

Test Booklet No. _____

This booklet consists of 150 questions and pages.

RGUPET/2025/1004/109

RGUPET 2025
Common Entrance Test, 2025
DOCTOR OF PHILOSOPHY IN MATHEMATICS

Full Marks: 150

Time: 3 Hours

Roll No.

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Day and Date of Examination: _____

Signature of Invigilator(s) _____

Signature of Candidate _____

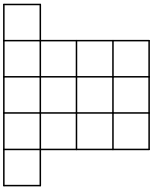
General Instructions:

PLEASE READ ALL THE INSTRUCTIONS CAREFULLY BEFORE MAKING ANY ENTRY.

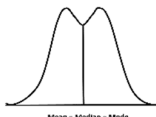
1. DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO.
2. Candidate must write his/her Roll Number on the space provided.
3. This Test Booklet contains 150 Multiple Choice Questions (MCQs) from the concerned subject. Each question carries 1 mark.
4. Please check the Test Booklet to verify that the total pages and total number of questions contained in the test booklet are the same as those printed on the top of the first page. Also check whether the questions are in sequential order or not.
5. Candidates are not permitted to enter into the examination hall after the commencement of the entrance test or leave the examination hall before completion of Examination.
6. Making any identification mark in the OMR Answer Sheet or writing Roll Number anywhere other than the specified places will lead to disqualification of the candidate.
7. Candidates shall maintain silence inside and outside the examination hall. If candidates are found violating the instructions mentioned herein or announced in the examination hall, they will be summarily disqualified from the entrance test.
8. In case of any dispute, the decision of the Entrance Test Committee shall be final and binding.
9. The OMR Answer Sheet consists of two copies, the Original copy and the Student's copy.

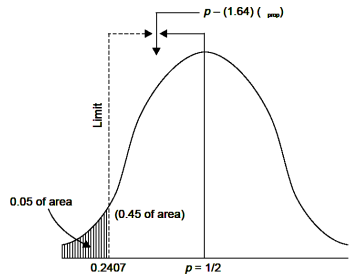
1	The “Mission Sudarshan Chakra”, recently launched by the Prime Minister of India, primarily relates to				development of a multilayered air and missile defence system
	a) a national renewable energy mission	b) a national digital currency mission	c) development of a multilayered air and missile defence system	d) a national mission to modernise Indian Railways	(c)
2	“Pushpak”- a national mission being implemented by the Indian Institute of Technology, Bombay is related to the development of				Drone technology
	a) Helicopters	b) Dairy technology	c) Drone technology	d) Artificial intelligence	(c)
3	North East India’s first underwater tunnel project, announced in 2024, is proposed to connect				Numaligarh and Gohpur
	a) Dibrugarh and Dhemaji	b) Jorhat and Majuli	c) Numaligarh and Gohpur	d) Guwahati and North Guwahati	(c)
4	Which of the following statements are correct? A. Canada hosted the 51 st G7 summit in 2025. B. Four players were honoured with the Khel Ratna Award 2025. C. Sweden was ranked first in Global Innovation Index 2024. D. Operation Sindoor was Launched by India to attack terrorist bases in Pakistan on 7 th May 2025.				(a)
	a) A, B and D	b) A, B and C	c) Only A	d) All of the above	A, B and D
5	Which of the followings are correct? A. Lip Butan has been appointed as the new CEO of Intel in March 2025 B. Shri C P Radhakrishnan has been appointed as the Vice President of India C. India’s rank in the Human Development Index 2025 released by UNDP is 99 D. India has become the 2 nd largest road network in the World.				(d)
	a) A and B only	b) A, B and C only	c) A, C and D only	d) A, B, D only	A, B, D only
6	Which of the following sentences is false? A. Palk Strait joins India and Sri Lanka B. The Radcliffe Line is between India and Bangladesh C. The MacMohan Line separates India and China D. The Durand Line is between Iran and Afghanistan.				
	a) A, B	b) B, C	c) C, D	d) B, D	(d)
7	Assertion (A): Eclipses do not occur on all full moon and new moon days. Reason (R): The moon revolves round the earth in an elliptical orbit.				A and R are true but R doesnot explain A

	a) A and R are true and R correctly explains A.	b) A and R are true but R does not explain A.	c) A is true R is false	d) R is true but A is false	(b)
8	Right to equality is a-				Fundamental right
	a) fundamental right	b) social right	c) cultural right	d) legal right	(a)
9	The author of the book "Midnight's Children" is-				Salman Rushdie
	a) Shakespeare	b) Leo Tolostoy	c) Salman Rushdie	d) R K Narayan	(c)
10	Match the organizations with their headquarters:				
	A. UNESCO		1. New York		
	B. WHO		2. Paris		
	C. UNICEF		3. Geneva		
	D. IMF		4. Washington D.C.		
	a) A-3, B-2, C-4, D-1	b) A-2, B-3, C-1, D-4	c) A-2, B-4, C-3, D-1	d) A-1, B-3, C-2, D-4	(b)
11	He said, "Happy new year!" The correct indirect speech of the above is-				He wished me a happy new year.
	a) He said the new year was happy.	b) He wished me a happy new year.	c) He said to me that happy new year.	d) I was wished a happy new year.	(b)
12	Identify the correct sentence(s) from the following. A. One of my friends is a doctor. B. I don't know nothing about her. C. It is a two-hour journey. D. We will be definitely there at the yesterday's programme.				
	a) A, B	b) B, C	c) A, C	d) C, D	(c)
13	"She drank the _____ milk that was there in the flask." The appropriate quantifier to fill in the blank is-				little
	a) all	b) little	c) sour	d) few	(b)
14	"a/ great /and/ reality/their/ theory/in/there/ disparity/is" The correct reordered meaningful sentence with the above jumbled words/phrases is- P. There is a great theory and their reality in disparity. Q. There is a great disparity in their theory and reality. R. Their great disparity is in a theory and reality there. S. Their great theory is a reality and in disparity there.				There is a great disparity in their theory and reality.
	a) P	b) Q	c) R	d) S	(b)
15	The correct match of synonyms and antonyms is:				A-ii, B-iii, C-i, D-iv
	A. Futile		i. Help		
	B. Generic		ii. Effective		
	C. Hinder		iii. Individual		
	D. Inception		iv. Termination		

