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(MPH/PHD/URS-EE-2017) Subject : MATHEMATICS

Sr. No. 10205

Code A

Time: 14 Hours	Max. Marks: 100	Total Questions: 100
Roll No.	(in figure)	(in words)
Name :	Father's N	ame:
Mother's Name :	Date of Exa	amination:
(Signature of the candidate)		(Signature of the Invigilator

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

- Candidates are required to attempt any 75 questions out of the given 100 multiple choice questions of 4/3 marks each. No credit will be given for more than 75 correct responses.
- 2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
- 4. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.
- 5. There will be no negative marking. Each correct answer will be awarded 4/3 mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.
- 7. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.



Question No.		Questions			
1.		nd the total number of subsets of A has 56 number of subsets of B, then the number of subsets of B, the number of subsets of S, the number of subsets of S, th			
	(1) 4	(2) 5			
	(3) 6	(4) 8			
2.	If P (A) denotes the power correct?	set of the set A, then which of the following	ing is		
	(1) $A \cap P(A) = A$	(2) $A \cup P(A) = P(A)$			
2 1	(3) $A - P(A) = A$	(4) $P(A) - \{A\} = P(A)$			
3.	The order of a set A is 4 and that of a set B is 3. The number of relations from A to B is:				
	(1) 12	(2) 144			
	(3) 2048	(4) 4096			
4.	The set of real numbers in	the closed interval {0, 1} is			
	(1) finite set	(2) uncountable set			
	(3) countable set	(4) None of these			
5.	The nth term of the sequen	ice			
	$\left\{2, \frac{-3}{2}, \frac{4}{3}, \frac{-5}{4}, \right.$	} is:			
	(1) $(-1)^{n-1} \left(1 + \frac{1}{n}\right)$	(2) $(-1)^{n-1} \left(1 - \frac{1}{n}\right)$			
	(3) $(-1)^{n-1} \left(1 + \frac{2}{n}\right)$	$(4) (-1)^{n-1} \frac{2^n}{n-1}$			

Question No.	Questions
6.	The series $x + \frac{2^2 x^2}{2} + \frac{3^3 x^3}{2} + \frac{4^4 x^4}{4} + \dots$ is convergent if:
×	(1) $x > \frac{1}{e}$ (2) $0 < x < \frac{1}{e}$
	(3) $\frac{2}{e} < x < \frac{3}{e}$ (4) $\frac{e}{3} < x < \frac{e}{2}$
7.	The series $\sum \left(1+\frac{1}{n}\right)^{-n^2}$ is:
	(1) Convergent (2) Divergent (3) Oscillatory (4) None of these
8.	If $f(x) = x(x-1)(x-2)$; $x \in \left[0, \frac{1}{2}\right]$, then the value of 'C' of Lagrange's
	mean value theorem is:
8	(1) $\frac{1}{3}$ (2) $\frac{1}{4} + \frac{1}{\sqrt{2}}$
	(1) $\frac{1}{3}$ (2) $\frac{1}{4} + \frac{1}{\sqrt{2}}$ (3) $\frac{6 + \sqrt{21}}{18}$ (4) $\frac{6 - \sqrt{21}}{6}$
9.	It is given that the function
	$f(x) = \begin{cases} \frac{a \cos x}{\frac{\pi}{2} - x}, & x \neq \frac{\pi}{2} \\ 1, & x = \frac{\pi}{2} \end{cases}$
	is continuous at $x = \frac{\pi}{2}$, value of a is:
	(1) -1 (2) 1
	(3) 2 (4) $\frac{\pi}{2}$

Question No.	Qu	estions			
10.	Which of the following functions is not uniformly continuous in [2, ∞)?				
	$(1) \frac{1}{x} \qquad \qquad (3)$	$\frac{1}{x^2}$			
	(3) e ^x	1) sin x			
11.	If $f_n(x) = \tan^{-1} nx$, $n \in [0, 1]$, who				
	limit is $f(x) = \begin{cases} 0, x = 0 \\ \frac{\pi}{2}, x \in (0,1] \end{cases}$, then				
	(1) f(x) is differentiable (2	2) f(x) is not differentiable			
7	(3) f(x) is continuous (4)	1) None of these			
12.	The integral $\int_{0}^{\infty} \sin x dx$:				
	(1) exists (2	2) exists and equals zero			
	(3) exists and equals 1 (4	1) does not exist			
13.	If f is Riemann integrable with re	spect to α on [a, b], then:			
	(1) f and α are both increasing				
	(2) f and a are both bounded				
	(3) f is bounded and α is increasi	ng function			
-	(4) f is increasing and α is bound	led function			
14.	If $f(x) = \sin x$, then the total varia	ation of f (x) on [0, 2] is			
	(1) 3	2) 1			
	(3) 2	1) ∞			

Question No.	Questions
15.	If f is a non-negative function, $< E_i > a$ disjoint sequence of measurable sets and $E = \bigcup E_i$, then
	(1) $ \int_{E} f > \sum_{E_{i}} f $ (2) $ \int_{E} f < \sum_{E_{i}} f $
	(3) $\int_{E} f = \bigcup_{E_{i}} f$ (4) $\int_{E} f = \sum_{E_{i}} f$
16.	For the function $f(x, y) = \begin{cases} \frac{xy^2}{x^2 + y^4}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$, the directional derivative
	along $\vec{u} = (\sqrt{2}, \sqrt{2})$ at $(0, 0)$ is:
	(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$
	(3) $2\sqrt{2}$ (4) $\sqrt{2}/3$
17.	If X is a complete metric space, E is non-empty open subset of X, then:
	(1) E is a null set (2) E is of first category
	(3) E is of second category (4) E is incomplete
	[-5 -8 0]
18.	If A = 3 5 0, then A ² is:
	1 2 -1
	(1) nilpotent (2) idempotent
	(3) involutory (4) periodic

Question No.			Quest	tions
19.	IfA	$= \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ satisfi	es the matrix ec	quation $A^2 - \lambda A + 2I = 0$, then value of
1 - 1	λis	:		
	(1)	0	(2)	1
	(3)	2	(4)	±2
20.		vector space spar		rthogonal vectors, the dimension of vectors
		X ₁ , X ₂ ,, X _N ,	- X ₁ , -X ₂ ,	X _N is:
4	(1)	N	(2)	N+1
	(3)	2N	(4)	N ²
21.	The	eigen values of a	skew-symmetr	ric matrix are :
	(1)	always zero	(2)	always pure imaginary
	(3)	always real	(4)	either zero or pure imaginary
22.	The	dimension of th	e vector space	of all 3 × 3 real symmetric matrices
	(1)	3	(2)	4
	(3)	6	(4)	9
	(0)			
23.			non-singular l	inear transformations $T: \mathbb{R}^4 \to \mathbb{R}^3$
23.	The	number of all	non-singular li	

Question No.	Questions			
24.	Let $T: \mathbb{R}^3 \to \mathbb{R}^3$ be a linear transformation given by $T(x, y, z) = \left(\frac{x}{2}, \frac{y}{2}, 0\right)$. Rank of T is:			
× ,	(1) 3 (2) 1			
	(3) 4 (4) 2			
25.	A real quadratic form in three variables is equivalent to the diagonal form $-(x_1-x_2)^2-x_3^2$. Then, the quadratic form is:			
	(1) negative definite (2) semi-negative definite			
1	(3) positive definite (4) semi-positive definite			
26.	The positive integer n for which the equality $\left(\frac{\sqrt{3}}{2} + \frac{1}{2}i\right)^n = -1$ holds,			
	is:			
	(1) 2 (2) 4			
	(3) 5 (4) 6			
27.	If $f(z) = 3x - y + 5 + i$ (ax + by - 3), then the values of a and b so that the function $f(z)$ is entire, are:			
	(1) $a = 1, b = 3$ (2) $a = 3, b = 1$			
	(3) $a = 1, b = -3$ (4) $a = -1, b = 3$			
28.	The function $f(z) = e^{2z+i}$ is:			
	(1) differentiable at $z = 0$ (2) differentiable at $z = -1$			
	(3) differentiable at z = i (4) no where differentiable			

Question No.		Questions
29.	The principal value of (-1)	is:
	(1) e ⁻¹ / ₂	(2) e ^{-x}
	(3) $e^{-3\pi}$	(4) e ^{-35/2}
30.	Solutions of the equation si	nh z = cosh z are given by
	(1) $z = (-1 + 4n) \pi i$	(2) $z = e^{-3\pi i}$
	(3) $z = e^{(2n+1)\pi i}$	(4) There are no solutions
31.	The value of the integral $\oint_C 0 \le t \le 2\pi$, is:	$\frac{1}{z}$ dz, where C is the circle x = cos t, y = sin
	(1) 2πi	(2) π i
	(3) 2 π	$(4) \frac{1}{2\pi}$
32.	If C is the circle $ z - 3 $: $\oint_C \frac{2z+5}{z^2-2z} dz =$	= 2, then using Cauchy's integral formula
	(1) 9πi	$(2) \frac{9\pi i}{2}$
	(3) 6 π i	(4) 3 π i
33.	For the function $f(z) = \frac{co}{z^2(z^2)}$	$\frac{ds z}{(z-\pi)^3}$, the residue at the pole $z=\pi$ is:
	(1) 4π ³	(2) $\frac{4\pi}{\pi^2-6}$
	(3) $\frac{\pi^2 - 6}{2\pi^4}$	$(4) - \frac{\pi^2 - 6}{2\pi^3}$

Question No.	Questions					ions
34.	Using Ca		idue theorem,	value of the integral $\oint_C \frac{\tan z}{z} dz$,		
= 1	(1) 4 i		(2)	-4i		
	(3) -2 i		(4)	2 i		
35.	The only l	bounded en	tire functions a	re constants. This result is due to :		
	(1) Cauc	hy	(2)	Liouville		
	(3) Schw	varz	(4)	Morera		
36.	(1) a ren (2) a pol	novable sing le		ngularity z = ∞ is:		
	(4) a nor	n-isolated es	sential singula			
37.	(4) a nor	n-isolated es iy, $w = u +$	sential singula			
37.	(4) a nor	n-isolated es iy, w = u + ransformed	iv, then by the			
37.	(4) a nor If z = x + x = 0 is tr	n-isolated es iy, w = u + ransformed v = 1	iv, then by the into the line:	e transformation w = z e i 4, the line		
37.	(4) a nor If z = x + x = 0 is tr (1) u - v (3) v = -	n-isolated es iy, w = u + ransformed v = 1 - u	iv, then by the into the line : (2) (4)	e transformation $w = z e^{i\pi/4}$, the line $u + v = 1$		
	(4) a nor If z = x + x = 0 is tr (1) u - v (3) v = -	n-isolated es iy, w = u + ransformed y = 1 u mber of 4 dig	iv, then by the into the line : (2) (4)	e transformation $w = z e^{i\pi/4}$, the line $u + v = 1$ $v = u$		

Question No.			Ques	tions	
39.	The nuare :	umber of posit	ve integers whi	h are less than 108	and prime to 108,
	(1) 24	1	(2)	36	
	(3) 40		(4)	52	
40.	The number of zeros at the end of 75 is:				
	(1) 12	2	(2)	16	
	(3) 18	3	(4)	75	
41.	The nu	ımber of elem	ents of order 10	in Z ₃₀ is:	
	(1) 4		(2)	3	
	(3) 2		(4)	1	
42.	The generators of the group $G = \{a, a^2, a^3, a^4 = e\}$ are:				
	(1) a	and a²	(2)	a and a4	
	(3) a	and a ³	(4)	a only	
43.	If H and K are two subgroups of G of order 6 and 8 respectively, then order of HK is 16 if order of H \cap K is:				
	(1) 2		(2)	3	
	(3) 4		(4)	6	
44.	44. Let G be a group of order 15, then the number of sorder 3 is:		e number of sylow	subgroups of G of	
2	(1) 4		(2)	3	
- 1	(3) 2		(4)	1	
45.	The car	rdinality of a f	inite integral do	main can not be:	
	(1) 6		(2)		
4	(3) 3		(4)	9	

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No.	G	uesti	ons		
46.	A ring of polynomials over a field is a :				
	(1) group	(2)	unique factorization domain		
	(3) prime field	(4)	irreducible		
47.	Let R be a commutative ring wit	h uni	ty such that (0) is a prime ideal of R,		
	(1) {0} is a maximal ideal of R	(2)	R has zero divisors		
	(3) R is a field	(4)	R is a integral domain		
48.	A totally disconnected space is	a:			
	(1) T _o -space		T ₁ -space		
	(3) T ₂ -space	(4)	T ₃ -space		
49.	Every indiscrete space is:				
	(1) compact and connected	(2)	not compact		
	(3) disconnected	(4)	connected but not compact		
50.	If Y is a subspace of X, A is clo	sed in	Y and Y is closed in X, then:		
	(1) A is not closed in X	(2)	A is semi-closed in X		
	(3) A is open in X	(4)	None of these		
51.	Solution of (xy² + x) dx + (yx² -	y) d	y = 0 is:		
	(1) $\tan^{-1}(x^2y^2 + 1) = c$	(2)	(x + 1) (y + 1) = c		
	(3) $(x^2 + 1)(y^2 + 1) = c$	(4)	$x^2 + y^2 + 1 = c$		
52.	P.I. for $(D^2 - 4D + 4)$ y = x e^{2x} ,	is:			
	(1) $\frac{x^3 e^{2x}}{6}$	(2)	$\frac{x^2 e^{2x}}{4}$		
	(3) $\frac{x^3 e^{2x}}{8}$	(4)	8 e ^{2x}		

Question No.			Ques	tions
53.	The Green's function G (x, t) is:			
	(1)	one dimensional	(2)	two dimensional
	(3)	three dimensional	(4)	n-dimensional
54.		ving by variation of pa ue of Wornskion w, is	rameters t	the equation, $\frac{d^2y}{dx^2} + 4y = \tan 2x$, then
	(1)	4	(2)	3
	(3)	1	(4)	0
55.	Wh (SL	ich of the following is P)?	not true	about the Strum-Liouville Problem
0 14	(1)	All eigen values are r	eal and no	n-negative.
	(2)	SLP has always an ei	gen functio	on.
	(3)	Eigen functions corres w.r.t. weight function	sponding to	different eigen values are orthogona
	(4)	For each eigen value function.	there exist	s only one linearly independent eiger
56.	Solu	ution of $\frac{\partial^2 z}{\partial x^2} + z = 0$ wi	th $x = 0$, z	$= e^y$ and $\frac{\partial z}{\partial x} = 1$, is:
	(1)	$z = \cos x - e^y \sin x$	(2)	$z = \cos x + e^y \sin x$
	(3)	$z = \sin x - e^y \cos x$	(4)	$z = \sin x + e^y \cos x$
57.	The	differential equation	$f_{xx} + 2f_{xy} +$	$4f_{yy} = 0$ is:
		parabolic		elliptic
	23.51			

