

2026-27

Table 2 (A-1): Structure of the Undergraduate Programme and the Distribution of Credits (Semester System with Single Major)

Sem.	Core (Major) Discipline Specific Courses	Minor	Multi/ Inter Disciplinary Courses	Ability Enhancement Courses (Language)	Skill Based Activities		Common Value Added Courses	Total Credits
					Skill Enhancement / Vocational Courses	Internship/ Apprenticeship(Ap)/ Project- Work (PW)/ Community Engagement(CE)/ Research Project/ Dissertation/ OCC		
I	C-1(6)	M-1(4)	MD-1(3)	AEC-1(2)	SEC(VOC)-1(3)	PW/Ap/CE (2)		20
II	C-2(6) C-3(6)	M-2(4)		AEC-2(2)			VAC-1(2)	20
III	C-4(6) DSE-1(4)	M-3(4)	MD-2(3)	AEC-3(2)			VAC-2(2)	21
IV	C-5(6) DSE-2(4)	M-4(4)		AEC-4(2)	SEC(VOC)-2(3)	PW/Ap/CE (2)		21

Anilg
22/08/2026.

Shikha
22/8/26

for
24/8/26

Julia

Dikshi
22/8/26

22/08/26.

Puniti

St. Aloysius (Auto.) College, Jabalpur [M.P.]

Department of Mathematics

2025-2026

Proposed Structure for Undergraduate Programme: UGC CBCS System for Universities

Level	Semester	Main Faculty (as per prerequisite)		Any Faculty	Skill Enhancement Course (SEC)	Ability Enhancem ent Course (AEC)	DSE	Field project/internship/apprentic e/ entrepreneurship/communit y engagement and service	Credits	Qualification title (Credits requirement)
		Subject I	Subject II	Subject III				#Inter/Intra Faculty		
		Major	Minor	Generic Elective Course	Vocational Course					
Level 5	1	1 (6Credits)	1 (6Credits)	1 (4Credits)		1 (4Credits)			6+6+4+4 =20	
	2	1 (6Credits)	1 (6Credits)	1 (4Credits)		1 (4Credits)			6+6+4+4 =20	
Level 6	3	1 (6Credits)	1 (6Credits)	1 (4Credits)	1 (4Credits)				6+6+4+4 =20	Undergraduate Diploma in Main Faculty (80)
	4	1 (6Credits)	1 (6Credits)	1 (4Credits)	1 (4Credits)				6+6+4+4 =20	
Level 7	5	1 (6Credits)			1 (4Credits)		DSE-1 (4Credits)	Field project/internship/ apprenticeship 1(6 Credits)	6+4+4+6 =20	Research in Main Faculty (160)
	6	1 (6Credits)					DSE-2 (4Credits) DSE-3 (4Credits)	Field project/internship/ apprenticeship 1(6 Credits)	6+4+4+6 =20	
Level 8	7	1 (6Credits)					DSE-3 (4Credits)	Field project/internship/ apprenticeship 1(6 Credits)	6+4+4+6 =20	(160)

Arslang
22/08/2026

Rishi

Daksh
22/8/26

22/8/26

22/8/26

22/8/26

22/8/26



ST. ALOYSIUS' COLLEGE JABALPUR (MADHYA PRADESH)

Autonomous, Reaccredited 'A++' Grade by NAAC (CGPA 3.58/4.00)

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DST-FIST Supported & Star College Scheme by DBT

Affiliated to Rani Durgavati Vishwavidyalaya, Jabalpur (M.P.)

BACHELOR OF SCIENCE (B.Sc. I Semester, Major - I)

