60)
	Name of Subject: Mathematics-I	
The same of the sa	Subject Code: BSC-103	
	Paper ID: 15927	
	Scientific calculator is Not Allowed	
Time Allowed: 03 Hours	Scientific careament is a second	Max. Marks: 60
NOTE:		
NOIE.		
1) Parts A and B are c	compulsory	land with internal choice
2) Part-C has Two Qu	nestions Q8 and Q9. Both are compulsory	, but with internal choice
3) Any missing data n	nay be assumed appropriately	
	Part - A	[Marks: 02 each]
Q1	and the same of th	a long multi-stoke a
✓ a) Define	Legendre's linear equation.	
(cb) Evaluat	te $\lim_{x\to 0} x \log x$ . $\mathbf{L}$	The same of the sa
	an eigen value of a non-singular matrix	A. Then prove that $\lambda$ is an
	value of $A^{-1}$ .	3-1 00 00-1
d) Evaluat	te the improper integral $\int_{-1}^{1} \frac{dx}{x^{2/3}}$ .	x value of A -1
(e) Solve	$p^2 - 7p + 12 = 0$ , where $p = \frac{dy}{dx}$ .	
	that $\sum \left(\frac{n+1}{3n}\right)^n$ is convergent. $\frac{1}{3}$	
	Part – B	[Marks: 04 each]
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Q2. Solve the dif	fferential equation $y dx - x dy + \log x dx =$	スメス
$(3.)$ Prove that $\gamma$	$\left(\frac{1}{2}\right) = \sqrt{\pi}$ .	
(04.) For what val	lue of k the system of equations $x + y + z$	z = 2, x + 2y + z = -2
x+y+(k-1)	5)z = k has no solution.	2,
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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.

[Marks: 12 each(06 for each subpart if any)]



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

- (i) Solve (px y)(py + x) = 2p, where  $p = \frac{dy}{dx}$ .
- (ii) Solve the differential equation  $xy(1+xy^2)\frac{dy}{dx} = 1$ .



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.

For what value of x the power series

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

converges? What is its sum?