	a) A-i, B-ii, C-iii, D-iv	b) A-iii, B-ii, C-iv, D-iii	c) A-iv, B-iii, C-i, D-ii	d) A-ii, B-iii, C-i, D-iv	(d)
16	The total number of squares in the following figure is: 				22
	a) 24	b) 20	c) 22	d) 18	(c)
17	Fill in the blank in the following pattern. ELFY GLHX ILJW ----- MLNU				KLLV
	a) KLLV	b) KLMX	c) JLLV	d) JLMX	a)
18	Raghav introduces Vineet as the only son of the only brother of his father's wife. How Raghav and Vineet are related?				cousin
	a) brother	b) cousin	c) uncle	d) son-in-law	(b)
19	Which two numbers should be interchanged to make the given equation mathematically correct? $3 \times 6 + 72 \div 8 - 24 = 12$				6, 8
	a) 6, 8	b) 6, 24	c) 3, 8	d) None	(a)
20	If BANKER is coded as CAOKFR, then how would LAWYER be coded?				MAXYFR
	a) LBWZES	b) LBWYFR	c) MAXYFR	d) MAXZES	c)
21	Same error occurs at the same size in every measurement, and such errors can only be eliminated either by thinking through the sources of problems and removing them. This type of error is termed as:				
	a) Random errors	b) Systematic errors	c) Cascading errors	d) Perpetual errors	b
22	Hypothesis-driven research begins with a hypothesis. A hypothesis is a statement about the world that can be true or false, and whose truth is being tested.				
	a) A valid hypothesis is based on 'that exists'	b) A hypothesis is a positive conclusion	c) A hypothesis can never be tested	d) A valid hypothesis must be falsifiable	d
23	Which of the following statements that could be considered as valid scientific hypotheses? A. Eating two ounces of olive oil a day decreases the odds of contracting heart disease. B. What is the best fertilizer to use to get large and tasty tomatoes? C. Macs are better than PCs. D. Briar's Aspirin cures headaches faster than RCS Aspirin.				Answer
	a) A, B	b) A, B, C	c) A, D	d) B, C	c
24	Relate the 'function or relationship' (A) and 'comment' (B) and select the appropriate answer				Answer

	A: Find how the speed of sound in air at fixed pressure depends upon air temperature.				
	B: The control variable is temperature, and the response variable is sound speed.				
	a) Functional relationship is correct and the comment is true for the relationship	b) Functional relationship is incorrect but the comment is true for the relationship	c) Functional relationship is correct but the comment is false for the relationship	d) Neither the functional relationship is correct nor the comment is true	a
25	Relate 'sampling design' and its 'method'				Answer
	Sampling Design		Method		
	A. Deliberate		i. Sample collected as information received and survey progresses		
	B. Simple random		ii. sample drawn from a heterogeneous group		
	C. Stratified		iii purposive selection of particular units		
	D. Sequential		iv. very item in the population has an equal chance of inclusion		
	a) A-iii, B-iv, C-ii, D-i	b) A-ii, B-iv, C-iii, D-i	c) A-i, B-iii, C-ii, D-iv	d) A-iii, B-ii, C-iv, D-i	a
26	Number of observations in a normal distribution is 1000. How many observations will be there between $\mu+1\sigma$ and $\mu-1\sigma$				Answer
	a) 500	b) 680	c) 720	d) 950	b
27	Which of the following are reasons for citing a paper?				Answer
	A. use its ideas, definitions, terms in a Research B. provides upcoming facts regarding undergoing Research Question. C. to adopt part/full methodology it adopted for a certain task. D. to refer to data also used in Current Research.				
	a) A, B, C	b) B, C, D	c) A, C, D	d) A, B, D	c
28	Scholars who wish to meet publication expectations mostly resort to a variety of techniques to increase their output and crank up their citation ranking, which are not considered ethical. Identify these techniques:				Answer
	A. Gift authorship B. Extensive experiments C. Salami Slicing D. Extensive referencing				
	a)A, B, C	b) A, B, D	c) B, C, D	d) A, C, D	d
29	Match the references (APA 7 style):				Answer
	A. Journal Article	i. Edwards, A. A., Steacy, L. M., Siegelman, N., Rigobon, V. M., Kearns, D. M., Rueckl, J. G., & Compton, D. L. (2022). Unpacking the unique relationship between set for variability and word reading development: Examining word- and child-level predictors of performance. <i>Journal of Educational Psychology</i> , 114(6), 1242–1256. https://doi.org/10.1037/edu0000696			

	B. Authored Book	ii. Levenson, H., Jinich, S., Vaz, A., & Rousmaniere, T. (2025). <i>Deliberate practice in emotionally focused couple therapy</i> . American Psychological Association. https://doi.org/10.1037/0000436-000																																																
	C. Webpage	iii. Zeleke, W. A., Hughes, T. L., & Drozda, N. (2020). Home-school collaboration to promote mind-body health. In C. Maykel & M. A. Bray (Eds.), <i>Promoting mind-body health in schools: Interventions for mental health professionals</i> (pp. 11–26). American Psychological Association. https://doi.org/10.1037/0000157-002																																																
	D. Edited Book Chapter	iv. Taras, Z. (2024, May 30). <i>Situational irony can be funny, tragic or even terrifying</i> . howstuffworks. https://entertainment.howstuffworks.com/arts/literature/situational-irony.htm																																																
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30	Which one of the following refers to positive skewness?																																																	
	a) 	b) 	c) 	d) 	c																																													
31	How much is the degree of freedom for the following data table?				Answer																																													
	<table><tr><th>S. No.</th><th>X_i</th><th>Hypothesised mean</th><th>$D_i = (X_i - \mu_{H_0})$</th><th>D_i^2</th></tr><tr><td colspan="5">$m_{H_0} = 578 \text{ kg.}$</td></tr><tr><td>5</td><td>572</td><td>578</td><td>-6</td><td>36</td></tr><tr><td>6</td><td>578</td><td>578</td><td>0</td><td>0</td></tr><tr><td>7</td><td>570</td><td>578</td><td>-8</td><td>64</td></tr><tr><td>8</td><td>572</td><td>578</td><td>-6</td><td>36</td></tr><tr><td>9</td><td>596</td><td>578</td><td>18</td><td>324</td></tr><tr><td>10</td><td>544</td><td>578</td><td>-34</td><td>1156</td></tr><tr><td>$n = 10$</td><td></td><td></td><td>$\sum D_i = -60$</td><td>$\sum D_i^2 = 1816$</td></tr></table>				S. No.	X_i	Hypothesised mean	$D_i = (X_i - \mu_{H_0})$	D_i^2	$m_{H_0} = 578 \text{ kg.}$					5	572	578	-6	36	6	578	578	0	0	7	570	578	-8	64	8	572	578	-6	36	9	596	578	18	324	10	544	578	-34	1156	$n = 10$			$\sum D_i = -60$	$\sum D_i^2 = 1816$	
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32	Find out the Null hypothesis for the given table				Answer																																													
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33	What will be sum of the deviations of observations from the regression line?				Answer																																													
	a) $-\infty$	b) 0	c) $+\infty$	d) undefined	b																																													
34	Derive from the following diagram				Answer																																													