No.	Questions Questions					
58.	The surface satisfying $\frac{\partial^2 u}{\partial y^2} = x^3y$ containing two lines $y = 0 = u$ and					
	y = 1 = u is	-				
	(1) $u = x^3y^3 + y(1 - x^3)$					
halfell	(3) $u = x^3y^2 + 1 - x^3$	(4)	$u = x^2y^3 + 1 - x^3$			
59.	The relation $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$ rep	resents	the partial differential equation:			
	(1) $2z = p + q$	(2)	$2z = \frac{xp}{yq}$			
	(3) 2z = xq + yp	(4)	2z = xp + yq			
60.	Using Newton's-Raphson me reciprocal of a natural number		n iterative formula to compute the			
	(1) $x_{n+1} = x_n (2 - N \cdot x_n)$	(2)	$\mathbf{x}_{n+1} = \mathbf{x}_n - \mathbf{N} \; \mathbf{x}_n^2$			
	CO 17					
	(3) $x_{n+1} = 2 x_n - N$	(4)	$\mathbf{x}_{n+1} = 2 - \mathbf{N} \cdot \mathbf{x}_n$			
61.	(3) $x_{n+1} = 2 x_n - N$ $\Delta \tan^{-1} \left(\frac{n-1}{n} \right) =$	(4)	$\mathbf{x}_{n+1} = 2 - \mathbf{N} \cdot \mathbf{x}_n$			
61.			$x_{n+1} = 2 - N \cdot x_n$ $tan^{-1} \left(\frac{1}{n^2}\right)$			
61.	$\Delta \tan^{-1}\left(\frac{n-1}{n}\right) =$	(2)				
62.	$\Delta \tan^{-1} \left(\frac{n-1}{n} \right) =$ $(1) 2 \tan^{-1} \left(\frac{1}{n^2} \right)$ $(3) \tan^{-1} \left(\frac{1}{2n^2} \right)$	(2)	$\tan^{-1}\left(\frac{1}{n^2}\right)$			
	$\Delta \tan^{-1} \left(\frac{n-1}{n} \right) =$ (1) $2 \tan^{-1} \left(\frac{1}{n^2} \right)$ (3) $\tan^{-1} \left(\frac{1}{2n^2} \right)$ The first term of the series	(2)	$\tan^{-1}\left(\frac{1}{n^2}\right)$ $\tan^{-1}\left(\frac{1}{2n}\right)$			

Question No.	Questions					
63.	In the Gauss elimination method for solving a system of linear algebraic equations, triangularization leads to:					
	(1) diagonal matrix	(2)	lower triangular matrix			
	(3) upper triangular matrix	(4)	singular matrix			
64.	In Simpson's one-third rule the	e cur	y = f(x) is assumed to be:			
	(1) circle	(2)	parabola .			
	(3) ellipse	(4)	hyperbola			
65.	The second order Runge-kutt problem $y' = -y$, $y(0) = y_0$ with		thod is applied to the initial value size h. Then y (h) =			
4	(1) $y_0 (h^2 - 2h - 2)$	(2)	$\frac{y_0}{2} (h^2 - 2h + 2)$			
	(3) $\frac{y_0}{6}$ (h ² – 2h + 2)	(4)	$\frac{y_0}{6}$ (h ² - 2h - 2)			
66.	Using Picard's method upto the y (0) = 1, is y ₃ =	ird a	pproximation, solution of $\frac{dy}{dx} = -xy$			
	$(1) 1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{16}$	(2)	$1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{24}$			
	$(3) 1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{32}$	(4)	$1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{48}$			
67.	The minimizing curve must sa	tisfy a	a differential equation, called as:			
	(1) Euler-Lagrange equation	(2)	Lagrange equation			
	(3) Euler-Gauss equation	(4)	Cauchy-Euler equation			

Question No.	Questions
68.	Given the functional $\int_{x_0}^{x_1} \left(\frac{{y'}^2}{x^3} \right) dx$, then the extremal is:
	(1) $y = \frac{cx^3}{3} + c_1$ (2) $y = \frac{cx^4}{4} + c_1$
	(3) $y = cx^2 + c_1$ (4) $y = \sin x$
69.	Solution of the integral equation $\int_{0}^{x} (x-t)^{-\frac{1}{2}} u(t) dt = 1$ is:
	(1) $u(x) = \frac{1}{x\sqrt{\pi}}$ (2) $u(x) = \frac{\pi}{\sqrt{x}}$
	(3) $u(x) = \frac{1}{\pi \sqrt{x}}$ (4) $u(x) = \frac{1}{\sqrt{\pi x}}$
70.	The resolvent third kernel of the Volterra's integral equation with kernel $k(x, t) = 1$, is
	(1) $(x-t)^2$ (2) $\frac{1}{2}(x-t)^2$
	(3) $\frac{1}{3} (x-t)^3$ (4) $\frac{1}{[3]} (x-t)^3$
71.	The $(n-1)$ th derivative of the Green's function $G(x, t)$ with regard to x at the point $x = t$, has:
	(1) Discontinuity of 1st kind (2) Discontinuity of 2nd kind
	(3) Removable discontinuity (4) No discontinuity

Question No.	Questions					
72.	Which of the following is incorrect? (1) The eigen values of a symmetric kernel are real.					
	(2) All iterated kernels of a symmetric kernel are also symmetric.					
	(3) Every symmetric kernel with norm ≠ 0 has at least one eigen value					
	(4) Fredholm integral equation of the second kind has always an eigenvalue.					
73.	For a particle of mass m moving under a potential $v = \frac{k}{q}$, which one of the following relations is correct?					
	(1) $\ddot{q} = \frac{k}{m q^2}$ (2) $m \dot{q}^2 + \frac{2k}{q} = constant$					
	(3) $m \dot{q} + \frac{2k}{q} = constant$ (4) $m \dot{q}^2 + \frac{k}{q} = constant$					
74.	A rigid body moving in space with one point fixed, has degrees of freedom:					
	(1) 3 (2) 4					
	(3) 6 (4) 2					
75.	For the Lagrangian $L = \frac{1}{2}\dot{q}^2 - q\dot{q} + q^2$, the conjugate momentum p is:					
	(1) q - q (2) q + q					
	(3) $\frac{1}{2}\dot{q}q$ (4) $q-\dot{q}$					

Question No.	Questions					
76.	For n independent events A	For n independent events A_i , A_2 ,, A_n , let $P(A_i) = \frac{1}{i+1}$, $i = 1, 2,, n$. Then the probability of happening at least one of the events is				
	$(1) \frac{n}{n+1}$	(2)				
	(3) 1/n		$1-\frac{1}{n}$			
77.	The idea of posterior probab	ilities wa	is introduced by			
	(1) Pascal	(2)	Poisson			
	(3) Fisher	(4)	Thomas Bayes			
78.	In a perfectly symmetrical 75% items are below 75. The	distribut en, the co (2)	ion, 50% of items are above 60 and refficient of quartile deviation is			
	(3) 1/4	(4)				
79.	In any discrete series (when between M.D. about mean a	all the v	values are not same) the relationship			
	(1) M.D. = S.D.	(2)	M.D. < S.D.			
	(3) M.D. > S.D.	(4)	M.D. = Mean + S.D.			
80.	A random variable X can to probability that X takes the value of P (X = 0) is	ake all n ne value	on-negative integral values, and the r is proportional to (0.4). Then the			
	(1) 1	(2)	0.4			
			5			

Question No.	Questions			estions			
81.	Let X_1 and X_2 be two stochastic random variables having variances k as 2 respectively. If the variance of $Y = 3X_2 - X_1$ is 25, then the value of k (1) 7 (2) 19 (3) -7 (4) -19						
82.	W	nich	of the	followin	o is inc		statement?
	(1)	ho	oth the	centra a seque	l limit ti	heorer	n and the Weak law of large number ndom variables with finite mean and
	(2)	Fo	or the s ay hold	equence but the	e of ind	epend	ent r.v.'s, Weak law of large numbers theorem may not hold.
	(3)	Ula	nder co	ertain	conditionare not i	ons, t	he central limit theorem holds for
	(4)	Li	ndeber	g-Levy	theorem	shou	ld not be inferred as a particular case
83.	Ma						t the correct answer using the codes
	giv	en u	nder th	ne lists			the codes
	4400	6743565	st I				List II
	(Dia		ution)			(M	oment Generating Function) for real t
	A.			istribut		1.	(q + p e ^t) ⁿ , where p is probability of success
	В.			distril		2.	p (1 - q e ^t)-1, where p is probability of success
	C.	No	rmal di	stribut	ion	3.	$e^{\lambda (e^{t}-1)}$, where λ is mean
	D.	Bin	omial	listribu	tion	4.	$\exp\left(t^{2}/2\right)$ for standard variate
	Cod	es:					
	2000	A	В	C	D		
	(1)	1	2 1 3	- 3	4		
	(2)	3	1	4	2		
	(4)		2		4		
	(4)	0	2	4	1		

Question No.		Quest	ions		
84.	Suppose that the probability of a dry day following a rainy day is $\frac{2}{3}$ and				
	that the probability of	f a rainy day fo	ollowing a dry day is $\frac{1}{2}$. Given that		
	January 19 is a dry da dry day?	ay, what is the p	probability that January 21 will be a		
	(1) $\frac{5}{12}$	(2)	7 12		
	(3) 7/18	(4)	$\frac{11}{18}$		
85.	Let X ₁ , X ₂ ,, X _n be 1	in dependent	and identically distributed variates		
	each with pdf f(x) =				
	Then mean of smalle	st order statist	inia		
		St Or act boatson	10 15		
	$(1) \frac{n}{n+1}$	(2)			
			$\frac{1}{n}$		
86.	$(1) \frac{n}{n+1}$ $(3) \frac{1}{n+1}$	(2)	$\frac{1}{n}$		
86.	$(1) \frac{n}{n+1}$ $(3) \frac{1}{n+1}$	(2) (4) 0, 1), then the	1 1		

Question No.	Questions			
87.	Mean square error of an estimator t of parameter θ is expressed as (1) Bias + Var (t) (2) [Bias + Var (t)] ² (3) (Bias) ² + [Var (t)] ² (4) (Bias) ² + Var (t)			
88.	The degrees of freedom for t-statistic for paired t-test based on 20 pair of observations is (1) 38 (2) 19 (3) 39 (4) 18			
89.	If the sample size in Wald-Wolfowitz run test is large, the variate I (number of runs) is asymptotically normal with mean (1) $\frac{2n_1n_2}{n_1+n_2}+1$ (2) $\frac{2n_1}{n_1+n_2}+1$			
	(3) $\frac{2n_2}{n_1 + n_2} + 1$ (4) $\frac{2n_1n_2}{n_1 + n_2}$ where n_1 , n_2 are the sizes of the two samples.			
90.	In the usual notations, $R_{1.23}^2$ can be expressed as: (1) $R_{1.23}^2 = 1 - (1 - r_{12}^2)(1 - r_{13.2}^2)$ (2) $R_{1.23}^2 = 1 - (1 - r_{12}^2)(1 - r_{13.2})$ (3) $R_{1.23}^2 = (1 - r_{12}^2)(1 - r_{13.2}^2)$ (4) $R_{1.23}^2 = (1 - r_{12})(1 - r_{13.2})$			
	 Consider a multiple linear regression model with r regressors, r ≥ 1 and the response variable Y. Suppose Ŷ is the fitted value of Y. R² is the coefficient of determination and R² is the adjusted coefficient of determination. Then (1) R² always increases if an additional regressor is included in the model (2) R² always increases if an additional regressor is included in the model (3) R² < R² adj for all r 			
	(4) Correlation coefficient between Y and Ŷ is always non-negative.			

Question No.	Questions						
92.	Suppose X is a p-dimensional random vector with variance-covariance matrix Σ . If P_1 , P_2 ,, P_p represent p orthogonal eigenvectors of Σ corresponding to the eigen values $\lambda_1 > \lambda_2 > > \lambda_p \geq 0$ respectively, then which of the following is not correct?						
	(1)	First principal co	mponent is P	р ₋₁ Х			
	(2)	$P_{-1}^T X $ and $P_{-1}^T X $ a	e correlated				
	(3)	$Var (P_{-1}^T X) = \lambda_1$					
	(4)	$T_r(\Sigma) = \sum_{i=1}^p \lambda_i$					
93.			e size 100, un	d $N_2 = 300$, $S_2^2 = 4$; the variance of other proportional allocation is			
	Oction .	0.240	(2)				
94.	21.50			r trend, $Y_i = i$; $i = 1, 2, 3,, k$, then			
		$Var(\overline{y}_{st}) \leq Var(\overline{y}_{sys})$		$Var(\overline{y}_{st}) \ge Var(\overline{y}_{sys})$			
		$Var(\overline{y}_{st}) = Var(\overline{y}_{sys})$		$Var(\overline{y}_{st}) > Var(\overline{y}_{sys})$			
95.		total number of criment is	main and in	nteraction effects in a 24 factoria			
	(1)	3	(2)	14			
	(3)	15	(4)	16			
96.	While analysing the data of a $k \times k$ Latin square design, the error d.f. in analysis of variance is equal to:						
	anai	J-40 04 1 04 Edition 10					
		$k^3 - 3k^2 + 2k$	(2)	$k^2 - 1$			

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Question No.	Questions					
97.	For a system with n elements connected in series with constant (but different for each element) hazard rates $\lambda_1, \lambda_2,, \lambda_n$ respectively, then mean time to failure of the system is					
	(1) $1 - \prod_{i=1}^{n} (1 - e^{-\lambda_i \tau})$ (2) $\int_{0}^{\infty} \left[1 - \prod_{i=1}^{n} (1 - e^{-\lambda_i \tau}) \right] dt$					
	(3) $e^{-\sum_{i=1}^{n} \lambda_{i} t}$ (4) $\int_{0}^{\infty} e^{-\sum_{i=1}^{n} \lambda_{i} t} dt$					
98,	If primal in an LPP has alternative optimal solution, then the dual has					
	(1) No feasible solution (2) Unbounded solution					
	(3) Alternative optimal solution (4) Degenerate optimal solution					
99.	A manufacturing company has determined from an analysis of its accounting and production data for a certain part that its demand is 9000 units per annum and is uniformly distributed over the year. Further, it is known that the lead time is uniform and equals 8 working days, and the total working days in an year are 300. Then the re-order level would be					
	(1) 30 (2) 2400					
	(3) 240 (4) $\frac{300}{8}$					
100.	Trains arrive at the yard every 15 minutes and the service time is 30 minutes. If the line capacity of the yard is limited to 4 trains, then the probability that the yard is empty (assuming the arrivals follows Poisson distribution and the service times follow the exponential distribution) is					
	(1) $\frac{1}{31}$ (2) $\frac{1}{32}$					
	(3) $\frac{1}{2}$ (4) $\frac{1}{4}$					

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(MPH/PHD/URS-EE-2017) University.