भाग अ - परिचय			
कार्यक्रम-प्रमाण पत्र	कक्षा -बी.एससी.	प्रथम सेमेस्टर	सत्र: 2026-2027
विषय - गणित			
1	पाठ्यक्रम का कोड	बीजगणित और त्रिकोणमिति कोर कोर्स (मेजर - 1) इस कोर्स का अध्ययन करने के लिए, विद्यार्थियों ने गणित विषय का अध्ययन कक्षा 12 वीं में किया हो।	
2	पाठ्यक्रम का शीर्षक		
3	पाठ्यक्रम का प्रकार		
4	पूर्वापेक्षा (Prerequisite):		
5	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: 1. वैदिक बीजगणित को समझने में। 2. आव्यूह की जाति का उपयोग करके संवर्धित आव्यूह के पंक्ति सोपानक रूप द्वारा रैखिक समीकरणों की संगतता एवं असंगतता प्रणालियों को पहचानने में। 3. एक वर्ग आव्यूह के लिए आइगेन मान और संबंधित आइगेन सदिश को खोजना। 4. रैखिक, द्विघात, घन और उच्च-घात बहुपदों सहित विभिन्न प्रकार के समीकरणों को पहचानना और समझना। 5. वास्तविक दुनिया के व्यवहार (जैसे, तरंग, पेंडुलम) को मॉडल करने के लिए	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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		वृत्तीय फलनों का उपयोग करके वृत्तीय गति और दोलन संबंधी घटनाओं में कोणों और दूरियों से जुड़ी समस्याओं को हल करने में। 6. द्रव गतिकी, विद्युत परिपथ या विशेष सापेक्षता जैसे क्षेत्रों में समस्याओं के मॉडल बनाने के लिए अतिपरवलयीय फलनों का उपयोग करने में।	
6	क्रेडिट मान	सैद्धांतिक: 6	
7	कुल अंक	अधिकतम अंक: 30 + 70	न्यूनतम उत्तीर्णांक: 35

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भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 90 घंटे

मॉड्यूल	विषय	घंटे की संख्या
I	I. भारतीय ज्ञान परंपरा: 1.1 बीजगणित और आव्यूह में भारतीय गणितज्ञों का योगदान 1.1.1 भास्कराचार्य द्वितीय 1.1.2 ब्रह्मगुप्त 1.1.3 महावीराचार्य 1.1.4 नारायण पंडित 1.2 वैदिक बीजगणित 1.2.1 बीजगणितीय गुणन 1.2.2 बीजगणितीय विभाजन	25
	II. बीजगणित - I 2.1 आव्यूह की जाति 2.2 आव्यूह का एशेलन एवं प्रासामान्य रूप 2.3 आइगेन-मान 2.4 आइगेन-सदिश	
II	बीजगणित - II 3.1 आव्यूह का अभिलाक्षणिक समीकरण 3.2 केली-हैमिल्टन प्रमेय 3.3 आव्यूह का व्युत्क्रम आव्यूह ज्ञात करने में केली-हैमिल्टन प्रमेय का अनुप्रयोग 3.4 रैखिक समीकरणों के निकाय के हल के लिए आव्यूह का प्रयोग 3.5 रैखिक समीकरणों के निकाय की संगतता एवं असंगतता पर प्रमेय	15

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	3.6 तीन अज्ञात राशियों के त्रैखिक समीकरणों के हल	
III	बीजगणित - III 4.1 समीकरण का मूल 4.2 सांश्लेषिक विभाजन 4.3 समीकरण के मूल और गुणांकों के मध्य संबंध 4.4 चिन्ह का दकार्ते नियम	15
IV	त्रिकोणमिति - I 5.1 डि-मॉयवर प्रमेय 5.2 एक सम्मिश्र राशि के मूलों का निष्कर्षण 5.3 $\sin n\theta$, $\cos n\theta$ और $\tan n\theta$ का प्रसार	15
V	त्रिकोणमिति - II 6.1 वृत्ताकार फलन 6.2 अतिपरवल्यिक फलन 6.3 प्रतिलोम वृत्ताकार फलन 6.4 प्रतिलोम अतिपरवल्यिक फलन	15
वस्तु स्थिति	औद्योगिक अनुप्रयोग:	05
अध्ययन / गतिविधि विधि	1. उद्योग, व्यापार और अर्थशास्त्र से संबंधित समस्याओं को हल करने के लिए आव्यूह के अनुप्रयोग। 2. उद्योग और वास्तविक दुनिया से संबंधित समस्याओं को हल करने के लिए त्रिकोणमिति के अनुप्रयोग।	

सार बिंदु (कीवर्ड)/ टैग:

वैदिक बीजगणित, आव्यूह की जाति, आव्यूह के अभिलाक्षणिक समीकरण, समीकरण का मूल, डि-मॉयवर प्रमेय, वृत्तीय फलन, अतिपरवल्यिक फलन, औद्योगिक अनुप्रयोग।

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आग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi 2000.
2. S. L. Loney: Plane Trigonometry. Part II: Analytical Trigonometry, Math Valley, 2019.
3. Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.
4. Bharati Krsna Tirthaji Maharaja: "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
5. Udayan S. Patankar & Sunil M. Patankar: Elements of Vedic Mathematics, TTU Press, Tallinn, 2018.
6. Sandor Molnar & Ferenc Szidarovszky: Introduction To Matrix Theory: With Applications To Business And Economics, World Scientific Publishing Co Pte Ltd., 2002.
7. Terry H. Wesner: Trigonometry with Applications, Brown (William C.) Co., U.S. 1996.

8. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. Shanti Narayan and P. K. Mittal: A Textbook of Matrices, S. Chand Publishing, 2010.
2. Chandrika Prasad: A Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad, 2017.
3. N. Jacobson: Basic Algebra Vol. I and II, W. H. Freeman, 2009.
4. I. S. Luther and I. B. S. Passi: Algebra Vol. I and II, Narosa Publishing House, 1997.

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5. N. P. Bali: Higher Trigonometry, New Age International Publications, 2023.

6. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu

Mathematics, Asia Publishing House, 1962.

अनुशंसित डिजिटल प्लेटफॉर्म / वेब लिंक:

<https://epgp.inflibnet.ac.in>

<https://freevideolectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111107112/>

<https://nptel.ac.in/courses/122104018>

<https://nptel.ac.in/courses/111/101/111101080/>

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भाग द - अनुशासित मूल्यांकन विधियाँ

अनुशासित सतत मूल्यांकन विधियाँ:

अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन:

सतत व्यापक मूल्यांकन
(CCE):

आकलन:

विश्वविद्यालयीन परीक्षा

समय: 03.00 घंटे

क्लास टेस्ट

असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):

30 अंक

अनुभाग (अ): बहुविकल्पीय प्रश्न

अनुभाग (ब): लघु उत्तरीय प्रश्न

अनुभाग (स): दीर्घ उत्तरीय प्रश्न

70 अंक

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BACHELOR OF SCIENCE (B.Sc. I Semester, Major - I)

Part A : Introduction			
Program: Certificate Course	Class: B.Sc.	Semester: I	Session: 2026-27
Subject: Mathematics			
1	Course Code		
2	Course Title	Algebra and Trigonometry	
3	Course Type	Core Course (Major - 1)	
4	Pre-requisite (if any)	To study this course, a student must have the subject Mathematics in class 12 th .	
5	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Understand the Vedic algebra. 2. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using the rank of matrix. 3. To find the Eigen values and corresponding Eigen vectors for a square matrix. 4. Recognizing and understanding different types of equations, including linear, quadratic, cubic, and higher-degree polynomials. 5. Solve problems involving angles and distances in circular motion and oscillatory phenomena, using	

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		circular functions to model real-world behaviour (e.g., waveforms, pendulums).
		6. Use hyperbolic functions to model problems in areas like fluid dynamics, electrical circuits, or special relativity.
6	Credit Value	Theory: 6
7	Total Marks	Max. Marks: 30+70 Min. Passing Marks: 35

Part B: Content of the Course

Total Lectures: 90 hours

Module	Topics	No. of Hours
I	Indian Knowledge System: 1.1 Contribution of Indian Mathematicians in Algebra and Matrix 1.1.1 Bhaskaracharya's II 1.1.2 Brahmagupta 1.1.3 Mahaviracharya 1.1.4 Narayana Pandit 1.2 Vedic Algebra 1.2.1 Algebraic Multiplication 1.2.2 Algebraic Division	25

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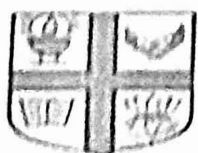
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	Algebra - I 2.1 Rank of a Matrix 2.2 Echelon and Normal form of a Matrix 2.3 Eigen-Values 2.4 Eigen-Vectors	
II	Algebra - II 3.1 Characteristic equations of a Matrix 3.2 Cayley Hamilton theorem 3.3 Application of Cayley Hamilton theorem to find the inverse of a Matrix. 3.4 Application of Matrix to solve a system of linear equations 3.5 Theorems on consistency and inconsistency of a system of linear equations 3.6 Solving linear equations up to three unknowns	15
III	Algebra - III 4.1 Root of an equation 4.2 Synthetic Division 4.3 Relation between the Roots and the Coefficients of an Equation 4.4 Descarte's rules of Signs	15
IV	Trigonometry - I 5.1 De-Moivre's theorem 5.2 Extraction of roots of a complex quantity 5.3 Expansions of $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$	15
V	Trigonometry - II 6.1 Circular Functions 6.2 Hyperbolic Functions 6.3 Inverse Circular Functions	15

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Case	6.4 Inverse Hyperbolic Functions	65
Study/Activity	Industrial Applications: 1. Applications of Matrices to solve the problems related to Industries, Business and Economics. 2. Applications of Trigonometry to solve the problems related to Industries and real world.	