	 Assertion: In this normal distribution 5 percent of the sample are rejected. Justification: It shows a two tailed hypothesis test model at 90 percent confidence level																
	a) Assertion is true and justification explains the Assertion	b) Assertion is false but justification explains the Assertion	c) Assertion is true and justification is true but does not explain the Assertion	d) Assertion is true and justification for the Assertion is incorrect	d												
35	Match into pairs for the Statistical method with appropriate details mentioned:				Answer												
	<table border="1"><thead><tr><th>Statistical method</th><th>Details</th></tr></thead><tbody><tr><td>A. Correlation</td><td>i. Order 2, 3, 4,</td></tr><tr><td>B. Polynomial regression</td><td>ii. More than two population on same characteristics</td></tr><tr><td>C. ANOVA</td><td>iii. Test of homogeneity</td></tr><tr><td>D. Chi square</td><td>iv. Requires only two variables</td></tr></tbody></table>				Statistical method	Details	A. Correlation	i. Order 2, 3, 4,	B. Polynomial regression	ii. More than two population on same characteristics	C. ANOVA	iii. Test of homogeneity	D. Chi square	iv. Requires only two variables			
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36	Match the following and give the correct answer:				Answer												
	<table><tbody><tr><td>A.</td><td>Nature of Interaction holding atom</td><td>i Kinetics</td></tr><tr><td>B.</td><td>Rate of Chemical Reaction</td><td>ii Bond</td></tr><tr><td>C.</td><td>Increase the rate of reaction</td><td>iii Lipid</td></tr><tr><td>D.</td><td>hydrocarbon chain insoluble in water</td><td>iv catalyst</td></tr></tbody></table>				A.	Nature of Interaction holding atom	i Kinetics	B.	Rate of Chemical Reaction	ii Bond	C.	Increase the rate of reaction	iii Lipid	D.	hydrocarbon chain insoluble in water	iv catalyst	
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37	In a simple harmonic motion, the velocity of a particle is maximum at:				Answer												
	a) Mean position	b) Extreme position	c) Halfway between mean and extreme	d) At all positions	(a)												
38	In a double-slit experiment, if the distance between slits is doubled, what happens to the fringe spacing on the screen?				Answer												
	a) Fringe spacing halves	a) Fringe spacing doubles	c)Fringe spacing remains the same	d)Fringe spacing quadruples	(a)												
39	A block slides down a frictionless inclined plane. Which of the following statements is true?				Answer												

	a) Mechanical energy is not conserved	b) Potential energy decreases, kinetic energy increases	c) Kinetic energy decreases	d) Acceleration is zero	(b)								
40	Which of the following is true for a photon in a vacuum?				Answer								
	a) It has mass but no energy	b) It has energy but no rest mass	c) It has rest mass and energy	d) It can be accelerated by a force	(b)								
41	Which of the following is diamagnetic?				Answer								
	a) CO ₂	b) O ₂	c) NO	d) O ₂ ⁻	(a)								
42	Match the following ligands with their denticity:				Answer								
	<table><tr><td>A. NH₃</td><td>i. Quadridentate</td></tr><tr><td>B. EDTA</td><td>ii. Monodentate</td></tr><tr><td>C. Oxalate</td><td>iii. Hexadentate</td></tr><tr><td>D. Porphyrin</td><td>iv. Bidentate</td></tr></table>				A. NH ₃	i. Quadridentate	B. EDTA	ii. Monodentate	C. Oxalate	iii. Hexadentate	D. Porphyrin	iv. Bidentate	
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43	In which of the following compounds is the metal-metal bonding present ?				Answer								
	a) NaCl	b) ZnO	c) Al ₂ O ₃	d) Cr ₂ Cl ₆	(d)								
44	A solution contains 0.1 mol of a non-volatile solute in 1 L of water at 298 K. Calculate the osmotic pressure:				Answer								
	a) 2.44 atm	b) 1.33 atm	c) 0.22 atm	d) 0.11 atm	(a)								
45	According to Henry's law, the solubility of a gas in a liquid is:				Answer								
	a) Independent of pressure.	b) Directly proportional to pressure.	c) Inversely proportional to pressure.	d) Exponential with pressure.	(b)								
46	Relate the statements: A: Assertion—SSDs are faster than HDDs. B: Justification—Because SSDs use flash memory instead of spinning disks.				Answer								
	a) Both A and B are true, and B is the correct explanation of A	b) Both A and B are true, but B is NOT the correct explanation of A	c) A is true, but B is false	d) A is false, but B is true	(a)								

47	Match the pairs:				Answer
	A. Machine Learning		i Enables machines to understand and process human language		
	B. Natural Language Processing (NLP)		ii Uses data to learn and improve predictions automatically		
	C. Computer Vision		iii Analyzes and interprets visual data like images and videos		
	D. Expert Systems		iv Mimics human decision-making using rules and knowledge base		
	a) A – iv, B – i, C – iii, D – ii.	b) A – iv, B – iii, C – i, D – ii.	c) A – ii, B – i, C – iii, D – iv.	d) A – iii, B – i, C – iv, D – ii.	(c)
48	Which programming language is widely used for AI and ML development?				Answer
	a) Python	b) JavaScript	c) C#	d) HTML	(a)
49	Which of the following statement is true:				Answer
	a) A byte is made up of 16 bits.	b) ROM is volatile memory that loses data when power is switched off.	c) A compiler translates high-level code into machine code line by line.	d) A firewall is used to protect a computer network from unauthorized access.	(d)
50	What is a network of networks called?				Answer
	a) Intranet	b) Internet	c) WAN	d) LAN	(b)

51	Newton-Raphson iteration formula for finding $\sqrt[3]{c}$, where $c > 0$ is				
	a) $x_{n+1} = \frac{2x_n^3 + \sqrt[3]{c}}{2x_n^2}$	b) $x_{n+1} = \frac{3x_n^3 - \sqrt[3]{c}}{3x_n^2}$	c) $x_{n+1} = \frac{2x_n^3 + c}{3x_n^2}$	d) $x_{n+1} = \frac{2x_n^3 - c}{3x_n^2}$	(c)
52	In Simpson's one-third rule the curve $y = f(x)$ is assumed to be a				
	a) circle	b) parabola	c) hyperbola	d) None of these	(b)
53	The value of $\Delta^3 x^2$ at $x = 0$ (where Δ is forward difference operator)				
	a) 0	b) 0.5	c) 1.5	d) None of these	(a)
54	Which of the following is false				
	a) $E = \Delta + 1$	b) $E\Delta = \Delta$	c) $E\Delta \neq \Delta E$	d) $E^{-1} = 1 - \nabla$	(c)
55	A rigid body moving freely in space has degrees of freedom				
	a) 6	b) 9	c) 4	d) 3	(a)
56	Backward Euler method for solving differential equation $\frac{dy}{dx} = f(x, y)$ is				
	a) $y_{n+1} = y_n + hf(x_n, y_n)$	b) $y_{n+1} = y_n + hf(x_{n+1}, y_{n+1})$	c) $y_{n+1} = y_{n-1} + 2hf(x_n, y_n)$	d) $y_{n+1} = (1 + h)f(x_{n+1}, y_{n+1})$	(b)
57	The condition for the convergence of the Newton Raphson method to a root α is				
	a) $\frac{f'(\alpha)}{2f''(\alpha)} < 1$	b) $\frac{f'(\alpha)}{f''(\alpha)} < 1$	c) $\frac{f'(\alpha)}{2f''(\alpha)} < 1$	d) $\frac{f'(\alpha)}{f''(\alpha)} > 1$	(c)