Subject : MATHEMATICS

Sr. No. 10206

Time: 1¼ Hours	Max. Marks: 100	Total Questions: 100
Roll No	(in figure)	(in words)
Name :	Father's N	Name :
Mother's Name :	Date of Ex	camination:
(Signature of the candidate)		(Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

- 1. Candidates are required to attempt any 75 questions out of the given 100 multiple choice questions of 4/3 marks each. No credit will be given for more than 75 correct responses.
- The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
- 4. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.
- 5. There will be no negative marking. Each correct answer will be awarded 4/3 mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 6. Use only Black or Blue BALL POINT PEN of good quality in the OMR Answer-Sheet.
- 7. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

Question No.	Questions			
1.	If $f_n(x) = \tan^{-1} nx$, $n \in [0, 1]$, whose point-wise $\lim_{x \to \infty} f(x) = \begin{cases} 0, & x = 0 \\ \frac{\pi}{2}, & x \in (0, 1] \end{cases}$, then:			
	(1) f(x) is differentiable (2) f(x) is not differentiable			
	(3) f(x) is continuous (4) None of these			
2.	The integral $\int_{0}^{\infty} \sin x dx$:			
	(1) exists (2) exists and equals zero			
	(3) exists and equals 1 (4) does not exist			
3.	If f is Riemann integrable with respect to α on [a, b], then: (1) f and α are both increasing (2) f and α are both bounded			
	(3) f is bounded and a is increasing function			
	(4) f is increasing and α is bounded function			
4.	If $f(x) = \sin x$, then the total variation of $f(x)$ on $[0, 2]$ is			
	(1) 3 (2) 1			
	(3) 2 (4) ∞			
5.	If f is a non-negative function, $\langle E_i \rangle$ a disjoint sequence of measurable sets and $E = \bigcup_i E_i$, then (1) $\int_E f \rangle \sum_{E_i} \int_E f$ (2) $\int_E f \langle \sum_{E_i} \int_E f \rangle \int_E f$			
	(3)			

Question No.	Questions				
6.	For the function $f(x, y) = \begin{cases} \frac{xy^2}{x^2 + y^4}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$, the directional derivative along $\vec{u} = (\sqrt{2}, \sqrt{2})$ at $(0, 0)$ is:				
	(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$				
	(3) $2\sqrt{2}$ (4) $\sqrt{2}/3$				
7.	If X is a complete metric space, E is non-empty open subset of X, then: (1) E is a null set (2) E is of first category (3) E is of second category (4) E is incomplete				
8.	If $A = \begin{bmatrix} -5 & -8 & 0 \\ 3 & 5 & 0 \\ 1 & 2 & -1 \end{bmatrix}$, then A^2 is:				
	(1) nilpotent (2) idempotent (3) involutory (4) periodic				
9.	If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ satisfies the matrix equation $A^2 - \lambda A + 2I = 0$, then value of λ is:				
	(1) 0 (3) 2 (4) -2				

Question No.	Questions				
10.	If X ₁ , X ₂ ,, X _N are N non-zero orthogonal vectors, the dimension of the vector space spanned by the 2N vectors				
	$X_1, X_2, \dots, X_N, -X_1, -X_2, \dots, X_N$ is:				
	(1) N (2) N+1				
	(3) 2N (4) N ²				
11.	Consider a multiple linear regression model with r regressors, $r \ge 1$ and				
	the response variable Y. Suppose \hat{Y} is the fitted value of Y. R^2 is the coefficient of determination and R^2_{adj} is the adjusted coefficient of determination. Then				
	(1) R ² always increases if an additional regressor is included in the model				
	(2) R _{adj} always increases if an additional regressor is included in the model				
	(3) $R^2 < R_{adj}^2$ for all r				
	(4) Correlation coefficient between Y and Ŷ is always non-negative.				
12.	Suppose X is a p-dimensional random vector with variance-covariance matrix Σ . If P_1 , P_2 ,, P_p represent p orthogonal eigenvectors of Σ corresponding to the eigen values $\lambda_1 > \lambda_2 > > \lambda_p \geq 0$ respectively, then which of the following is not correct?				
	(1) First principal component is P ₋₁ ^T X				
	(2) $P_{-1}^{T} X$ and $P_{-1}^{T} X$ ae correlated				
	(3) $\operatorname{Var}(P_{-1}^{T}X) = \lambda_1$				
	(4) $T_r(\Sigma) = \sum_{i=1}^p \lambda_i$				

Question No.	Questions For 2 strata $N_1 = 200$, $S_1^2 = 9$ and $N_2 = 300$, $S_2^2 = 4$; the variance of				
13.					
	sample mean of sample size 100, under proportional allocation is				
	(1) 0.048 (2) 0.056				
	(3) 0.240 (4) 0.084				
14.	If the population consists of a linear trend, $Y_i = i$; $i = 1, 2, 3,, k$, then				
	(1) $\operatorname{Var}(\overline{y}_{st}) \leq \operatorname{Var}(\overline{y}_{sys})$ (2) $\operatorname{Var}(\overline{y}_{st}) \geq \operatorname{Var}(\overline{y}_{sys})$				
	(3) $\operatorname{Var}(\overline{y}_{st}) = \operatorname{Var}(\overline{y}_{sys})$ (4) $\operatorname{Var}(\overline{y}_{st}) > \operatorname{Var}(\overline{y}_{sys})$				
15.	The total number of main and interaction effects in a 24 factoria experiment is				
	(1) 3 (2) 14				
-	(3) 15 (4) 16				
16.	While analysing the data of a $k \times k$ Latin square design, the error d.f. in analysis of variance is equal to :				
	(1) $k^3 - 3k^2 + 2k$ (2) $k^2 - 1$				
	(3) $k^2 - k - 2$ (4) $k^2 - 3k + 2$				
17.	For a system with n elements connected in series with constant (but different for each element) hazard rates $\lambda_1, \lambda_2,, \lambda_n$ respectively, then mean time to failure of the system is				
	(1) $1 - \prod_{i=1}^{n} (1 - e^{-\lambda_i t})$ (2) $\int_{0}^{\infty} \left[1 - \prod_{i=1}^{n} (1 - e^{-\lambda_i t}) \right] dt$				
	(3) $e^{-\sum_{i=1}^{n} \lambda_{i} t}$ (4) $\int_{0}^{\infty} e^{-\sum_{i=1}^{n} \lambda_{i} t} dt$				
40	If primal in an LPP has alternative optimal solution, then the dual has				
18.	in primar in an EFF has alternative optimal solution, then the dual has				
18.	(1) No feasible solution (2) Unbounded solution				

Question No.	A manufacturing company has determined from an analysis of its accounting and production data for a certain part that its demand is 9000 units per annum and is uniformly distributed over the year. Further, it is known that the lead time is uniform and equals 8 working days, and the total working days in an year are 300. Then the re-order level would be				
19.					
	(1) 30 (2) 2400				
	(3) 240 (4) $\frac{300}{8}$				
20.	Trains arrive at the yard every 15 minutes and the service time is 30 minutes. If the line capacity of the yard is limited to 4 trains, then the probability that the yard is empty (assuming the arrivals follows Poisson distribution and the service times follow the exponential distribution) is				
	(1) $\frac{1}{31}$ (2) $\frac{1}{32}$				
	(3) $\frac{1}{2}$ (4) $\frac{1}{4}$				
21.	The $(n-1)$ th derivative of the Green's function $G(x, t)$ with regard to x at the point $x = t$, has:				
	(1) Discontinuity of 1st kind (2) Discontinuity of 2nd kind				
100	(3) Removable discontinuity (4) No discontinuity				
(Which of the following is incorrect? (1) The eigen values of a symmetric kernel are real.				
	2) All iterated kernels of a symmetric kernel are also symmetric.				
	3) Every symmetric kernel with norm ≠ 0 has at least one eigen value				
(4) Fredholm integral equation of the second kind has always an eigen value.				

Question No.	Questions				
23.	For a particle of mass m moving following relations is correct		er a potential $v = \frac{k}{q}$, which one of the		
	$(1) \ddot{q} = \frac{k}{m q^2}$	(2)	$m \dot{q}^2 + \frac{2k}{q} = constant$		
	(3) $m \dot{q} + \frac{2k}{q} = constant$	(4)	$m \dot{q}^2 + \frac{k}{q} = constant$		
24.	A rigid body moving in spa freedom:	ace wit	h one point fixed, has degrees of		
	(1) 3	(2)	4		
	(3) 6	(4)	2		
25.	For the Lagrangian $L = \frac{1}{2}\dot{q}^2$	- q q + q	² , the conjugate momentum p is:		
	(1) q-q	(2)	q + q		
	$(3) \frac{1}{2} \dot{q} q$	(4)	q-q		
26.	For n independent events A	, A ₂ , ening a	., A_n , let $P(A_i) = \frac{1}{i+1}$, $i = 1, 2,, n$ at least one of the events is		
-	$(1) \frac{n}{n+1}$	(2)	$\frac{1}{n+1}$		
18	$(3) \frac{1}{n}$	(4)	$1-\frac{1}{n}$		

No.	Questions				
27.	The idea of posterior probabilities was introduced by				
	(1) Pasc		(2)	Carlotte Control of the Control of t	
	(3) Fishe	er	(4)		
28.	In a perfe 75% items	ectly symmetrics s are below 75. T	l distribu	ntion, 50% of items are above 60 an coefficient of quartile deviation is	
	(1) 15		(2)		
	(3) $\frac{1}{4}$		(4)	$\frac{1}{5}$	
29.	In any dis- between M	crete series (whe I.D. about mean	n all the	values are not same) the relationship	
	(1) M.D.		(2)		
	(3) M.D.	> S.D.	(4)	M.D. = Mean + S.D.	
30.	A random variable X can take all non-negative integral values, and the probability that X takes the value r is proportional to $(0.4)^r$. Then the value of P (X = 0) is				
		N 2 22			
	(1) 1	N	(2)	0.4	
			(2)		
	(1) 1 (3) 0.6		(4)	<u>5</u>	
31.	(1) 1 (3) 0.6 Solution of	$(xy^2 + x) dx + (y^2 + y^2 + 1) = c$	(4) $x^2 + y) dy$	$\frac{5}{3}$ = 0 is:	
31.	(1) 1 (3) 0.6 Solution of (1) tan ⁻¹ ($(xy^2 + x) dx + (y$	(4) $x^2 + y) dy$ (2)	<u>5</u>	
31.	(1) 1 (3) 0.6 Solution of (1) tan ⁻¹ ((3) (x ² + 1	$(xy^2 + x) dx + (y^2 + y^2 + 1) = c$	(4) x ² + y) dy (2) (4)	$\frac{5}{3}$ = 0 is: (x + 1) (y + 1) = c	
31.	(1) 1 (3) 0.6 Solution of (1) tan ⁻¹ ((3) (x ² + 1	$(xy^{2} + x) dx + (y^{2}x^{2}y^{2} + 1) = c$ $(y^{2} + 1) = c$	(4) x ² + y) dy (2) (4)	$\frac{5}{3}$ = 0 is: (x + 1) (y + 1) = c	

Question No.	Questions					
33.	The	Green's function G (x,	t) is:			
	(1)	one dimensional	(2)	two dimensional		
	(3)	three dimensional	(4)	n-dimensional		
34.		ing by variation of para e of Wornskion w, is	ameters t	he equation, $\frac{d^2y}{dx^2} + 4y = \tan 2x$, the		
	(1)	4	(2)	3		
	(3)	1	(4)	0		
35.	Whie (SLF		not true	about the Strum-Liouville Proble		
	(1) All eigen values are real and non-negative.					
100	(2) SLP has always an eigen function.					
	(3) Eigen functions corresponding to different eigen values are orthogonal w.r.t. weight function.					
	(4) For each eigen value there exists only one linearly independent eigen function.					
36.	Solu	tion of $\frac{\partial^2 z}{\partial x^2} + z = 0$ wit	h x = 0, z	$= e^{y}$ and $\frac{\partial z}{\partial x} = 1$, is:		
	(1)	$z = \cos x - e^y \sin x$	(2)	$z = \cos x + e^y \sin x$		
	(3)	$z = \sin x - e^y \cos x$	(4)	$z = \sin x + e^y \cos x$		
37.	The differential equation $f_{xx} + 2f_{yy} + 4f_{yy} = 0$ is:					
	(1)	parabolic	(2)	elliptic		
		hyperbolic	(4)			

Question No.	The surface satisfying $\frac{\partial^2 u}{\partial y^2} = x^3 y$ containing two lines $y = 0 = u$ and				
38.					
	y = 1 = u is (1) $u = x^3y^3 + y (1 - x^3)$	(2) $u = x^3y^3 - y(1 + x^3)$			
	(3) $u = x^3y^2 + 1 - x^3$	(4) $u = x^2y^3 + 1 - x^3$			
39.	The relation $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$ rep	presents the partial differential equation:			
	(1) $2z = p + q$	$(2) 2z = \frac{xp}{yq}$			
	(3) 2z = xq + yp	(4) 2z = xp + yq			
40.	reciprocal of a natural number				
	(1) $x_{n+1} = x_n (2 - N \cdot x_n)$				
	(3) $x_{n+1} = 2 x_n - N$	(4) $x_{n+1} = 2 - N \cdot x_n$			
41.	The value of the integral $\oint_C \frac{1}{z}$	dz, where C is the circle $x = \cos t$, $y = \sin t$,			
	$0 \le t \le 2\pi$, is:	the state of the s			
	(1) 2 π i	(2) π i			
	(3) 2 π	$(4) \frac{1}{2\pi}$			
42.	If C is the circle $ z - 3 =$	2, then using Cauchy's integral formula,			
-	$\oint_C \frac{2z+5}{z^2-2z} \mathrm{d}z =$				
	(1) 9 π i	$(2) \frac{9\pi i}{2}$			

Question No.		Ques	tions		
43.	For the function $f(z) = \frac{\cos z}{z^2 (z-\pi)^3}$, the residue at the pole $z = \pi$ is:				
	(1) 4π ³		$\frac{4\pi}{\pi^2-6}$		
	(3) $\frac{\pi^2 - 6}{2\pi^4}$	(4)	$\frac{\pi^2-6}{2\pi^3}$		
44.	Using Cauchy's resid $C: z-1 = 2$, is:	ue theorem,	value of the integral $\oint_C \frac{\tan z}{z} dz$,		
0	(1) 4 i	(2)	-4i		
	(3) -2i	(4)	2i		
45.	The only bounded entir	e functions a	re constants. This result is due to :		
	(1) Cauchy		Liouville		
	(3) Schwarz	(4)	Morera		
46.	For the function f (z) =	$\frac{1-e^z}{1+e^z}$, the si	ngularity z = ∞ is :		
	(1) a removable singula	arity	11 - 11 - 10 1 - 20 1		
2	(2) a pole				
	(3) an isolated essential singularity				
	(4) a non-isolated esser	ntial singular	rity		
47.	If $z = x + iy$, $w = u + iv$, then by the transformation $w = z e^{i\frac{\pi}{4}}$, the line $x = 0$ is transformed into the line:				
	(1) $u-v=1$	(2)	u + v = 1		
	(3) $v = -u$	(4)	v = u		

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Question No.	Questions				
48.	Total number of 4 digit	numbers wit	th no two digits common, are :		
T party	(1) 4096	(2)	5436		
	(3) 4896	(4)	4536		
49.	The number of positive are:	integers which	ch are less than 108 and prime to 108,		
	(1) 24	(2)	36		
	(3) 40	(4)	52		
50.	The number of zeros at	the end of	75 is:		
	(1) 12	(2)	16		
	(3) 18	(4)	75		
51.	The eigen values of a sl	kew-symmetr	ric matrix are :		
	(1) always zero	(2)	always pure imaginary		
-	(3) always real	(4)	either zero or pure imaginary		
52.	The dimension of the vis:	vector space	of all 3 × 3 real symmetric matrices		
	(1) 3	(2)	4		
	(3) 6	(4)	9		
53.	The number of all no is:	n-singular li	near transformations $T: \mathbb{R}^4 \to \mathbb{R}^3$		
	(1) 4	(2)	3		
	(3) 1	(4)	0		

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Question No.	Questions	Questions			
54.	Let $T: \mathbb{R}^3 \to \mathbb{R}^3$ be a linear transformation given by $T(x, y, z) = \left(\frac{x}{2}, \frac{y}{2}, 0\right)$. Rank of T is:				
	(1) 3 (2) 1				
	(3) 4 (4) 2				
55.	A real quadratic form in three variables is equivalent to the diagonal $-(x_1-x_2)^2-x_3^2$. Then, the quadratic form is:	form			
	(1) negative definite (2) semi-negative definite				
311	(3) positive definite (4) semi-positive definite				
56.	The positive integer n for which the equality $\left(\frac{\sqrt{3}}{2} + \frac{1}{2}i\right)^n = -1$ holds,				
	is:				
	(1) 2 (2) 4				
	(3) 5 (4) 6				
57.	If $f(z) = 3x - y + 5 + i$ (ax + by - 3), then the values of a and b so that function $f(z)$ is entire, are:	the			
	(1) $a = 1, b = 3$ (2) $a = 3, b = 1$				
	(3) $a = 1, b = -3$ (4) $a = -1, b = 3$				
58.	The function $f(z) = e^{2z+i}$ is:				
9 11	(1) differentiable at $z = 0$ (2) differentiable at $z = -1$				
7,54	(3) differentiable at z = i (4) no where differentiable				

Question No.	Questions				
59.	The	principal value of (-	-1) ³ⁱ is:		
1.4	(1)	$e^{-\pi/2}$	(2)	e-#	
	(3)	e ^{-3 x}	(4)	$e^{-3\pi/2}$	
60.	Sol	ations of the equation	sinh z = co	sh z are given by	
	(1)	$z = (-1 + 4n) \pi i$	(2)	$z=e^{-3\pi i}$	
	(3)	$z=e^{(2n+1)\pi i}$	(4)	There are no solutions	
61.	The	number of elements	of order 10	in Z ₃₀ is:	
	(1)	4	(2)	3	
	(3)	2	(4)	1	
62.	The generators of the group $G = \{a, a^2, a^3, a^4 = e\}$ are:				
	(1)	a and a²	(2)	a and a4	
	(3)	a and a ³	(4)	a only	
63.	If H and K are two subgroups of G of order 6 and 8 respectively, then order of HK is 16 if order of H ∩ K is:				
	(1)	2	(2)	3	
	(3)	4	(4)	6	
64.		G be a group of order er 3 is :	r 15, then th	e number of sylow subgroups of G of	
	(1)	4	(2)	3	
	(3)	2	(4)	1 * *	
65.	The cardinality of a finite integral domain can not be:				
	(1)	6	(2)	5	
X	(3)	3	(4)	2	

Questions						
A ring of polynomials over a field is a:						
(1) group	(2)	unique factorization domain				
(3) prime field	(4)	irreducible				
Let R be a commutative ring with	h un	ity such that (0) is a prime ideal of R				
(1) {0} is a maximal ideal of R	(2)	R has zero divisors				
(3) R is a field	(4)	R is a integral domain				
A totally disconnected space is	a:					
(1) T ₀ -space	(2)	T ₁ -space				
(3) T ₂ -space	(4)	T ₃ -space				
Every indiscrete space is:		and the second				
(1) compact and connected	(2)	not compact				
(3) disconnected	(4)	connected but not compact				
If Y is a subspace of X, A is clos	ed in	Y and Y is closed in X, then:				
(1) A is not closed in X	(2)	A is semi-closed in X				
(3) A is open in X	(4)	None of these				
$\Delta \tan^{-1}\left(\frac{n-1}{n}\right) =$						
$(1) 2 \tan^{-1} \left(\frac{1}{n^2}\right)$	(2)	$\tan^{-1}\left(\frac{1}{n^2}\right)$				
$(3) \tan^{-1}\left(\frac{1}{2n^2}\right)$	(4)	$\tan^{-1}\left(\frac{1}{2n}\right)$				
	A ring of polynomials over a field (1) group (3) prime field Let R be a commutative ring with then (1) {0} is a maximal ideal of R (3) R is a field A totally disconnected space is an example of the space	A ring of polynomials over a field is (1) group (2) (3) prime field (4) Let R be a commutative ring with unthen (1) {0} is a maximal ideal of R (2) (3) R is a field (4) A totally disconnected space is a: (1) T_0 -space (2) (3) T_2 -space (4) Every indiscrete space is: (1) compact and connected (2) (3) disconnected (4) If Y is a subspace of X, A is closed in (1) A is not closed in X (2) (3) A is open in X (4) $\Delta \tan^{-1}\left(\frac{n-1}{n}\right) =$ (1) $2 \tan^{-1}\left(\frac{1}{n^2}\right)$ (2)				

No.	Questions					
72.	The first term of the series whose second and subsequent terms are $3, 3, 0, -1, 0$ is:					
	(1) 10 (3) 15 (2) 12 (4) 20					
73.	In the Gauss elimination method for solving a system of linear algebraic equations, triangularization leads to:					
	(1) diagonal matrix (2) lower triangular matrix (3) upper triangular matrix (4) singular matrix					
74.	In Simpson's one-third rule the curve y = f(x) is assumed to be: (1) circle (2) parabola (3) ellipse (4) hyperbola					
75.	The second order Runge-kutta method is applied to the initial value problem $y' = -y$, $y(0) = y_0$ with step size h. Then $y(h) =$ (1) $y_0(h^2 - 2h - 2)$ (2) $\frac{y_0}{2}(h^2 - 2h + 2)$					
	(3) $\frac{y_0}{6} (h^2 - 2h + 2)$ (4) $\frac{y_0}{6} (h^2 - 2h - 2)$					
	Using Picard's method upto third approximation, solution of $\frac{dy}{dx} = -xy$, $y(0) = 1$, is $y_3 =$ $(1) 1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{16}$ $(2) 1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{24}$ $(3) 1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{32}$ $(4) 1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{48}$					

Question No.	Questions The minimizing curve must satisfy a differential equation, called as:						
77.							
	(1) Euler-Lagrange equation	(2)	Lagrange equation				
	(3) Euler-Gauss equation	(4)	Cauchy-Euler equation				
78.	Given the functional $\int_{x_0}^{x_1} \left(\frac{y'^2}{x^3} \right) dx$, the	n the extremal is:				
	(1) $y = \frac{cx^3}{3} + c_1$	(2)	$y = \frac{cx^4}{4} + c_1$				
	(3) $y = cx^2 + c_1$	(4)	$y = \sin x$				
79.	Solution of the integral equation	on s	$(x-t)^{-\frac{1}{2}}u(t) dt = 1$ is:				
	(1) $u(x) = \frac{1}{x\sqrt{\pi}}$	(2)	$u(x) = \frac{\pi}{\sqrt{x}}$				
	(3) $u(x) = \frac{1}{\pi \sqrt{x}}$	(4)	$u(x) = \frac{1}{\sqrt{\pi x}}$				
80.	The resolvent third kernel of kernel k (x, t) = 1, is	f the	Volterra's integral equation with				
	(1) $(x-t)^2$	(2)	$\frac{1}{2} (x-t)^2$				
	(3) $\frac{1}{3} (x-t)^3$	(4)	$\frac{1}{13} (x-t)^3$				
81.	If A and B are finite sets and the elements than the total num elements in A is:	e tot	al number of subsets of A has 56 more of subsets of B, then the number of				
	(1) 4	(2)	5				
	(3) 6	(4)	8				

Questio No.	Questions
82,	If P (A) denotes the power set of the set A, then which of the following is correct? (1) $A \cap P(A) = A$ (2) $A \cup P(A) = P(A)$ (3) $A - P(A) = A$ (4) $P(A) = P(A)$
83.	(4) P(A) - {A} = P(A) The order of a set A is 4 and that of a set B is 3. The number of relations (1) 12 (2) 144 (3) 2048 (4) 4096
84.	(4) 4096 The set of real numbers in the closed interval {0, 1} is (1) finite set (2) uncountable set (3) countable set (4) None of these
85.	The nth term of the sequence $\left\{2, \frac{-3}{2}, \frac{4}{3}, \frac{-5}{4}, \dots\right\} \text{ is :}$
	(1) $(-1)^{n-1} \left(1 + \frac{1}{n}\right)$ (2) $(-1)^{n-1} \left(1 - \frac{1}{n}\right)$ (3) $(-1)^{n-1} \left(1 + \frac{2}{n}\right)$ (4) $(-1)^{n-1} \frac{2^n}{n-1}$
86.	The series $x + \frac{2^2 x^2}{2} + \frac{3^3 x^3}{3} + \frac{4^4 x^4}{4} + \dots$ is convergent if:
	(1) $x > \frac{1}{e}$ (2) $0 < x < \frac{1}{e}$
(3) $\frac{2}{e} < x < \frac{3}{e}$ (4) $\frac{e}{3} < x < \frac{e}{2}$

Question No.	Questions
87.	The series $\sum \left(1+\frac{1}{n}\right)^{-n^2}$ is:
	(1) Convergent (2) Divergent
	(3) Oscillatory (4) None of these
88.	If $f(x) = x(x-1)(x-2)$; $x \in \left[0, \frac{1}{2}\right]$, then the value of 'C' of Lagrange's mean value theorem is:
	(1) $\frac{1}{3}$ (2) $\frac{1}{4} + \frac{1}{\sqrt{2}}$ (3) $\frac{6 + \sqrt{21}}{18}$ (4) $\frac{6 - \sqrt{21}}{6}$
	(3) $\frac{6+\sqrt{21}}{18}$ (4) $\frac{6-\sqrt{21}}{6}$
89.	It is given that the function $f(x) = \begin{cases} \frac{a \cos x}{\frac{\pi}{2} - x}, & x \neq \frac{\pi}{2} \\ 1, & x = \frac{\pi}{2} \end{cases}$
	is continuous at $x = \frac{\pi}{2}$, value of a is:
	(1) -1 (2) 1
	(3) 2 (4) π/ ₂
90.	Which of the following functions is not uniformly continuous in $[2, \infty)$?
	(1) $\frac{1}{x}$ (2) $\frac{1}{x^2}$
	(3) e ^x (4) sin x

Question No.	Questions					estions	
91.	(1)	espe	ectively	be two	stochas variand	tic rar e of Y (2	
92.	(1)	For market Univa	oth the ld for a riance. or the s ay hold ader co riables adeber	equence but the ertain which g-Levy	l limit to ence of inde e of inde e centra condition are not i	epend l limit ons, t	statement? n and the Weak law of large numbers ndom variables with finite mean and ent r.v.'s, Weak law of large numbers theorem may not hold. he central limit theorem holds for
93.	giv	tch en u Lis	List I a	and Lis		selec	List II oment Generating Function) for real t
	A. B.			stribut distrib		1.	(q + p e ^t) ⁿ , where p is probability of success
	C.			stribut		2.	p $(1 - q e^t)^{-1}$, where p is probability of success $e^{\lambda(e^t-1)}$, where λ is mean
			omial o	listribu	tion	4.	$\exp\left(t^{2}/2\right)$ for standard variate
	Cod	es:	-				
	745	A	В	C	D		44.7
18	(1)	1	2	3	4		
	(2)	0	1	4	2		
	(4)	3	9	C 3 4 1 4	4		
	(4)	O	4	4	1		

Question No.		Quest	ions		
94.	Suppose that the probability of a dry day following a rainy day is $\frac{2}{3}$ and				
	that the probability of	a rainy day f	ollowing a dry day is $\frac{1}{2}$. Given that		
			probability that January 21 will be a		
	(1) $\frac{5}{12}$	(2)	7/12		
	(3) 7/18	(4)	11 18		
95.	each with pdf $f(x) = \begin{cases} $	1, 0 < x < 1 0, otherwise	and identically distributed variates		
	Then mean of smallest	order statist	IC 18		
	$(1) \frac{n}{n+1}$	(2)	$\frac{1}{n}$		
	$(3) \frac{1}{n+1}$	(4)	1		
96.	If X,, X, are i.i.d. N (0,	1), then the	listribution of $X_1 - X_2$ is		
	(1) N (0, 1)		N (0, 2)		

Questio No.	Questions
97.	Mean square error of an estimator t of parameter θ is expressed as (1) Bias + Var (t) (2) [Bias + Var (t)] ² (3) (Bias) ² + [Var (t)] ² (4) (Bias) ² + Var (t)
98.	The degrees of freedom for t-statistic for paired t-test based on 20 par
99.	(1) 38 (3) 39 (4) 18
	If the sample size in Wald-Wolfowitz run test is large, the variate (number of runs) is asymptotically normal with mean (1) $\frac{2n_1n_2}{n_1+n_2}+1$ (2) $\frac{2n_1}{n_1+n_2}+1$ (3) $\frac{2n_2}{n_1+n_2}+1$ (4) $\frac{2n_1n_2}{n_1+n_2}$ where n_1 , n_2 are the sizes of the two samples.
00.	In the usual notations, $R_{1,23}^2$ can be expressed as: 1) $R_{1,23}^2 = 1 - (1 - r_{12}^2)(1 - r_{13,2}^2)$ (2) $R_{1,23}^2 = 1 - (1 - r_{12}^2)(1 - r_{13,2})$ 3) $R_{1,23}^2 = (1 - r_{12}^2)(1 - r_{13,2}^2)$ (4) $R_{1,23}^2 = (1 - r_{12})(1 - r_{13,2})$
2	

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(MPH/PHD/URS-EE-2017) Subject: MATHEMATICS

Sr. No. 10227

Code

C

Time: 14 Hours	Max. Marks: 100	Total Questions: 100
Roll No	(in figure)	(in words)
Name:	Father's Na	me :
Mother's Name :	Date of Exa	mination:
(Signature of the candidate)		Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