58	Identify the statements as either True or False Newton–Raphson method of solving the equation $f(x) = 0$ is a second-order iteration process. Gauss–Seidel method of solving a system of linear algebraic equations is an iterative method. The grid error in Runge–Kutta method of order p is $\varepsilon = O(h^{p+1})$. Simpson’s one-third rule of integration is two points closed type Newton–Cotes’ quadrature formula.				(D)										
	a) 1–True, 2–False, 3–False, 4–False	b) 1–True, 2–True, 3–True, 4–True	c) 1–True, 2–False, 3–True, 4–False	d) 1–True, 2–True, 3–False, 4–False											
59	Match List-I for various numerical integration rules with List-II in respect of their degrees of precision by using the given codes: <table><tr><th>List-I</th><th>List-II</th></tr><tr><td>1. Trapezoidal rule</td><td>1</td></tr><tr><td>2. Simpson’s one-third rule</td><td>2</td></tr><tr><td>3. Simpson’s three-eighth rule</td><td>3</td></tr><tr><td>4. Weddle’s rule</td><td>7</td></tr></table>				List-I	List-II	1. Trapezoidal rule	1	2. Simpson’s one-third rule	2	3. Simpson’s three-eighth rule	3	4. Weddle’s rule	7	(A)
List-I	List-II														
1. Trapezoidal rule	1														
2. Simpson’s one-third rule	2														
3. Simpson’s three-eighth rule	3														
4. Weddle’s rule	7														
	a) 1–(i), 2–(ii), 3–(iii), 4–(iv)	b) 1–(ii), 2–(iii), 3–(iv), 4–(i)	c) 1–(iii), 2–(iv), 3–(i), 4–(ii)	d) 1–(iv), 2–(i), 3–(ii), 4–(iii)											
60	Match the iterative methods for linear systems with their type: <table><tr><th>List-I</th><th>List-II</th></tr><tr><td>Jacobi method</td><td>Best for symmetric positive definite systems</td></tr><tr><td>Gauss–Seidel method</td><td>Iterative, Slow</td></tr><tr><td>Successive Over-Relaxation (SOR)</td><td>Iterative, accelerated convergence</td></tr><tr><td>Conjugate gradient method</td><td>Iterative, faster than Jacobi</td></tr></table>				List-I	List-II	Jacobi method	Best for symmetric positive definite systems	Gauss–Seidel method	Iterative, Slow	Successive Over-Relaxation (SOR)	Iterative, accelerated convergence	Conjugate gradient method	Iterative, faster than Jacobi	(B)
List-I	List-II														
Jacobi method	Best for symmetric positive definite systems														
Gauss–Seidel method	Iterative, Slow														
Successive Over-Relaxation (SOR)	Iterative, accelerated convergence														
Conjugate gradient method	Iterative, faster than Jacobi														
	a) 1–(ii), 2–(iii), 3–(iv), 4–(i)	b) 1–(ii), 2–(iv), 3–(iii), 4–(i)	c) 1–(iii), 2–(iv), 3–(i), 4–(ii)	d) 1–(iv), 2–(i), 3–(ii), 4–(iii)											
61	Match the following: <table><tr><th>List-I</th><th>List-II</th></tr><tr><td>Newton-Raphson</td><td>Integration</td></tr><tr><td>Runge-kutta</td><td>Root finding</td></tr><tr><td>Gauss-seidel</td><td>Ordinary Differential Equations</td></tr><tr><td>Simpson’s Rule</td><td>Solution of system of Linear Equations</td></tr></table>				List-I	List-II	Newton-Raphson	Integration	Runge-kutta	Root finding	Gauss-seidel	Ordinary Differential Equations	Simpson’s Rule	Solution of system of Linear Equations	(A)
List-I	List-II														
Newton-Raphson	Integration														
Runge-kutta	Root finding														
Gauss-seidel	Ordinary Differential Equations														
Simpson’s Rule	Solution of system of Linear Equations														
	a) 1–(ii), 2–(iii), 3–(iv), 4–(i)	b) 1–(ii), 2–(iv), 3–(iii), 4–(i)	c) 1–(iii), 2–(iv), 3–(i), 4–(ii)	d) 1–(iv), 2–(i), 3–(ii), 4–(iii)											

62	Match the following:				(C)
	List-I		List-II		
	1. the moment of inertia of a uniform rod about a perpendicular bisector		i. $ML^2/12$		
	2. Moment of inertia of hoop about it's central axis		ii. MR^2		
	3. the moment of inertia of a rectangular plate about a line parallel to an edge and passing through the centre		iii. $ML^2/12$		
	4. the moment of inertia of a uniform circular plate about its axis		iv. $MR^2/2$		
	a) 1–(ii), 2–(iii), 3–(iv), 4–(i)	b) 1–(ii), 2–(iv), 3–(i), 4–(iii)	c) 1–(i), 2–(ii), 3–(iii), 4–(iv)	d) 1–(iv), 2–(i), 3–(ii), 4–(iii)	
63	Match the following based on their definitions:				(D)
	List-I		List-II		
	1. holonomic constraint		i. Constraint independent of time		
	2. non-holonomic constraint		ii. Cannot be expressed as exact relation between coordinates		
	3. rheonomous constraints		iii. Expressible in the form $f(q_1, q_2, q_3, \dots q_n, t) = 0$		
	4. scleronomous constraints		iv. Explicitly depends on time		
	(A) 1–(ii), 2–(iii), 3–(iv), 4–(i)	(B) 1–(ii), 2–(iv), 3–(i), 4–(iii)	(C) 1–(i), 2–(ii), 3–(iii), 4–(iv)	(D) 1–(iii), 2–(ii), 3–(iv), 4–(i)	
64	Consider the statements 1. The Hamiltonian is always equal to the total energy of the system 2. Hamilton's equations are first-order differential equations. 3. Canonical transformations preserve Hamilton's equations. 4. Poisson brackets play a role analogous to commutators in quantum mechanics. Choose the correct option in the sequence of statements No. 1, 2, 3, 4				(A)
	a) False, True, True, True	b) True, True, True, True	c) False, False, True, False	d) False, False, False, True	
65	Assertion (A): Bisection method always converges to a root of the equation. Reason (R): It is based on the Intermediate Value Theorem.				(A)
	a) Both A and R are true, and R is the correct explanation of A.	b) Both A and R are true, but R is not the correct explanation of A.	c) A is true, but R is false.	d) A is false, but R is true.	
66	Assertion (A): Truncation error decreases when step size h decreases. Reason (R): Truncation error arises due to neglecting higher-order terms in Taylor series expansion.				(D)
	a) Both A and R are true, but R is not the	b) Both A and R are true, and R is the correct	c) A is true, but R is false.	d) A is false, but R is true.	