- Candidates are required to attempt any 75 questions out of the given 100 multiple choice questions of 4/3 marks each. No credit will be given for more than 75 correct responses.
- 2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
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- Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.
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Question No.		6	(ues	tions			
1.	The number of elements of order 10 in Z _{so} is:						
	(1) 4		(2)	3			
	(3) 2		(4)	1			
2.	The generate	ors of the group G =	= {a,	a^2 , a^3 , $a^4 = e$ } are:			
	(1) a and a ²		(2)	a and a4			
	(3) a and a ³	21.76	(4)	a only			
3.	If H and K a order of HK	re two subgroups is 16 if order of H	of G	of order 6 and 8 respectively, then s:			
	(1) 2		(2)	3			
	(3) 4 .		(4)	6			
4.	Let G be a gr order 3 is:	oup of order 15, the	en th	e number of sylow subgroups of G of			
6	(1) 4		(2)	3			
	(3) 2		(4)	1.			
5.	The cardinal	ty of a finite integr	al de	omain can not be :			
War.	(1) 6		(2)	5			
	(3) 3		(4)	2			
6.	A ring of poly	nomials over a fiel	d is	a:			
	(1) group		(2)	unique factorization domain			
	(3) prime fi	eld	(4)	irreducible			
7.	Let R be a cor then	mmutative ring wit	h un	ity such that {0} is a prime ideal of R,			
	(1) {0} is a n	naximal ideal of R	(2)	R has zero divisors			
	(3) Risafie	ld	(4)	R is a integral domain			

uestion No.	Questions					
8.	A totally disconnected space is a: (1) T_0 —space (2) T_1 —space (3) T_2 —space (4) T_3 —space					
9.	(1) compact and connected (2) not compact (3) disconnected (4) connected but not compact					
10.	(3) disconnected If Y is a subspace of X, A is closed in Y and Y is closed in X, then: (1) A is not closed in X (2) A is semi-closed in X (3) A is open in X (4) None of these					
11.	The eigen values of a skew-symmetric matrix are: (1) always zero (2) always pure imaginary (3) always real (4) either zero or pure imaginary					
12.	(3) always real The dimension of the vector space of all 3 × 3 real symmetric matrices is: (1) 3 (2) 4 (3) 6 (4) 9 The number of all non-singular linear transformations T: R* → R					
13.	is: (1) 4 (2) 3 (4) 0					
14.	Let $T: \mathbb{R}^3 \to \mathbb{R}^3$ be a linear transformation given by $T(x, y, z) = \left(\frac{x}{2}, \frac{y}{2}, 0\right)$ Rank of T is: (2) 1 (3) 4 (4) 2					

Question No.	Questions						
15.			oles is equivalent to the diagonal form				
THE SHIP	$-(x_1-x_2)^2-x_3^2$. Then, the quadratic form is:						
	(1) negative definite	(2)	semi-negative definite				
	(3) positive definite	(4)	semi-positive definite				
16.		hich t	he equality $\left(\frac{\sqrt{3}}{2} + \frac{1}{2}i\right)^n = -1$ holds,				
	is:	(0)					
	(1) 2	(2)					
	(3) 5	(4)	6				
17.	If $f(z) = 3x - y + 5 + i$ (ax + by function $f(z)$ is entire, are:	7 – 3), 1	then the values of a and b so that the				
	(1) $a = 1, b = 3$	(2)	a = 3, b = 1				
	(3) $a = 1, b = -3$	(4)	a = -1, b = 3				
18.	The function $f(z) = e^{2z+i}$ is:						
	(1) differentiable at $z = 0$	(2)	differentiable at $z = -1$				
	(3) differentiable at $z = i$	(4)	no where differentiable				
19.	The principal value of (-1)3i i	8:					
	(1) $e^{-\frac{\pi}{2}}$	(2)	e-*				
	(3) e ^{-3 *}	(4)	e ^{-3x/2}				
20.	Solutions of the equation sinh	z = co	sh z are given by				
	(1) $z = (-1 + 4n) \pi i$	(2)	$z = e^{-3\pi i}$				
	(3) $z = e^{(2n+1)\pi i}$	(4)	There are no solutions				

Question No.		Ques	tions				
21.	If A and B are finite sets and the total number of subsets of A has 56 more elements than the total number of subsets of B, then the number of elements in A is:						
	(1) 4	(2)	5				
	(3) 6	(4)	8				
22.	If P (A) denotes the power :	set of the	set A, then which of the following is				
	(1) $A \cap P(A) = A$	(2)	$A \cup P(A) = P(A)$				
	(3) $A - P(A) = A$	(4)	$P(A) - \{A\} = P(A)$				
23.	The order of a set A is 4 and from A to B is:	d that of	a set B is 3. The number of relations				
	(1) 12	(2)	144				
	(3) 2048	(4)	4096				
24.	The set of real numbers in t	the closed	l interval {0, 1} is				
	(1) finite set	(2)	uncountable set				
	(3) countable set	(4)	None of these				
25.	The nth term of the sequen	ce					
2 1	$\left\{2, \frac{-3}{2}, \frac{4}{3}, \frac{-5}{4}, \dots\right\}$	} is:					
	(1) $(-1)^{n-1} \left(1 + \frac{1}{n}\right)$	(2)	$(-1)^{n-1}\left(1-\frac{1}{n}\right)$				
	(3) $(-1)^{n-1} \left(1 + \frac{2}{n}\right)$	(4)	$(-1)^{n-1} \frac{2^n}{n-1}$				

	Questions
The series $x + \frac{2^2 x^2}{2} + \frac{3^3 x^3}{3} + \frac{3^3 x^3}{3}$	4 ⁴ x ⁴ + is convergent if:
$(1) x > \frac{1}{e}$	$(2) 0 < x < \frac{1}{e}$
$(3) \frac{2}{e} < \chi < \frac{3}{e}$	$(4) \frac{e}{3} < x < \frac{e}{2}$
The series $\sum \left(1+\frac{1}{n}\right)^{-n^2}$ is:	
(1) Convergent (3) Oscillatory	(2) Divergent (4) None of these
If $f(x) = x(x-1)(x-2)$; $x \in$ mean value theorem is:	$\left[0,\frac{1}{2}\right]$, then the value of 'C' of Lagrange's
(1) $\frac{1}{3}$	(2) $\frac{1}{4} + \frac{1}{\sqrt{2}}$
(3) $\frac{6+\sqrt{21}}{18}$	(4) $\frac{6-\sqrt{21}}{6}$
It is given that the function $f(x) = \begin{cases} \frac{a \cos x}{\frac{\pi}{2} - x}, & x \neq \frac{\pi}{2} \\ 1, & x = \frac{\pi}{2} \end{cases}$	
is continuous at $x = \frac{\pi}{2}$, value	
(1) -1	(2) 1 (4) $\frac{\pi}{2}$
	(1) $x > \frac{1}{e}$ (3) $\frac{2}{e} < x < \frac{3}{e}$ The series $\sum \left(1 + \frac{1}{n}\right)^{-n^2}$ is: (1) Convergent (3) Oscillatory If $f(x) = x(x-1)(x-2)$; $x \in mean value theorem is:$ (1) $\frac{1}{3}$ (3) $\frac{6+\sqrt{21}}{18}$ It is given that the function $f(x) = \begin{cases} \frac{a\cos x}{\pi}, & x \neq \frac{\pi}{2} \\ 1, & x = \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, value

Question No.	Questions
30.	Which of the following functions is not uniformly continuous in $[2, \infty)$? (1) $\frac{1}{x}$ (2) $\frac{1}{x^2}$ (3) e^x (4) $\sin x$
31.	 (3) e^x Consider a multiple linear regression model with r regressors, r ≥ 1 and the response variable Y. Suppose Ŷ is the fitted value of Y. R² is the coefficient of determination and R² is the adjusted coefficient of determination. Then (1) R² always increases if an additional regressor is included in the model (2) R² always increases if an additional regressor is included in the model (3) R² < R² adj for all r (4) Correlation coefficient between Y and Ŷ is always non-negative.
32.	 (4) Correlation coefficient Suppose X is a p-dimensional random vector with variance-covariance matrix Σ. If P₁, P₂,, P_p represent p orthogonal eigenvectors of Σ corresponding to the eigen values λ₁ > λ₂ > > λ_p ≥ 0 respectively, then which of the following is not correct? (1) First principal component is P₋₁^T X (2) P₋₁^T X and P₋₁^T X as correlated (3) Var (P₋₁^T X) = λ₁ (4) T_r (Σ) = ∑_{i=1}^p λ_i
33.	For 2 strata $N_1 = 200$, $S_1^2 = 9$ and $N_2 = 300$, $S_2^2 = 4$; the variance of sample mean of sample size 100, under proportional allocation is (1) 0.048 (2) 0.056 (3) 0.240 (4) 0.084

Question No.	Questions $ \label{eq:Questions} $ If the population consists of a linear trend, $Y_i = i$; $i = 1, 2, 3,, k$, then						
34.							
	(1) Var (5	$(\overline{y}_{st}) \le Var(\overline{y}_{sys})$	(2)	Var ($\overline{y}_{st} \ge Var(\overline{y}_{sys})$		
	(3) Var (5	\overline{y}_{st}) = $Var(\overline{y}_{sys})$	(4)	Var (\overline{y}_{st}) > $Var(\overline{y}_{sys})$		
35.	The total		in and ir	terac	tion effects in a 24 factorial		
	(1) 3		(2)	14			
	(3) 15		(4)	16			
36.	While analysing the data of a $k \times k$ Latin square design, the error d.f. in analysis of variance is equal to:						
	(1) k ³ - 5	$8k^2 + 2k$	(2)	k^2-1			
	(3) k ² -1	$\varsigma - 2$	(4)	$k^2 - 3$	3k + 2		
37.	For a system with n elements connected in series with constant (but different for each element) hazard rates $\lambda_1, \lambda_2,, \lambda_n$ respectively, then mean time to failure of the system is						
	(1) $1 - \prod_{i=1}^{n}$	$\left[(1-e^{-\lambda_i t}) \right]$	(2)	$\int_{0}^{\infty} \left[1 - \right]$	$-\prod_{i=1}^{n} (1 - e^{-\lambda_i t}) \bigg] dt$		
	(3) $e^{-\sum_{i=1}^{n} \lambda_i}$	ų t	(4)	$\int_{0}^{\infty} e^{-\sum_{i=1}^{N}}$	$\sum_{i=1}^{n} \lambda_{i} t$ dt		
38,	If primal in an LPP has alternative optimal solution, then the dual has						
	(1) No fe	easible solution		(2)	Unbounded solution		

Question No.	Questions					
39.	accounting and produ units per annum and i known that the lead t	npany has determined from an analysis of tion data for a certain part that its demand is 9 s uniformly distributed over the year. Further, me is uniform and equals 8 working days, and an year are 300. Then the re-order level would	000 it is the			
BE	(1) 30	(2) 2400				
	(3) 240	(4) 300/8				
40.	30 minutes. If the line	yard every 15 minutes and the service time capacity of the yard is limited to 4 trains, then ard is empty (assuming the arrivals follows Pois ervice times follow the exponential distribution	the			
	(1) $\frac{1}{31}$	(2) $\frac{1}{32}$				
	(3) 1/2	(4) $\frac{1}{4}$				
41.	$\Delta \tan^{-1}\left(\frac{n-1}{n}\right) =$					
	$(1) 2 \tan^{-1} \left(\frac{1}{n^2}\right)$	$(2) \tan^{-1}\left(\frac{1}{n^2}\right)$				
	(3) $\tan^{-1}\left(\frac{1}{2n^2}\right)$	(4) $\tan^{-1}\left(\frac{1}{2n}\right)$				
42.	The first term of the 8, 3, 0, -1, 0 is:	series whose second and subsequent terms	are			
	(1) 10	(2) 12				
	(3) 15	(4) 20				

Question No.	Questions						
43.	In the Gauss elimination method for solving a system of linear algebraic equations, triangularization leads to:						
	(1) diagonal matrix (2) lower triangular matrix						
	(3) upper triangular matrix (4) singular matrix						
44.	In Simpson's one-third rule the curve y = f(x) is assumed to be:						
	(1) circle (2) parabola						
	(3) ellipse (4) hyperbola						
45.	The second order Runge-kutta method is applied to the initial value problem $y' = -y$, $y(0) = y_0$ with step size h. Then $y(h) =$						
×	(1) $y_0 (h^2 - 2h - 2)$ (2) $\frac{y_0}{2} (h^2 - 2h + 2)$						
	(3) $\frac{y_0}{6} (h^2 - 2h + 2)$ (4) $\frac{y_0}{6} (h^2 - 2h - 2)$						
46.	Using Picard's method upto third approximation, solution of $\frac{dy}{dx} = -xy$, $y(0) = 1$, is $y_3 =$						
	(1) $1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{16}$ (2) $1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{24}$						
	(3) $1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{32}$ (4) $1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{48}$						
47.	The minimizing curve must satisfy a differential equation, called as:						
	(1) Euler-Lagrange equation (2) Lagrange equation						
	(3) Euler-Gauss equation (4) Cauchy-Euler equation						

Question No.	Questions
48.	Given the functional $\int_{x_0}^{x_1} \left(\frac{{y'}^2}{x^3} \right) dx$, then the extremal is:
	(1) $y = \frac{cx^3}{3} + c_1$ (2) $y = \frac{cx^4}{4} + c_1$
	(3) $y = cx^2 + c_1$ (4) $y = \sin x$
49.	Solution of the integral equation $\int_{0}^{x} (x-t)^{-\frac{1}{2}} u(t) dt = 1$ is:
	(1) $u(x) = \frac{1}{x\sqrt{\pi}}$ (2) $u(x) = \frac{\pi}{\sqrt{x}}$
	(3) $u(x) = \frac{1}{\pi \sqrt{x}}$ (4) $u(x) = \frac{1}{\sqrt{\pi x}}$
50.	The resolvent third kernel of the Volterra's integral equation with kernel $k(x, t) = 1$, is
- 4	(1) $(x-t)^2$ (2) $\frac{1}{2}(x-t)^2$
	(3) $\frac{1}{3} (x-t)^3$ (4) $\frac{1}{2} (x-t)^3$
51.	The value of the integral $\oint \frac{1}{z} dz$, where C is the circle $x = \cos t$, $y = \sin t$,
	$0 \le t \le 2\pi$, is:
-	(1) 2 m i (2) m i
	(3) 2π (4) $\frac{1}{2\pi}$