	correct explanation of A.	explanation of A.									
67	Assertion (A): LU decomposition is a direct method for solving a system of linear equations. Reason (R): LU decomposition reduces the system to lower and upper triangular systems which can be solved efficiently.				C)						
	a) A true, R false	b) A and R true, R not explanation	c) A and R true, R explains A	d) A false, R true							
68	Assertion (A): The areal velocity remains constant when a particle moves in the influence of a central force. Reason (R): The angular momentum of a particle moving under a central force is conserved.				(D)						
	a) A false, R true	b) A and R true, R not explanation	c)A true, R false	d) A and R true, R explains A							
69	Let $P(t)$ be the inner product space of all real polynomials of degree at most two equipped with the inner product $\langle f(t), g(t) \rangle = \int_0^1 f(t)g(t)dt, \forall f(t), g(t) \in P(t)$. Then the set $\{1, t, t^2\}$ is										
	a) orthogonal	b) orthonormal	c) orthogonal but not orthonormal	d) not orthogonal.	d						
70	The partial differential equation corresponding to the function $z = Ae^{mt} \sin mx$, where A and m are constants, is										
	a) $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial t^2} = 0$	b) $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial t^2} = 0$	c) $\frac{\partial^2 z}{\partial x^2} - \frac{\partial z}{\partial t} = 0$	d) $\frac{\partial z}{\partial x} + \frac{\partial^2 z}{\partial t^2} = 0$.	a						
71	Consider the following statements: A. If a function is analytic then it satisfies Cauchy Riemann equations. B. If a single valued function satisfies Cauchy- Riemann equations then it is analytic.										
	a) Both A and B are true.	b) A is false but B is true.	c) A is true but B is false.	d) Neither A nor B is true.	c						
72	The system of equations $x + 2y - 3z = \alpha, 2x + 6y - 11z = \beta, x - 2y + 7z = \gamma$ has no solution if										
	a) $\gamma + 2\beta - 5\alpha \neq 0$	b) $\gamma + 2\beta - 5\alpha = 0$	c) $5\alpha = 2\beta + \gamma$	d) $5\alpha = 2\beta - \gamma$.	a						
73	Match the following in a vector space. <table><tr><td>A. Basis</td><td>i. Rank</td></tr><tr><td>B. Range space of transformation</td><td>ii. Dimension</td></tr><tr><td>C. Kernel of a transformation</td><td>iii. Nullity</td></tr></table>				A. Basis	i. Rank	B. Range space of transformation	ii. Dimension	C. Kernel of a transformation	iii. Nullity	
A. Basis	i. Rank										
B. Range space of transformation	ii. Dimension										
C. Kernel of a transformation	iii. Nullity										
	a) A-i, B-ii, C-iii	b) A-iii, B-ii, C-i	c) A-iii, B-i, C-ii	d) A-ii, B-i, C-iii	d						
74	Clairaut's form of partial differential equation is				answer						
	a) $f\left(x, \frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}\right) = 0$	b) $f\left(x, \frac{\partial z}{\partial x}\right) = g\left(y, \frac{\partial z}{\partial y}\right)$	c) $f\left(\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}\right) = 0$	d) $z = x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} + f\left(\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}\right)$.	d						

75	Which of the following statement(s) is/are incorrect? A. An analytic function with constant modulus is constant. B. A single valued bounded function is constant. C. An analytic function $f(z)$ is constant if $\arg(f(z))$ is constant. D. An analytic function $f(z)$ is constant if $\operatorname{Real}(f(z))$ is constant.				
	a) Both A and C	b) Both B and D	c) Only B	d) Only C	c
76	The function $f(z) = xy + iy$ is				answer
	a) Everywhere continuous and analytic.	b) Everywhere continuous but not analytic.	c) Not continuous but analytic.	d) Neither continuous nor analytic.	b
77	Let $f(z) = (z^2 + 1)^2 / (z^2 + 2z + 2)^3$ and C be the circle $ z = 4$. The value of $\frac{1}{2\pi i} \int_C \frac{f'(z)}{f(z)} dz$ is				answer
	a) -2	b) -1	c) 1	d) 2	a
78	A bilinear transformation $f(z) = (az + b)/(cz + d)$ with two distinct fixed points α and β is said to be elliptic if				answer
	a) $\left \frac{c\beta + d}{c\alpha + d} \right = 1$	b) $\left \frac{c\beta + d}{c\alpha + d} \right \neq 1$	c) $\left \frac{c\beta + d}{c\alpha + d} \right > 1$	d) $\left \frac{c\beta + d}{c\alpha + d} \right < 1$	a
79	If R is the radius of convergence of the power series $\sum_n a_n z^n$, then radius of convergence of the power series $\sum_n n a_n z^{n-1}$ is				answer
	a) R/n	b) nR	c) R	d) $a_n R$	c
80	Let $f(z) = z^2 + 3z - 1$. Then the maximum value of $ f(z) $ in the domain $D = \{z: z \leq 1\}$				answer
	a) 5	b) 3	c) $\sqrt{13}$	d) $\sqrt{5}$	c
81	Let $f(z)$ be analytic on and inside a circle C with centre $ z - z_0 = r$. Then the value of $f(z_0)$ is				answer
	a) $\frac{1}{2\pi i} \int_C f(z) dz$	b) $\frac{1}{2\pi i} \int_C f(z_0 + re^{i\theta}) dz$	c) $\frac{1}{2\pi} \int_C f(z_0 + re^{i\theta}) dz$	d) $\int_C f(z_0 re^{i\theta}) dz$	c
82	The nature of the singularity of function $1/(\cos z - \sin z)$ at $z = \pi/4$ is				
	(a) removable singularity	(b) isolated singularity	(c) simple pole	(d) essential singularity	c
83	The absolute value of $(1 + i)^{24}$ is				
	a) 2^{24}	b) 2^{12}	c) 2^6	d) 2^3	b
84	What is the output of the following Python code? <code>print(type(5.0))</code>				
	a) <code><float></code>	b) <code><class 'float'></code>	c) <code><type 'float'></code>	d) <code><class 'int'></code>	b)
85	What will be the output of this C code? <code>int x = 5;</code> <code>printf("%d", x++);</code>				
	a) 6	b) 5	c) Error	d) Undefined	b)
86	Which of the following is a valid identifier in C?				c)
	a) <code>int</code>	b) <code>2variabl</code> <code>e</code>	c) <code>_value</code>	d) <code>value@name</code>	
87	Which of the following is not a valid Python data type?				

	a) real	b) int	c) float	d) str	a)
88	What will be the output of the following python code? x = 3 print(x ** 2)				
	a) 3	b) 9	c) 8	d) 7	b)
89	What is the output of this Python snippet? print(5+6)				
	a) 11	b) error	c) none	d) 56	a)
90	Which protocol is used to transfer web pages?				a)
	a) HTTP	b) FTP	c) TCP	d) SMTP	
91	What is the binary equivalent of the decimal number 13?				
	a) 1011	b) 1101	c) 1001	d) 1110	b)
92	What is the function of the ALU (Arithmetic Logic Unit)?				
	a) Controlling input/output	b) Data storage	c) Performing arithmetic and logical operations	d) Managing memory	c)
93	What is the output of the following C-code? int a = 10; printf("%d", a == 10);				
	a) 1	b) error	c) 10	d) 1	d)
94	A cyclist pedals from his house to his city at a speed 10 km p.h. and back from the city to his house at 15 km p.h.. Chose the correct option about the average speed: A) Lies in between 10 to 11 B) Lies between 11 to 17 C) Lies between 10 to 15				
	a) only A is true	b) A and B both	c) B and C both	d) none of these	c)
95	In hypothesis testing, the p-value represents				
	a) The probability that the null hypothesis is true	b) The significance level of the test	c) The probability of observing data at least as extreme as the current sample, under the null hypothesis	d) The power of the test	c)
96	Which of the following is not true about the normal distribution?				
	a) It is symmetric about the mean	b) It is defined only for positive values	c) Mean, median, and mode are equal	d) It has two parameters: mean and variance	b)
97	The joint probability density function of a 2D random variable (X, Y) is given by				