Question No.		Que	stions				
52.	If C is the circle $ z-3 $ $ \oint \frac{2z+5}{z^2-2z} dz = $	= 2, the	en using Cauchy's integral formula,				
	c z - 2z						
	(1) 9πi	(2)	<u>9πi</u> 2				
	(3) 6πi	(4)	3πί				
53.	For the function $f(z) = \frac{1}{z^2}$	$\frac{\cos z}{(z-\pi)^3}, t$	he residue at the pole $z = \pi$ is:				
	(1) 4π ³	(2)	$\frac{4\pi}{\pi^2-6}$				
	(3) $\frac{\pi^2 - 6}{2\pi^4}$	(4)	$\frac{\pi^2-6}{2\pi^3}$				
54.	Using Cauchy's residue theorem, value of the integral $\oint_C \frac{\tan z}{z} dz$, $C: z-1 = 2$, is:						
5	(1) 4i	(2)	-4i				
	(3) -2 i	(4)	2 i				
55.	The only bounded entire functions are constants. This result is due to:						
	(1) Cauchy		Liouville				
	(3) Schwarz	(4)	Morera				
56.	For the function $f(z) = \frac{1}{14}$	$-\frac{e^z}{e^z}$, the si	ngularity z = ∞ is :				
	(1) a removable singulari	ty	100				
	(2) a pole						
	(3) an isolated essential s	ingularity					
	(4) a non-isolated essenti	al singular	ity				

luestion No.	Qu	est	ions				
57.	If $z = x + iy$, $w = u + iv$, then by $x = 0$ is transformed into the line	the	transformation $w = z e^{i\pi/4}$, the line				
			u+v=1				
	(3) v = -u	(4)	v = u				
58.	Total number of 4 digit numbers	wit	h no two digits common, are:				
		(2)	5436				
	(0) 4000	(4)	4536				
59.	The number of positive integers v	whi	ch are less than 108 and prime to 108,				
	(1) 24	(2)	36				
	(3) 40	(4)	52				
60.	The number of zeros at the end	of L	75 is:				
	(1) 12	(2)	16				
	(3) 18	(4)					
61.	The $(n-1)$ th derivative of the G the point $x = t$, has:	ree	n's function G (x, t) with regard to x at				
	(1) Discontinuity of 1st kind	(2)	Discontinuity of 2nd kind				
	(3) Removable discontinuity	(4)	No discontinuity				
62.	Which of the following is incorr	ect	?				
	(1) The eigen values of a symmetric kernel are real.						
	(2) All iterated kernels of a symmetric kernel are also symmetric.						
	(3) Every symmetric kernel w	(3) Every symmetric kernel with norm ≠ 0 has at least one eigen value					
	(4) Fredholm integral equation value.	n o	f the second kind has always an eiger				

Question No.	Questions					
63.	For a particle of mass m moving under a potential $v = \frac{k}{q}$, which one of the following relations is correct?					
	(1) $\ddot{q} = \frac{k}{m q^2}$ (2) $m \dot{q}^2 + \frac{2k}{q} = constant$					
	(3) $m \dot{q} + \frac{2k}{q} = constant$ (4) $m \dot{q}^2 + \frac{k}{q} = constant$					
64.	A rigid body moving in space with one point fixed, has degree freedom:	s of				
	(1) 3 (2) 4					
*-	(3) 6 (4) 2					
65.	For the Lagrangian $L = \frac{1}{2}\dot{q}^2 - q\dot{q} + q^2$, the conjugate momentum p is	:				
	(1) q-q (2) q+q					
	(3) $\frac{1}{2} \dot{q} q$ (4) $q - \dot{q}$					
66.	For n independent events A_1 , A_2 ,, A_n , let $P(A_i) = \frac{1}{i+1}$, $i = 1, 2,$ Then the probability of happening at least one of the events is	., n.				
	(1) $\frac{n}{n+1}$ (2) $\frac{1}{n+1}$					
	(3) $\frac{1}{n}$ (4) $1 - \frac{1}{n}$					

Question No.	Questions					
67.	The	idea of posterior	probabilities w	as introduced by		
	(1)	Pascal	(2)	Poisson		
	(3)	Fisher	(4)	Thomas Bayes		
68.				tion, 50% of items are above 60 and oefficient of quartile deviation is		
	(1)	15	(2)	30		
	(3)	$\frac{1}{4}$.	(4)	1 5		
69.	In any discrete series (when all the values are not same) the relationship between M.D. about mean and S.D. is					
	(1)	M.D. = S.D.	(2)	M.D. < S.D.		
	(3)	M.D. > S.D.	(4)	M.D. = Mean + S.D.		
70.	A random variable X can take all non-negative integral values, and the probability that X takes the value r is proportional to $(0.4)^r$. Then the value of P (X = 0) is					
	(1)	1	(2)	0.4		
	(3)	0.6	(4)	5 3		
71.	Let X_1 and X_2 be two stochastic random variables having variances k and 2 respectively. If the variance of $Y = 3X_2 - X_1$ is 25, then the value of k is					
7	(1)	7	(2)	19		
	(0)	-7	(1)	-19		

Question No.	Questions						stions	
72.	Which of the following is incorrect statement?							
	(1) Both the central limit theorem and the Weak law of large numbers hold for a sequence of i.i.d. random variables with finite mean and variance.							
-	(2)	Fo	r the se	equence but the	of inde	pende limit	ent r.v.'s, Weak law of large numbers theorem may not hold.	
	(3)	Ur	der ce	rtain o		ns, t	he central limit theorem holds for	
	(4)	Lir	ndeberg	Levy		shou	ld not be inferred as a particular case	
73.	Ma	tch l	List I ander th	nd Liste e lists	t II and	selec	t the correct answer using the codes	
	<u>List I</u>					List II		
	(Distribution)					(Moment Generating Function)		
-							for real t	
	A.	A. Poisson distribution				1.	(q + p e ^t) ⁿ , where p is probability of success	
	B.	B. Geometric distribution			oution	2.	$p (1 - q e^t)^{-1}$, where p is probability of success	
	C.	C. Normal distribution			ion	3.	$e^{\lambda (e^{t}-1)}$, where λ is mean	
	D. Binomial distribution		4.	$\exp\left(t^{2}/2\right)$ for standard variate				
-	Cod	les:						
		A	В	C	D			
	(1)	1	2	3	4		A MARKETON NO. 1	
	(2)	3		4	2			
	(3)	2	3	1	4			
	(4)	3	2	4	1			

Question No.	Questions
74.	Suppose that the probability of a dry day following a rainy day is $\frac{2}{3}$ and
	that the probability of a rainy day following a dry day is $\frac{1}{2}$. Given that January 19 is a dry day, what is the probability that January 21 will be a dry day?
	(1) $\frac{5}{12}$ (2) $\frac{7}{12}$
	(3) $\frac{7}{18}$ (4) $\frac{11}{18}$
75.	Let $X_1, X_2,, X_n$ be n in dependent and identically distributed variates each with pdf $f(x) = \begin{cases} 1, & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$ Then mean of smallest order statistic is
	(1) $\frac{n}{n+1}$ (2) $\frac{1}{n}$
	(3) $\frac{1}{n+1}$ (4) 1
76.	If X ₁ , X ₂ are i.i.d. N (0, 1), then the distribution of X ₁ - X ₂ is (1) N (0, 1) (2) N (0, 2)
	(3) $r(\frac{1}{2})$ (4) $r(1)$

Question No.	Wilestions		tions	
77.	Mean square error of an estimator t of parameter θ is expressed as			
100	(1) Bias + Var (t)		[Bias + Var (t)]2	
	(3) $(Bias)^2 + [Var(t)]^2$	(4)	(Bias)2 + Var (t)	
78.	The degrees of freedom for t- of observations is	statist	ic for paired t-test based on 20 pairs	
	(1) 38	(2)	19	
	(3) 39	(4)	18	
79.	If the sample size in Wald-V (number of runs) is asymptotic	Wolfow cally n	itz run test is large, the variate R ormal with mean	
71	(1) $\frac{2n_1n_2}{n_1+n_2}+1$	(2)	$\frac{2n_1}{n_1+n_2}+1$	
	$(3) \frac{2n_2}{n_1 + n_2} + 1$	(4)	$\frac{2n_{1}n_{2}}{n_{1}+n_{2}}$	
	where n ₁ , n ₂ are the sizes of th	ne two	samples.	
80.	In the usual notations, R _{1,23} c	an be e	expressed as :	
	(1) $R_{1.23}^2 = 1 - (1 - r_{12}^2)(1 - r_{13.2}^2)$	(2)	$R_{1,23}^2 = 1 - (1 - r_{12}^2)(1 - r_{13,2})$	
	(3) $R_{1.23}^2 = (1 - r_{12}^2)(1 - r_{13.2}^2)$	(4)	$R_{1,23}^2 = (1-r_{12})(1-r_{13,2})$	
81.	If $f_n(x) = \tan^{-1} nx$, $n \in [0, 1]$, whose point-wise			
	limit is f(x) = $\begin{cases} 0, & x = 0 \\ \frac{\pi}{2}, & x \in (0,1] \end{cases}$, then			
	(1) f(x) is differentiable	(2)	f (x) is not differentiable	
	(3) f(x) is continuous	(4)	None of these	

Question No.	Questions
82.	The integral $\int_{0}^{\infty} \sin x dx$: (1) exists (2) exists and equals zero (3) exists and equals 1 (4) does not exist
83.	If f is Riemann integrable with respect to α on [a, b], then: (1) f and α are both increasing (2) f and α are both bounded (3) f is bounded and α is increasing function (4) f is increasing and α is bounded function
84,	If $f(x) = \sin x$, then the total variation of $f(x)$ on $[0, 2]$ is (1) 3 (2) 1 (3) 2 (4) ∞
85.	If f is a non-negative function, $\langle E_i \rangle$ a disjoint sequence of measurable sets and $E = \bigcup E_i$, then $(1) \int_{E} f \rangle \sum_{E_i} \int_{E_i} f \qquad (2) \int_{E} f \langle \sum_{E_i} \int_{E_i} f \rangle $ $(3) \int_{E} f = \bigcup_{E_i} \int_{E_i} f \qquad (4) \int_{E} f = \sum_{E_i} \int_{E_i} f \rangle $
86.	For the function $f(x, y) = \begin{cases} \frac{xy^2}{x^2 + y^4}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$, the directional derivative along $\vec{u} = (\sqrt{2}, \sqrt{2})$ at $(0, 0)$ is:
	(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$ (3) $2\sqrt{2}$ (4) $\sqrt{2}/3$

Question No.		Questions	
87.	If X is a complete metric space, E is non-empty open subset of X, then		
	(1) E is a null set	(2) E is of first category	
	(3) E is of second category	(4) E is incomplete	
	[-5 -8 0]		
88.	If $A = \begin{bmatrix} 3 & 5 & 0 \\ 1 & 2 & -1 \end{bmatrix}$, then A	² is:	
	1 2 -1		
	(1) nilpotent	(2) idempotent	
2	(3) involutory	(4) periodic	
89.	If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ satisfies the m	atrix equation $A^2 - \lambda A + 2I = 0$, then value	
89.	If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ satisfies the matrix λ is: (1) 0	atrix equation $A^2 - \lambda A + 2I = 0$, then value (2) 1	
89.	A 18 :		
	(1) 0 (3) 2	(2) 1 (4) -2 -zero orthogonal vectors the dimension of	
	(1) 0 (3) 2 If X ₁ , X ₂ ,, X _N are N non the vector space spanned by the second space spanned spanned space spanned space spanned space spanned space spanned spanned space spanned space spanned space spanned space spanned spanned space spanned spann	(2) 1 (4) -2 -zero orthogonal vectors, the dimension of the 2N vectors	
90.	(1) 0 (3) 2 If X ₁ , X ₂ ,, X _N are N non	(2) 1 (4) -2 -zero orthogonal vectors, the dimension of the 2N vectors	
90.	(1) 0 (3) 2 If X ₁ , X ₂ ,, X _N are N non the vector space spanned by to X ₁ , X ₂ ,, X _N , -X ₁ , -	-zero orthogonal vectors, the dimension of the 2N vectors $X_{2}, \dots -X_{N} \text{ is :}$	
90.	(1) 0 (3) 2 If X ₁ , X ₂ ,, X _N are N non the vector space spanned by to X ₁ , X ₂ ,, X _N , -X ₁ , -X ₂ (1) N (3) 2N	(2) 1 (4) -2 -zero orthogonal vectors, the dimension of the 2N vectors X ₂ ,X _N is: (2) N+1 (4) N ²	
90.	(1) 0 (3) 2 If X ₁ , X ₂ ,, X _N are N non the vector space spanned by to X ₁ , X ₂ ,, X _N , -X ₁ , -X ₂ (1) N	(2) 1 (4) -2 -zero orthogonal vectors, the dimension of the 2N vectors X ₂ ,X _N is: (2) N+1 (4) N ²	

Question No.		Questions		
92.	P.I. for $(D^2 - 4D + 4)$ $y = x e^{2x}$, is:			
	(1) $\frac{x^3 e^{2x}}{6}$	(2) $\frac{x^2 e^{2x}}{4}$		
	(3) $\frac{x^3 e^{2x}}{8}$	(4) 8 e ^{2x}		
93.	The Green's function G (x, t) is			
	(1) one dimensional	(2) two dimensional		
	(3) three dimensional	(4) n-dimensional		
94.	Solving by variation of parameter value of Wornskion w, is	ers the equation, $\frac{d^2y}{dx^2} + 4y = \tan 2x$, then		
	(1) 4	(2) 3		
	(3) 1	(4) 0		
95.	Which of the following is not to (SLP)?	rue about the Strum-Liouville Problem		
	(1) All eigen values are real and non-negative.			
	(1) All eigen values are real and	i non-negative.		
	(2) SLP has always an eigen fur			
	(2) SLP has always an eigen fur			

Question No.		Questions	
96.	Solution of $\frac{\partial^2 z}{\partial x^2} + z = 0$ with $x = 0$, $z = e^y$ and $\frac{\partial z}{\partial x} = 1$, is:		
9	$(1) z = \cos x - e^y \sin x$	(2) $z = \cos x + e^y \sin x$	
	(3) $z = \sin x - e^y \cos x$	$(4) z = \sin x + e^y \cos x$	
97.	The differential equation f	$_{x} + 2f_{xy} + 4f_{yy} = 0$ is:	
	(1) parabolic	(2) elliptic	
	(3) hyperbolic	(4) linear	
98.	The surface satisfying $\frac{\partial^2 u}{\partial y^2}$ y = 1 = u is	= x ³ y containing two lines y = 0 = u an	
	(1) $u = x^3y^3 + y(1 - x^3)$	(2) $u = x^3y^3 - y(1 + x^3)$	
	(3) $u = x^3y^2 + 1 - x^3$	(4) $u = x^2y^3 + 1 - x^3$	
99.	The relation $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$ replaced in the relation $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$	presents the partial differential equation:	
	(1) $2z = p + q$	$(2) 2z = \frac{xp}{yq}$	
» 1	(3) 2z = xq + yp	(4) 2z = xp + yq	
00.	Using Newton's-Raphson me reciprocal of a natural numb	ethod, an iterative formula to compute the er N, is:	
		NAME OF THE PARTY	
	(1) $x_{n+1} = x_n (2 - N \cdot x_n)$	(2) $x_{n+1} = x_n - N x_n^2$	

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(MPH/PHD/URS-EE-2017) Subject : MATHEMATICS Code D Mathemat.