	$f(x, y) = \begin{cases} 2; & 0 < x < 1, 0 < y < x \\ 0, & \text{elsewhere} \end{cases}$ Choose the correct option about the conditional density function of Y given $X = x$ and for Y given $Y = y$ A. $1/x$ and $1/(1 - y)$ B. $1/x^2$ and $1/(1 - y)$ C. $1/x$ and $1/(1 + y)$				
	a) only A is true	b) only B is true	c) B and C true	d) none of these	a)
98	The sample variance is an unbiased estimator of				
	a) Population mean	b) Population variance	c) Population median	d) Population standard deviation	a)
99	Which test is used to compare two means assuming equal variances?				d)
	a) ANOVA	b) Chi-square test	c) Z-test	d) Independent t-test	
100	The standard error of the mean decreases when:				
	a) Sample size decreases	b) Sample size increases	c) Population variance increases	d) Mean decreases	b)
101	If $P(A) = 2/3$, $P(B) = 1/2$ and $P(A \cup B) = 5/6$ then the events A and B are				c)
	a) Mutually exclusive	b) Independent as well as mutually exclusive	c) Independent	d) Dependent only on event A	
102	If in a binomial distribution $n = 4$, $P(X = 0) = 16/81$, then $P(X = 4)$ equals				b)
	a) $\frac{1}{16}$	b) $\frac{1}{81}$	c) $\frac{1}{27}$	d) $\frac{1}{8}$	
103	The solution $y(x)$ of the integral equation $\int_0^x e^{x-t} y(t) dt = x$ is				b)
	a) $y(x) = 1 + x$	b) $y(x) = 1 - x$	c) $y(x) = 1 - x^2$	d) $y(x) = 1 + x^2$	
104	The second successive approximation to the solution of the integral equation $y(x) = x - \int_0^x (x - t) y(t) dt$, $y_0(x) = 0$ is:				b)
	a) $y_2(x) = 1 - x - \frac{x^3}{3}$	b) $y_2(x) = x - \frac{x^3}{6}$	c) $y_2(x) = 1 - x - \frac{x^3}{6}$	d) $y_2(x) = -x - \frac{x^3}{3}$	
105	A necessary condition for the extremum of the function $\int_a^b F(x, y, y') dx$ is:				
	a) $\frac{\partial F}{\partial y'} = 0$	b) $\frac{\partial F}{\partial y} = 0$	c) $\frac{\partial F}{\partial y} - \frac{d}{dx} \left(\frac{\partial F}{\partial y'} \right) = 0$	d) $F - \frac{\partial F}{\partial y'} = C$	c)
106	The curve which extremized the functional $\int_a^b y' (1 + x^2 y') dx$ is the solution of the differential equation				

	a) $1 + 2x^2y' = 0$	b) $xy'' + 2y' = 0$	c) $xy'' - 2y' = 0$	d) $xy'' + 2y'^2 = 0$	b)
107	A curve passing through (x_0, y_0) and (x_1, y_1) and extremizing the functional $\int_{x_0}^{x_1} \sqrt{1 + y'^2}/x \, dx$ is				
	a) a catenary	b) a parabola	c) a ellipse	d) a circle	d)
108	The curve passing through (x_0, y_0) and (x_1, y_1) which when rotated about the x –axis gives a minimum surface area satisfies: A) The Euler's equation $\frac{\partial F}{\partial y} - \frac{d}{dx} \left(\frac{\partial F}{\partial y'} \right) = 0$ B) The differential equation $c^2(1 + y'^2) = y^2$ C) The differential equation $c^2(1 + y'^2) = 1 + y^2$				
	a) only A is true	b) A and B both true	c) B and C are true	d) A and B are true	d)
109	What is the main objective of the Calculus of Variations?				d)
	a) To evaluate definite integrals	b) To solve differential equations	c) To approximate functions with polynomials	d) To find the extrema of functional	
110	Which among the following is a <i>boundary condition</i> in a typical variational problem?				
	a) $y(x) = \sin x$	b) $\int_a^b y dx = C$	c) $y'' + y = 0$	d) $y(x_0) = y_0$ and $y(x_1) = y_1$	d)
111	The isoperimetric problem in Calculus of Variations involves:				d)
	a) Optimizing a function with boundary conditions	b) Optimizing a functional with no constraints	c) Solving differential equations numerically	d) Optimizing a functional subject to an integral constraint	
112	The Euler-Lagrange equation becomes insufficient when the functional includes higher-order derivatives. In such cases, the general form involves:				c)
	a) Lagrange multipliers	b) Only the first derivative	c) Partial derivatives up to the highest derivative present	d) No derivative at all	
113	If the kernel $K(x, t)$ of a Fredholm equation is given by $K(x, t) = \sum_{n=1}^{n=N} f_n(x) g_n(t)$, the equation can be reduced to:				b)
	a) A differential equation	b) A system of linear algebraic equations	c) A Fourier series	d) A system of differential equations	
114	In Neumann series method, convergence depends on:				

	a) The type of boundary conditions	b) The nature of the forcing function $f(x)$	c) The norm of the kernel $K(x, t)$ and λ	d) Whether the equation is linear or not	c)
11 5	Which of the following equations can occur as the class equation of a group of order 10? $10=1+1+1+2+5$ $10=1+2+3+4$ $10=1+1+3+5$ $10=1+1+1+\dots+1$ (10 times)				(d)
	a) Only A	b) A and B	c) A, B and C	d) Only D	$10=1+1+1+\dots+1$ (10 times)
11 6	For a positive integer n , let $\phi(n)$ be the Euler's ϕ function. Which of the following statements are true for $n > 3$? $\phi(n)$ can never divide n $\phi(p) = p$ for each prime p $\phi(n) n \Rightarrow n$ can have at most two distinct prime divisors. $\phi(n) \phi(nk)$ for every positive integer k .				(b)
	a) A and B	b) C and D	c) A and D	d) All of the above	C and D
11 7	Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason/Justification (R). Assertion(A): Up to isomorphism the number of Abelian groups of order 42 is 1. Justification(R): There is a unique Abelian group of order n iff n is not divisible by the square of any prime. In the light of the above statements choose the correct answer from the options given below:				(d)
	a) A is false but R is true	b) Both A and R are false	c) A is true but R is false	d) Both A and R are true and R is the correct reasoning of A.	Both A and R are true and R is the correct reasoning of A.
11 8	Match the items of 1 st column with the items of 2 nd column and indicate the code of correct matching:				(a)
	A. The number of elements in the vector space of dimension 3 over a finite field F_3 are			i. 11	
	B. The number of conjugacy classes of a group of order 27 is			ii. 12	
	C. If G be a finite abelian group of order 60, then the number of subgroups are			iii. 27	
	D. The number of normal subgroups of order 5 in a group of order 35 is			iv. 1	
	a)A $\rightarrow$ (iii), B $\rightarrow$ (i), C $\rightarrow$ (ii), D $\rightarrow$ (iv)	b)A $\rightarrow$ (i), B $\rightarrow$ (iii), C $\rightarrow$ (ii), D $\rightarrow$ (iv)	c) A $\rightarrow$ (iv), B $\rightarrow$ (ii), C $\rightarrow$ (i), D $\rightarrow$ (iii)	d) A $\rightarrow$ (iii), B $\rightarrow$ (i), C $\rightarrow$ (ii), D $\rightarrow$ (iv)	A $\rightarrow$ (iii), B $\rightarrow$ (i), C $\rightarrow$ (ii), D $\rightarrow$ (iv)

11 9	Let (X, T) be a topological space, where, $X = \{a, b, c, d\}$ and $T = \{\varnothing, X, \{b\}, \{a, b\}, \{a, b, d\}\}$ and $A = \{a, b, c\} \subset X$, then which of the following is the derived set of A? $D(A) = \{a, b, c\}$ $D(A) = \{a, c, d\}$ $D(A) = \{a, b\}$ $D(A) = \{a, d\}$				(c)								
	a) Only A	b) Only D	c) Only B	d) Only C	Only B								
12 0	Let Y be a topological space and G be a proper dense open subset of X. Pick the correct statements from the following. If Y is connected, then G is connected. If Y is compact, then $Y - G$ is compact. If Y is compact, then G is compact If $Y - G$ is compact, then Y is compact				(d)								
	a) A and B	b) A, B and C	c) Only C	d) Only B	Only B								
12 1	Match the items of 1 st column with the items of 2 nd column and indicate the code of correct matching: <table><tr><td>Closed subspace of a compact space is</td><td>i. Closed</td></tr><tr><td>Compact Hausdorff space is</td><td>ii. Normal space</td></tr><tr><td>Compact subset of a Hausdorff space is</td><td>iii. Regular space</td></tr><tr><td>Every T_3-space is</td><td>iv. Compact space</td></tr></table>				Closed subspace of a compact space is	i. Closed	Compact Hausdorff space is	ii. Normal space	Compact subset of a Hausdorff space is	iii. Regular space	Every T_3 -space is	iv. Compact space	(c)
Closed subspace of a compact space is	i. Closed												
Compact Hausdorff space is	ii. Normal space												
Compact subset of a Hausdorff space is	iii. Regular space												
Every T_3 -space is	iv. Compact space												
	a) $A \rightarrow (iii)$, $B \rightarrow (i)$, $C \rightarrow (ii)$, $D \rightarrow (iv)$	b) $A \rightarrow (iv)$, $B \rightarrow (iii)$, $C \rightarrow (ii)$, $D \rightarrow (i)$	c) $A \rightarrow (iv)$, $B \rightarrow (ii)$, $C \rightarrow (i)$, $D \rightarrow (iii)$	d) $A \rightarrow (iii)$, $B \rightarrow (i)$, $C \rightarrow (ii)$, $D \rightarrow (iv)$	$A \rightarrow (iv)$, $B \rightarrow (ii)$, $C \rightarrow (i)$, $D \rightarrow (iii)$								
12 2	Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason/Justification (R). Assertion (A): The map $f: R \rightarrow (0, \infty)$ defined by $f(x) = e^x$ is homeomorphism. Justification (B): The function f is bijective, open and continuous map. Choose the correct answer from the options given below:				(c)								
	a) A is true but R is false	b) A is false and R is true	c) Both A and R are true and R is the correct explanation for A	d) Both A and R are true but R is not the correct explanation for A	Both A and R are true and R is the correct explanation for A								
12 3	Consider the topological space (X, T) and $A \subseteq X$, (where, A' represents limit set of A), then match the items of 1 st column with the items of 2 nd column and indicate the code of correct matching: <table><tr><td>A is everywhere dense in X if</td><td>i. $A' = A$</td></tr><tr><td>A is perfect if</td><td>ii. $A' \subseteq A$</td></tr><tr><td>A is closed if</td><td>iii. $Cl(A) = X$</td></tr><tr><td>A is open if</td><td>iv. $Int(A) = A$</td></tr></table>				A is everywhere dense in X if	i. $A' = A$	A is perfect if	ii. $A' \subseteq A$	A is closed if	iii. $Cl(A) = X$	A is open if	iv. $Int(A) = A$	(d)
A is everywhere dense in X if	i. $A' = A$												
A is perfect if	ii. $A' \subseteq A$												
A is closed if	iii. $Cl(A) = X$												
A is open if	iv. $Int(A) = A$												

	a) $A \rightarrow (iii), B \rightarrow (iv), C \rightarrow (ii), D \rightarrow (i)$	b) $A \rightarrow (iv), B \rightarrow (iii), C \rightarrow (ii), D \rightarrow (i)$	c) $A \rightarrow (iv), B \rightarrow (ii), C \rightarrow (i), D \rightarrow (iii)$	d) $A \rightarrow (iii), B \rightarrow (i), C \rightarrow (ii), D \rightarrow (iv)$	$A \rightarrow (iii), B \rightarrow (i), C \rightarrow (ii), D \rightarrow (iv)$
124	Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason/Justification (R). Assertion (A): Let $A = \{(x, y) \in R^2 : y = mx, m (\neq 0) \in R\} \setminus \{(0,0)\}$, then A is nowhere dense in R^2. Justification (B): Interior of closure of A is not null. In the light of the above statements choose the correct answer from the options given below:				(a)
	a) A is true but R is false	b) A is false and R is true	c) Both A and R are true and R is the correct explanation for A	d) Both A and R are true but R is not the correct explanation for A	A is true but R is false
125	Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason/Justification (R). Assertion (A): Let $X = \{(x, y) \in R^2 : x^2 + 103xy + 7y^2 > 1\}$, then X is locally compact in R^2. Justification (B): Every open subset of a locally compact Hausdorff space is locally compact in the subspace topology. Identify the correct answer from the options given below:				(c)
	a) A is true but R is false	b) A is false and R is true	c) Both A and R are true and R is the correct explanation for A	d) Both A and R are true but R is not the correct explanation for A	Both A and R are true and R is the correct explanation for A
126	Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason/Justification (R). Assertion (A): Let $X = \{a, b, c\}, \tau = \{\varphi, \{a\}, \{a, b\}, \{a, c\}, X\}, Y = \{x, y, z\}, \tau_1 = \{\varphi, \{x\}, \{y, z\}, Y\}$ and $f: (X, \tau) \rightarrow (Y, \tau_1)$ is defined by $f(a) = f(b) = f(c) = y$, then f is not continuous. Justification (B): The function f is continuous if image of every open subset of X under f is open in Y. Identify the correct answer from the options given below:				(b)
	a) A is true but R is false	b) Both A and R are false.	c) Both A and R are true and R is the correct explanation for A	d) Both A and R are true but R is not the correct explanation for A	Both A and R are false
127	Let A and B be subsets of R. Define $C = \{a + b : a \in A, b \in B\}$. Pick out the true statements from the followings? (A) C is closed if A and B are closed. (B) C is closed if A is closed and B is compact. (C) C is compact if A is closed and B is compact. (D) C is open if at least one of A and B is open.				(b)