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Sr. No. 10212

Time: 11/4 Hours	Max. Marks: 100	Total Questions: 100
Roll No.	(in figure)	(in words)
Name:	Father's Na	ame :
Mother's Name :	Date of Exa	mination:
(Signature of the candidate)		(Signature of the Invigilator)

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- Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.
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Question No.	Questions		
1.	The $(n-1)$ th derivative of the Green's function $G(x, t)$ with regard to x at the point $x = t$, has:		
8	(1) Discontinuity of 1st kind (2) Discontinuity of 2nd kind		
	(3) Removable discontinuity (4) No discontinuity		
2.	Which of the following is incorrect?		
	(1) The eigen values of a symmetric kernel are real.		
	(2) All iterated kernels of a symmetric kernel are also symmetric.		
	(3) Every symmetric kernel with norm ≠ 0 has at least one eigen value		
V.	(4) Fredholm integral equation of the second kind has always an eigen value.		
3.	For a particle of mass m moving under a potential $v = \frac{k}{q}$, which one of the following relations is correct?		
70	(1) $\ddot{q} = \frac{k}{m q^2}$ (2) $m \dot{q}^2 + \frac{2k}{q} = constant$		
	(3) $m \dot{q} + \frac{2k}{q} = constant$ (4) $m \dot{q}^2 + \frac{k}{q} = constant$		
4.	A rigid body moving in space with one point fixed, has degrees of freedom:		
	(1) 3 (2) 4		
	(3) 6 (4) 2		

Question No.		Questions
5.	For the Lagrangian L =	$\frac{1}{2}\dot{q}^2 - q\dot{q} + q^2$, the conjugate momentum p is:
	(1) q̈-q	(2) q+q
	(1) $q - q$ (3) $\frac{1}{2} \dot{q} q$	(4) q-q
6.	THE RESERVE THE PARTY OF THE PA	s A_1 , A_2 ,, A_n , let $P(A_i) = \frac{1}{i+1}$, $i = 1, 2,, n$. appening at least one of the events is
ariova major n	$(1) \frac{n}{n+1}$	$(2) \frac{1}{n+1}$
	(3) 1/n	(4) $1-\frac{1}{n}$
7.	The idea of posterior pro	pabilities was introduced by
	(1) Pascal	(2) Poisson
	(3) Fisher	(4) Thomas Bayes
8.		al distribution, 50% of items are above 60 and Then, the coefficient of quartile deviation is
	(1) 15	(2) 30
	(3) 1/4	(4) $\frac{1}{5}$
9.	In any discrete series (what between M.D. about mea	nen all the values are not same) the relationship n and S.D. is
	(1) M.D. = S.D.	(2) M.D. < S.D.
	(3) M.D. > S.D.	(4) M.D. = Mean + S.D.

Question No.		Quest	ions	
10.	A random variable X can take all non-negative integral values, and the probability that X takes the value r is proportional to $(0.4)^r$. Then the value of P (X = 0) is			
	(1) 1	(2)		
	(3) 0.6	(4)	5 3	
11.	Solution of $(xy^2 + x) dx + (yx^2)$	+ y) dy	= 0 is:	
	(1) $\tan^{-1}(x^2y^2+1)=c$	(2)	(x+1)(y+1)=c	
	(3) $(x^2 + 1) (y^2 + 1) = c$	(4)	$x^2 + y^2 + 1 = c$	
12.	P.I. for $(D^2 - 4D + 4)$ y = x e^{2x}	, is:	and the same of the	
	(1) $\frac{x^3 e^{2x}}{6}$	(2)	$\frac{x^2 e^{2x}}{4}$	
	(3) $\frac{x^3 e^{2x}}{8}$	(4)	8 e ^{2x}	
13.	The Green's function G (x, t)	is:	The Residence of	
	(1) one dimensional	(2)	two dimensional	
	(3) three dimensional	(4)	n-dimensional	
14.	Solving by variation of parav	meters	the equation, $\frac{d^2y}{dx^2} + 4y = \tan 2x$, then	
	(1) 4	(2)	3	
1	(3) 1	(4)	0	

Question No.	Questions		
15.	Which of the following is not true about the Strum-Liouville Problem		
	(1) All eigen values are real and non-negative.		
	(2) SLP has always an eigen function.		
	(3) Eigen functions corresponding to different eigen values are orthogonal w.r.t. weight function.		
	(4) For each eigen value there exists only one linearly independent eigen function.		
16.	Solution of $\frac{\partial^2 z}{\partial x^2} + z = 0$ with $x = 0$, $z = e^y$ and $\frac{\partial z}{\partial x} = 1$, is:		
	(1) $z = \cos x - e^y \sin x$ (2) $z = \cos x + e^y \sin x$		
	(3) $z = \sin x - e^y \cos x$ (4) $z = \sin x + e^y \cos x$		
17.	The differential equation $f_{xx} + 2f_{xy} + 4f_{yy} = 0$ is:		
	(1) parabolic (2) elliptic		
	(3) hyperbolic (4) linear		
18.	The surface satisfying $\frac{\partial^2 u}{\partial y^2} = x^3 y$ containing two lines $y = 0 = u$ and		
	y - 1 - u 18		
	(1) $u = x^3y^3 + y(1 - x^3)$ (2) $u = x^3y^3 - y(1 + x^3)$		
	(3) $u = x^3y^2 + 1 - x^3$ (4) $u = x^2y^3 + 1 - x^3$		
19.	The relation $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$ represents the partial differential equation:		
	(1) $2z = p + q$ (2) $2z = \frac{xp}{yp}$		
1 (3) $2z = xq + yp$ (4) $2z = xp + yq$		

Question No.	Questions
20.	Using Newton's-Raphson method, an iterative formula to compute the reciprocal of a natural number N, is: (1) $x_{n+1} = x_n (2 - N \cdot x_n)$ (2) $x_{n+1} = x_n - N x_n^2$
0.1	(3) $x_{n+1} = 2 x_n - N$ (4) $x_{n+1} = 2 - N \cdot x_n$
21.	The value of the integral $\oint_C \frac{1}{z} dz$, where C is the circle $x = \cos t$, $y = \sin t$
	$0 \le t \le 2\pi$, is:
	(1) 2 π i (2) π i
-114	(3) 2π (4) $\frac{1}{2\pi}$
22.	If C is the circle $ z - 3 = 2$, then using Cauchy's integral formula
1	$\oint_C \frac{2z+5}{z^2-2z} dz =$
	(1) $9 \pi i$ (2) $\frac{9 \pi i}{2}$
	(3) 6πi (4) 3πi
23.	For the function $f(z) = \frac{\cos z}{z^2 (z-\pi)^3}$, the residue at the pole $z = \pi$ is:
	(1) $4\pi^3$ (2) $\frac{4\pi}{\pi^2-6}$
	(3) $\frac{\pi^2 - 6}{2\pi^4}$ (4) $\frac{\pi^2 - 6}{2\pi^3}$
	Using Cauchy's residue theorem, value of the integral $\oint_C \frac{\tan z}{z} dz$ C: $ z-1 = 2$, is:
	(1) 4i (2) -4i
	(3) -2i $(4) 2i$

Question No.	Questions The only bounded entire functions are constants. This result is due to:						
25.							
	(1)	Cauchy	(2)	Liouville	ê.		
	(3)	Schwarz	(4)	Morera			
26.	For	the function f(z)	$= \frac{1 - e^z}{1 + e^z}, \text{ the si}$	ngularity z = ∞ is:	111		
	(1)	a removable singu	ularity				
	(2)	a pole					
	(3)	an isolated essent	tial singularity				
	(4)	a non-isolated ess	ential singula	rity			
27.	If $z = x + iy$, $w = u + iv$, then by the transformation $w = z e^{i\pi/4}$, the line $x = 0$ is transformed into the line:						
	(1)	u - v = 1	(2)	u + v = 1			
	(3)	$\mathbf{v} = -\mathbf{u}$	(4)	v = u			
28.	Total number of 4 digit numbers with no two digits common, are:						
	(1)	4096	(2)	5436			
	(3)	4896	(4)	4536	9		
29.	The		e integers which	ch are less than 108 and prime	e to 108,		
	(1)	24	(2)	36			
	(3)	40	(4)	52			
30.	The	number of zeros a	at the end of	75 is:			
	(1)	12	(2)	16			
	(3)	18	(4)	75			

Question No.	Questions					
31.	If $f_n(x) = \tan^{-1} nx$, $n \in [0, 1]$, whose point-wise $[0, x=0]$					
	limit is $f(x) = \begin{cases} 0, x=0 \\ \frac{\pi}{2}, x \in (0,1] \end{cases}$, then:					
	(1) f(x) is differentiable (2) f(x) is not differentiable					
	(3) f(x) is continuous (4) None of these					
32.	The integral $\int_{0}^{\infty} \sin x dx$:					
3	(1) exists (2) exists and equals zero					
	(3) exists and equals 1 (4) does not exist					
33.	If f is Riemann integrable with respect to α on [a, b], then:					
	(1) f and a are both increasing					
	(2) f and α are both bounded					
	(3) f is bounded and α is increasing function					
	(4) f is increasing and α is bounded function					
34.	If $f(x) = \sin x$, then the total variation of $f(x)$ on $[0, 2]$ is					
	(1) 3 (2) 1					
	(3) 2 (4) ∞					
35.	If f is a non-negative function, $\langle E_i \rangle$ a disjoint sequence of measurable sets and $E = \bigcup E_i$, then					
	(1) $\int_{E} f > \sum \int_{E_{i}} f$ (2) $\int_{E} f < \sum \int_{E_{i}} f$					
	(3) $\int_{E} f = \bigcup_{E_{i}} f$ (4) $\int_{E} f = \sum_{E_{i}} f$					

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Question No.	Questions						
36.	For the function $f(x, y) = \begin{cases} \frac{xy^2}{x^2 + y^4}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$, the directional derivative						
	along $\vec{u} = (\sqrt{2}, \sqrt{2})$ at (0, 0) is:						
	(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$						
E	(3) $2\sqrt{2}$ (4) $\sqrt{2}/3$						
37.	If X is a complete metric space, E is non-empty open subset of X, then:						
	(1) E is a null set (2) E is of first category						
	(3) E is of second category (4) E is incomplete						
	[-5 -8 0]						
38.	If $A = \begin{bmatrix} 3 & 5 & 0 \end{bmatrix}$, then A^2 is:						
	If $A = \begin{bmatrix} -5 & -8 & 0 \\ 3 & 5 & 0 \\ 1 & 2 & -1 \end{bmatrix}$, then A^2 is:						
	(1) nilpotent (2) idempotent						
	(3) involutory (4) periodic						
39.	If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ satisfies the matrix equation $A^2 - \lambda A + 2I = 0$, then value of						
	λis:						
	(1) 0 (2) 1						
	(3) 2 (4) -2						

Question No.	Questions					
40.	If X ₁ , X ₂ ,, X _N are N non-zero orthogonal vectors, the dimension of the vector space spanned by the 2N vectors					
44	$X_1, X_2, \dots, X_N, -X_1, -X_2, \dots -X_N$ is:					
	(1) N (2) N+1					
	(3) 2N (4) N ²					
41.	Consider a multiple linear regression model with r regressors, $r \ge 1$ and					
	the response variable Y. Suppose \hat{Y} is the fitted value of Y. R^2 is the coefficient of determination and R^2_{adj} is the adjusted coefficient of determination. Then					
	(1) R ² always increases if an additional regressor is included in the model					
2.24	(2) R _{adj} always increases if an additional regressor is included in the model					
	(3) $R^2 < R_{adj}^2$ for all r					
	(4) Correlation coefficient between Y and Ŷ is always non-negative.					
42.	Suppose X is a p-dimensional random vector with variance-covariance matrix Σ . If P_1 , P_2 ,, P_p represent p orthogonal eigenvectors of Σ corresponding to the eigen values $\lambda_1 > \lambda_2 > > \lambda_p \geq 0$ respectively, then which of the following is not correct?					
	(1) First principal component is $P_{-1}^T X$					
	(2) $P_{-1}^T X$ and $P_{-1}^T X$ ae correlated					
	(3) $Var(P_{-1}^T X) = \lambda_1$					
	(4) $T_r(\Sigma) = \sum_{i=1}^p \lambda_i$					

Question No.	Questions					
43.	For 2 strata $N_1 = 200$, $S_1^2 = 9$ and $N_2 = 300$, $S_2^2 = 4$; the variance of sample mean of sample size 100, under proportional allocation is (1) 0.048 (2) 0.056					
	(3) 0.240	(4)	0.084			
44.	If the population consists of a	linear	trend, $Y_i = i$; $i = 1, 2, 3,, k$, then			
	(1) $\operatorname{Var}(\overline{y}_{st}) \leq \operatorname{Var}(\overline{y}_{sys})$	(2)	$Var(\overline{y}_{st}) \ge Var(\overline{y}_{sys})$			
mir au	(3) $\operatorname{Var}(\overline{y}_{st}) = \operatorname{Var}(\overline{y}_{sys})$	(4)	$Var(\overline{y}_{st}) > Var(\overline{y}_{sys})$			
45.	The total number of main experiment is	and ir	nteraction effects in a 24 factorial			
E Project	(1) 3	(2)	14			
	(3) 15	(4)	16			
46.	While analysing the data of a $k \times k$ Latin square design, the error d.f. in analysis of variance is equal to:					
	(1) $k^3 - 3k^2 + 2k$	(2)	k^2-1			
	(3) $k^2 - k - 2$	(4)	$k^2 - 3k + 2$			
47.		azard	nected in series with constant (burates λ_1 , λ_2 ,, λ_n respectively, then			
	(1) $1 - \prod_{i=1}^{n} (1 - e^{-\lambda_i t})$	(2)	$\int_{0}^{\infty} \left[1 - \prod_{i=1}^{n} \left(1 - e^{-\lambda_{i} t} \right) \right] dt$			
	$(3) e^{-\sum_{i=1}^{n} \lambda_i t}$	(4)	$\int_{0}^{\infty} e^{-\sum_{i=1}^{n} \lambda_{i} t} dt$			
48.		native	optimal solution, then the dual has			
	(1) No feasible solution		(2) Unbounded solution			
	(3) Alternative optimal solu	tion	(4) Degenerate optimal solution			

Question No.		Ques	stions			
49.	A manufacturing company has determined from an analysis of its accounting and production data for a certain part that its demand is 9000 units per annum and is uniformly distributed over the year. Further, it is known that the lead time is uniform and equals 8 working days, and the total working days in an year are 300. Then the re-order level would be					
	(1) 30	(2)				
	(3) 240	(4)	300			
50.	probability that the yar	capacity of the	15 minutes and the service time in a yard is limited to 4 trains, then the assuming the arrivals follows Poisson blow the exponential distribution) is			
	(1) $\frac{1}{31}$	(2)	1 32			
	(3) $\frac{1}{2}$	(4)	$\frac{1}{4}$			
51.	$\Delta \tan^{-1}\left(\frac{n-1}{n}\right) =$					
	$(1) 2 \tan^{-1} \left(\frac{1}{n^2} \right)$	(2)	$\tan^{-1}\left(\frac{1}{n^2}\right)$			
34	$(3) \tan^{-1}\left(\frac{1}{2n^2}\right)$	(4)	$\tan^{-1}\left(\frac{1}{2n}\right)$			
52.	The first term of the s $8, 3, 0, -1, 0$ is:	eries whose	second and subsequent terms are			
	(1) 10	(2)	12			
	(3) 15	(4)	20			

Question No.	Questions							
53.	In the Gauss elimination method for solving a system of linear algebraic equations, triangularization leads to:							
	(1) diagonal matrix	(2)	lower triangular matrix					
	(3) upper triangular matrix	(4)	singular matrix					
54.	In Simpson's one-third rule the	curv	y = f(x) is assumed to be:					
	(1) circle	(2)	parabola					
	(3) ellipse	(4)	hyperbola					
55.	The second order Runge-kutta method is applied to the initial value problem $y' = -y$, $y(0) = y_0$ with step size h. Then $y(h) =$							
	(1) $y_0 (h^2 - 2h - 2)$	(2)	$\frac{y_0}{2}$ (h ² - 2h + 2)					
	(3) $\frac{y_0}{6}$ (h ² – 2h + 2)	(4)	$\frac{y_0}{6}$ (h ² - 2h - 2)					
56.	y (0) = 1, is y ₃ =		pproximation, solution of $\frac{dy}{dx} = -xy$					
	$(1) 1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{16}$	(2)	$1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{24}$					
	$(3) 1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{32}$	(4)	$1 - \frac{x^2}{2} + \frac{x^4}{8} - \frac{x^6}{48}$					
57.	The minimizing curve must sa	tisfy	a differential equation, called as:					
	(1) Euler-Lagrange equation	(2)	Lagrange equation					
	(3) Euler-Gauss equation	(4)	Cauchy-Euler equation					

Question No.	Questions
58.	Given the functional $\int_{x_0}^{x_1} \left(\frac{{y'}^2}{x^3} \right) dx$, then the extremal is:
	(1) $y = \frac{cx^3}{3} + c_1$ (2) $y = \frac{cx^4}{4} + c_1$
	(3) $y = cx^2 + c_1$ (4) $y = \sin x$
59.	Solution of the integral equation $\int_{0}^{x} (x-t)^{-\frac{1}{2}} u(t) dt = 1$ is:
	(1) $u(x) = \frac{1}{x\sqrt{\pi}}$ (2) $u(x) = \frac{\pi}{\sqrt{x}}$
	(3) $u(x) = \frac{1}{\pi \sqrt{x}}$ (4) $u(x) = \frac{1}{\sqrt{\pi x}}$
60.	The resolvent third kernel of the Volterra's integral equation with kernel k (x, t) = 1, is
	(1) $(x-t)^2$ (2) $\frac{1}{2}(x-t)^2$
	(3) $\frac{1}{3} (x-t)^3$ (4) $\frac{1}{2} (x-t)^3$
61.	Let X_1 and X_2 be two stochastic random variables having variances k and 2 respectively. If the variance of $Y = 3X_2 - X_1$ is 25, then the value of k is
1	(1) 7 (2) 19
	(3) -7 (4) -19

No.	Questions									
62.	Which of the following is incorrect statement?									
	(1) Both the central limit theorem and the Weak law of large number hold for a sequence of i.i.d. random variables with finite mean as variance.									
	(2)	For	the seq	uence ut the	of inder central	ender limit t	nt r.v.'s, Weak law of large numbers heorem may not hold.			
	(3)				ondition re not in		e central limit theorem holds for ident.			
	(4)				neorem.		d not be inferred as a particular case			
63.			ist I an		II and	select	the correct answer using the codes			
	<u>List I</u>						List II			
	(Distribution)					(Moment Generating Function)				
							for real t			
	A.	Pois	son dis	tributi	on	1.	$(q + p e^t)^n$, where p is probability of success			
	В.	Geo	metric	distrib	ution	2.	p (1 - q e ^t)-1, where p is probability of success			
	C.	Nor	mal dis	tributi	on	3.	$e^{\lambda (e^{t}-1)}$, where λ is mean			
	D.	Bin	omial d	istribu	tion	4.	$\exp\left(\frac{t^2}{2}\right)$ for standard variate			
	Coc	les:								
		A	В	C	D					
	(1)	1	2	3	4					
	(2)	3	1	4	2					
	(3)	2	3	1	4					
	(4)	3	2	4	1					

Question No.	Questions					
64.	Suppose that the probability of a dry day following a rainy day is $\frac{2}{3}$ and					
	that the probability of a rainy day following a dry day is $\frac{1}{2}$. Given that January 19 is a dry day, what is the probability that January 21 will be a dry day?					
	(1) $\frac{5}{12}$ (2) $\frac{7}{12}$					
*	(3) $\frac{7}{18}$ (4) $\frac{11}{18}$					
	Let $X_1, X_2,, X_n$ be n in dependent and identically distributed variates, each with pdf $f(x) = \begin{cases} 1, & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$ Then mean of smallest order statistic is					
-	Then mean of smallest order statistic is $(1) \frac{n}{n+1} \qquad (2) \frac{1}{n}$					
	(3) $\frac{1}{n+1}$ (4) 1					
66.	If X_1 , X_2 are i.i.d. N (0, 1), then the distribution of $X_1 - X_2$ is (1) N (0, 1) (2) N (0, 2)					
(3) $\mathbf{r}\left(\frac{1}{2}\right)$ (4) \mathbf{r} (1)					
	Mean square error of an estimator t of parameter θ is expressed as 1) Bias + Var (t) (2) [Bias + Var (t)] ²					
(B) $(Bias)^2 + [Var(t)]^2$ (4) $(Bias)^2 + Var(t)$					

Question No.	Questions The degrees of freedom for t-statistic for paired t-test based on 20 pairs of observations is						
68.							
	(1) 38	(2)	19				
10	(3) 39	(4)	18				
69.	If the sample size in Wald-W (number of runs) is asymptotic		itz run test is large, the variate R ormal with mean				
	$(1) \frac{2n_1n_2}{n_1 + n_2} + 1$	(2)	$\frac{2n_1}{n_1 + n_2} + 1$				
	2n,	2000	2n ₁ n ₂				
	(3) $\frac{2n_2}{n_1 + n_2} + 1$	(4)	$\frac{2n_1n_2}{n_1+n_2}$				
	where n, n are the sizes of the two samples.						
70.	In the usual notations, R _{1,23} can be expressed as:						
	(1) $R_{1,23}^2 = 1 - (1 - r_{12}^2)(1 - r_{13,2}^2)$	(2)	$R_{1,23}^2 = 1 - (1 - r_{12}^2)(1 - r_{13,2})$				
	(3) $R_{1,23}^2 = (1-r_{12}^2)(1-r_{13,2}^2)$	(4)	$R_{1,23}^2 = (1 - r_{12}) (1 - r_{13,2})$				
71.	The number of elements of order 10 in Z ₃₀ is:						
	(1) 4	(2)	3/1-11				
	(m) 0	(4)	1				
	(3) 2	(2)					
72.	(3) 2 The generators of the group G		a^2 , a^3 , $a^4 = e$ } are:				
72.			a^{2} , a^{3} , $a^{4} = e$ } are: a and a^{4}				
72.	The generators of the group G	= {a,	a and a4				
72.	The generators of the group G (1) a and a ² (3) a and a ³	= {a, (2) (4) s of G	a and a ⁴ a only of order 6 and 8 respectively, then				
	The generators of the group G (1) a and a ² (3) a and a ³ If H and K are two subgroup order of HK is 16 if order of H (1) 2	= {a, (2) (4) s of G	a and a ⁴ a only of order 6 and 8 respectively, then is:				

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Question No.		Ques	tions					
74.	Let G be a group of order 15, then the number of sylow subgroups of G of order 3 is:							
	(1) 4	(2)	3					
	(3) 2	(4)	1					
75.	The cardinality of a finite integ	ral d	omain can not be:					
	(1) 6	(2)	5					
*****	(3) 3	(4)	2					
76.	A ring of polynomials over a field is a:							
74	(1) group	(2)	unique factorization domain					
	(3) prime field	(4)	irreducible					
77.	Let R be a commutative ring with unity such that {0} is a prime ideal of R, then							
	(1) {0} is a maximal ideal of R	(2)	R has zero divisors					
100	(3) R is a field	(4)	R is a integral domain					
78.	A totally disconnected space is	a :						
	(1) T ₀ -space	(2)	T ₁ -space					
-	(3) T ₂ -space	(4)	T ₃ -space					
79.	Every indiscrete space is:							
	(1) compact and connected	(2)	not compact					
	(3) disconnected	(4)	connected but not compact					

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Question No.	Questions												
80.	If Y is a subspace of X, A is closed in Y and Y is closed in X, then:												
	(1) A is not closed in X	(2)	A is semi-closed in X										
	(3) A is open in X	(4)	None of these										
81.	The eigen values of a skew-s	ymmetr	ic matrix are :										
	(1) always zero	(2)	always pure imaginary										
	(3) always real	(4)	either zero or pure imaginary										
82.	The dimension of the vector is:	space	of all 3 × 3 real symmetric matrices										
	(1) 3	(2)	4										
	(3) 6	(4)	9										
83.	The number of all non-sin	gular li	inear transformations $T: \mathbb{R}^4 \to \mathbb{R}^3$										
	(1) 4	(2)	3										
	(3) 1	(4)	0										
84.		ransform	nation given by T (x, y, z) = $\left(\frac{x}{2}, \frac{y}{2}, 0\right)$										
	Rank of T is:	(0)	and production of the state of										
	(1) 3	(2)											
	(3) 4	(4)	A b										
85.			oles is equivalent to the diagonal form										
	$-(x_1-x_2)^2-x_3^2$. Then, the	quadrati	c form is:										
	(1) negative definite	(2)	semi-negative definite										
-	(3) positive definite	(4)	semi-positive definite										

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Question No.	Questions The positive integer n for which the equality $\left(\frac{\sqrt{3}}{2} + \frac{1}{2}i\right)^n = -1$ holds,												
86.													
	is:												
	(1) 2 (2) 4												
	(3) 5 (4) 6												
87.	If $f(z) = 3x - y + 5 + i (ax + by - 3)$, then the values of a function $f(z)$ is entire, are:	and b so that the											
	(1) $a = 1, b = 3$ (2) $a = 3, b = 1$												
-	(3) $a = 1, b = -3$ (4) $a = -1, b = 3$												
88.	The function $f(z) = e^{2z+i}$ is:	-											
	(1) differentiable at z = 0 (2) differentiable at z =	=-1											
1	(3) differentiable at z = i (4) no where differentiable												
89.	The principal value of (-1) ³ⁱ is:												
	(1) $e^{-3/2}$ (2) $e^{-\pi}$												
	(3) $e^{-3\pi}$ (2) $e^{-\pi}$ (4) $e^{-3\pi/2}$												
90.	Solutions of the equation sinh z = cosh z are given by	-											
	(1) $z = (-1 + 4n) \pi i$ (2) $z = e^{-3\pi i}$												
	(3) $z = e^{(2n+1)\pi i}$ (4) There are no solution	ons											
91.	If A and B are finite sets and the total number of subsets elements than the total number of subsets of B, then elements in A is:	If A and B are finite sets and the total number of subsets of A has 56 more elements than the total number of subsets of B, then the number of elements in A is:											
	(1) 4 (2) 5												
	(3) 6 (4) 8												

No.	Questions											
92.	If P (A) denotes the power set of the set A, then which of the following is correct?											
	(1) $A \cap P(A) = A$ (2) $A \cup P(A) = P(A)$											
	(3) $A - P(A) = A$ (4) $P(A) - \{A\} = P(A)$											
93.	The order of a set A is 4 and that of a set B is 3. The number of relations from A to B is:											
	(1) 12 (2) 144											
	(3) 2048 (4) 4096											
94.	The set of real numbers in the closed interval {0, 1} is											
	(1) finite set (2) uncountable set											
	(3) countable set (4) None of these											
95.	The nth term of the sequence $\left\{2, \frac{-3}{2}, \frac{4}{3}, \frac{-5}{4}, \dots\right\}$ is:											
	(1) $(-1)^{n-1} \left(1 + \frac{1}{n}\right)$ (2) $(-1)^{n-1} \left(1 - \frac{1}{n}\right)$ (3) $(-1)^{n-1} \left(1 + \frac{2}{n}\right)$ (4) $(-1)^{n-1} \frac{2^n}{n-1}$											
96.	The series $x + \frac{2^2 x^2}{12} + \frac{3^3 x^3}{13} + \frac{4^4 x^4}{14} + \dots$ is convergent if:											
	(1) $x > \frac{1}{e}$ (2) $0 < x < \frac{1}{e}$											
	(3) $\frac{2}{e} < x < \frac{3}{e}$ (4) $\frac{e}{3} < x < \frac{e}{2}$											

Question No.	Questions										
97.	The series $\sum \left(1 + \frac{1}{n}\right)^{-n^2}$ is: (1) Convergent (3) Oscillatory	(2)	1 1 1 1 1 1 1 1								
98.	COV. COVERNO STATE	. 1.0	None of these], then the value of 'C' of Lagrange'								
	(1) $\frac{1}{3}$	(2)	$\frac{1}{4} + \frac{1}{\sqrt{2}}$ $\frac{6 - \sqrt{21}}{6}$								
	(3) $\frac{6+\sqrt{21}}{18}$	(4)	$\frac{6-\sqrt{21}}{6}$								
99.	It is given that the function										
	$f(x) = \begin{cases} \frac{a \cos x}{\frac{\pi}{2} - x}, & x \neq \frac{\pi}{2} \\ 1, & x = \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, value	of a i	s:								
	(1) -1	(2)									
	(3) 2	(4)	$\frac{\pi}{2}$								
100.	Which of the following function	ıs is r	ot uniformly continuous in [2, ∞)?								
	$(1) \frac{1}{x}$		$\frac{1}{x^2}$								
x: 5	(3) e ^x	(4)	sin x								

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1.	3	16.	1	31.	1	46.	2	61. 3	76.	1	91.	2	Henne	*****			
2.	3	17.	2	32.	1	47.	4	62. 3	77.	4	92.	3					
3.	4	18.	3	33.	3	48.	3	63. 3	78.	3	93.	1			10	ij	
4.	2	19.	2	34.	2	49.	1	64. 2	79.	2	94.	1				- 35	
5.	1	20.	1	35.	2	50.	2	65. 2	80.	3	95.	3					
6.	2	21.	4	36.	4	51.	3	66. 4	81.	1	96.	4	191				
7.	1.	22.	3	37.	3	52.	1	67. 1	82.	2	97.	4					
8.	4	23.	4	38.	4	53.	1	68. 2	83.	4	98.	4					
9.	2	24.	4	39,	2	54.	3	69. 3	84.	2	99.	3					
10.	3	25.	2	40.	3	55.	2	70. 2	85.	3	100.	1					
11.	2	26.	4	41.	1	56.	4	71. 1	86.	2							
12.	4	27.	1	42.	3	57.	2	72. 4	87.	4							
13.	3	28.	4	43.	2	58.	1	73. 2	88.	2							
14.	1	29.	3	44.	4	59.	4	74. 1	89.	1							
15.	4	30.	4	45.	1	60.	1	75. 1	90.	1							

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8.	3	23.	2	38.	1	53.	4	68.	3	83.	4	98.	2				
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13.	4	28.	4	43.	3	58.	4	73.	4	88.	3					
14.	4	29.	2	44.	2	59.	2	74.	2	89.	2					
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7.	4	22. 1	37.	2	52.	3	67.	4	82.	3	97.	1	
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