	a) A and C	b) B and D	c) A, B and C	d) All of them	B and D
12 8	The number of non-zero elements in the field Z_p , (where p is an odd prime number) which are square, is				(c)
	(a) $\frac{p-1}{p}$	(b) p	(c) $\frac{p-1}{2}$	(d) 1	$\frac{p-1}{2}$
12 9	Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason/Justification (R). Assertion (A): If two regression lines are parallel to each other, then the relation between the regression coefficients (b_{xy} and b_{yx}) is $b_{xy}b_{yx}=1$ Justification (R): The product of the slopes of the regression lines is unity. In the light of the above statements choose the correct answer from the options given below:				(d)
	a) Both A and R are true and R is the correct reasoning of A.	b) A is false but R is true	c) Both A and R are true but R is not the correct reasoning of A.	d) A is true but R is false.	A is true but R is false.
13 0	Coefficient of correlation is unaffected by change of which of the following factor Origin but not scale Scale but not origin Origin as well as scale in only one of the variables				(d)
	a) Only A	b) Only B	c) B and C	d) Only C	Only C
13 1	Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason/Justification (R). Assertion (A): A researcher wishes to estimate the mean of a population by using sufficiently large sample. The probability is 0.95 that the sample mean will not differ from the true mean by more than 25% of the standard deviation. Then the size of the large sample is 62. Justification (B): By hypothesis $P[\bar{x} - \mu \leq 25\% \text{ of } S.D] = 0.9$. But it is known that $P\left[\bar{x} - \mu \leq \frac{1.96\sigma}{\sqrt{n}}\right] = 0.95$ In the light of the above statements choose the correct answer from the options given below:				(c)
	a) A is true but R is false	b) A is false and R is true	c) Both A and R are true and R is the correct explanation for A	d) Both A and R are true but R is not the correct explanation for A	Both A and R are true and R is the correct explanation for A
13 2	Which of the following is/are correct? (A) $\bar{X}$ is a minimum variance unbiased estimator of the mean μ of a normal population. (B) $\bar{X}$ is not a minimum variance unbiased estimator of the mean μ of a normal population. (C) Neither (a) nor (b).				(a)

	(D) None of the above.				
	a) Only A	b) Only C	c) Only B	d) Only D	Only A
133	$\lim_{n \rightarrow \infty} (1 + 2/n)^n$ is equal to				Answer
	a) e	b) e^2	c) 1	d) 0	(b)
134	A sequence of real numbers converges if and only if it is				Answer
	a) monotonic	b) increasing	c) cauchy	d) bounded	(c)
135	Which of the following statements is/are true? A. The set of irrational numbers is countable. B. The set of rational numbers is uncountable. C. The set of all real transcendental numbers is countable. D. The set of all real algebraic numbers is countable.				Answer
	A and D	b) A, C and D	c) C only	d) D only	d)
136	If f is a function of bounded variation on $[a, b]$, then				Answer
	a) f can be expressed as the difference of two monotone increasing functions.	b) f must be absolutely continuous	c) f must be differentiable everywhere	d) f must be convex	(a)
137	Which of the following is not a property of Lebesgue measure?				Answer
	a) Countable additivity	b) Translation invariance	c) monotonicity	d) Multiplicatively under convolution	(d)
138	Which of the following is not uniformly continuous if $f: \mathbb{R} \rightarrow \mathbb{R}$?				Answer
	a) $f(x) = \sin x$	b) $f(x) = x^3$	c) $f(x) = \sqrt{x+1}$	d) $f(x) = \cos x$	(b)
139	The directional derivative of $f(x, y) = x^2 + y^2$ at (1,1) in the direction of vector (1,2) is:				Answer
	a) $2/\sqrt{5}$	b) $6/\sqrt{5}$	c) $8/\sqrt{5}$	d) $2\sqrt{5}$	(b)
140	The Lebesgue measure of the Cantor set is				Answer
	a) 0	b) 1	c) 1/2	d) nonmeasurable	(a)

14 1	Which of the following statements is/is false? If l is a limit point of (u_n) , then $\lim_{n \rightarrow \infty} u_n = l$. $\lim_{n \rightarrow \infty} u_n = l$, then l is the only limit point of (u_n) . Every bounded sequence has a limit.				Answer
	a) A and B	b) A and C	c) B and C	d) A, B and C	(b)
14 2	Consider the statements and choose the correct option: A: Every bounded sequence of real numbers has a convergent subsequence. R: The real numbers $\mathbb{R}$ is a complete metric space.				Answer
	a) Both A and R are true, and R is the correct explanation of A.	b) Both A and R are true, but R is not the correct explanation of A	c) A is true, R is false.	d) A is false, R is true.	(b)
14 3	Match the concept with the correct statement:				Answer
	A. Rolle's theorem		i.If $f(a) = f(b)$, then $\exists c \in (a, b)$ such that $f'(c) = 0$		
	B. Mean Value Theorem		ii. Relates average rate of change to instantaneous rate of change		
	C. Improper Integral Test		iii. Determines convergence of series using comparison with improper integrals.		
	a) A-i, B-ii, C-iii	b) A-i, B-iii, C-ii	c) A-ii, B-i, C-iii	d)A-iii, B-ii,C-i	(a)
14 4	The Lebesgue integral of a simple function $\varphi = \sum_{i=1}^n a_i \chi_{E_i}$, where $a_i \geq 0$, is defined as				Answer
	a) $\sup a_i$	b) $\sum_{i=1}^n a_i m(E_i)$	c) $\int_a^b f(x)dx$ in Riemann sense	d) $\inf a_i$	(b)
14 5	Which of the following statements is/are true? A. Uniform convergence preserves continuity. B. Uniform convergence preserves integrability. C. Uniform convergence preserves differentiability. D. Pointwise convergence preserves continuity.				Answer
	a)A and B.	b) A and C.	c) A, B and C	d) B and C.	(a)
14 6	If $f(x, y) = x + y $, then at $(0,0)$				Answer
	a) Both partial derivatives exist and are zero.	b) Partial derivatives do not exist	c)Partial derivatives exist but f is not differentiable	d) Partial derivatives exist and f is differentiable	(b)
14 7	The entering variable in each iteration of the simplex method is chosen based on				Answer

	a) Minimum ratio test	b) Maximum value in the cost row (for maximization)	c) Pivot element	d) Slack variables	(c)
14 8	The inverse function theorem requires				Answer
	a) Continuity of the function	b) The Jacobian determinant at the point is nonzero	c) The function to be one-to-one everywhere	d) The function to be bounded.	(b)
14 9	The steady-state probability that the system is empty in an M/M/1 queue is				Answer
	a) $1 - \rho$	b) ρ	c) μ/λ	d) 0	(a)
15 0	In a basic EOQ (Economic Order Quantity) model, the total cost is the sum of				Answer
	a) Ordering cost + Holding cost	b) Ordering cost + Shortage cost	c) Holding cost + Transportation cost	d) Ordering cost only	(a)