Keywords:

Vedic algebra, Rank of a Matrix, Characteristic equations of a Matrix, Root of an equation, De-Moivre's theorem, Circular Functions, Hyperbolic Functions, Industrial Applications.

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maltra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinat Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi 2000.
2. S.L. Loney: Plane Trigonometry. Part II: Analytical Trigonometry, Math Valley, 2019.
3. Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.
4. Bharati KrsnaTirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
5. Udayan S. Patankar & Sunil M. Patankar: Elements of Vedic Mathematics, TTU Press, Tallinn 2018.
6. Sandor Molnar (Author), Ferenc Szidarovszky: Introduction To Matrix Theory: With Applications To Business and Economics, World Scientific Publishing Co Pte Ltd., 2002.
7. Terry H. Wesner: Trigonometry with Applications, Brown (William C.) Co., U.S. 1996.

8. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. Shanti Narayan and P K Mittal: A Textbook of Matrices, S. Chand Publishing, 2010.
2. Chandrika Prasad: A Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad, 2017.
3. N. Jacobson: Basic Algebra Vol. I and II, W. H. Freeman, 2009.

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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4. I. S. Luther and I. B. S. Passi: Algebra Vol. I and II, Narosa Publishing House, 1997.
5. N P Bali: Higher Trigonometry, New Age International Publications, 2023.
6. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://freevideolectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111107112/>

<https://nptel.ac.in/courses/122104018>

<https://nptel.ac.in/courses/111/101/111101080/>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	30 Marks
University Exam (UE):	70 Marks

Internal Assessment:	Total Marks: 30
Continuous Comprehensive Evaluation (CCE)	

External Assessment:	Section (A) : Multiple Choice Questions	Total Marks: 70
University Exam Section	Section (B) : Short Questions	
Time: 03.00 Hours	Section (C) : Long Questions	

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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Ms. Abhileka Verma			



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College with Potential for Excellence (11/06/2017)
DST-FIST supported & Star College (Autonomous) by UGC
Affiliated to Ravi Dargawan Vaidya Prasthishan, Jabalpur (M.P.)

बी.एससी. प्रथम सेमेस्टर, माइक्र-1

भाग अ - परिचय		
कार्यक्रम-प्रमाण पत्र	कक्षा -बी.एससी.	प्रथम सेमेस्टर
सत्र: 2025/2026		
विषय - गणित		
1	पाठ्यक्रम का कोड	
2	पाठ्यक्रम का शीर्षक	आधारभूत कलन और सदिश कलन
3	पाठ्यक्रम का प्रकार	माइक्र-1
4	पूर्वापेक्षा (Prerequisite):	इस कोर्स का अध्ययन करने के लिए, विद्यार्थियों ने गणित विषय का अध्ययन कक्षा 12 वीं में किया हो।
5	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम - CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: - वैदिक दृष्टिकोण से अवकलन और समाकलन को समझने में। - विभिन्न निर्देशांक प्रणालियों में गणितीय गुणों का उपयोग करके समतल में वक्रों को रेखांकित करने में। - दृष्टतमीकरण, सामाजिक विज्ञान, भौतिकी और जीवन विज्ञान आदि में अवकलन का उपयोग करने में। - सदिश चर के संबंध में सदिश-मान फलनों को अवकलित करना सीखने में।

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maltra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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5. रादिश कलन में प्रमुख संकारकों के रूप में ग्रेडिएंट, डाइवर्जेंस और कर्ल की प्रबल समझ विकसित करने में।

6. रादिश कलन की अवधारणाएँ वास्तविक दुनिया की भौतिक घटनाओं से कैसे संबंधित हैं, इसकी सहज समझ विकसित करने में।

6

क्रेडिट मान

सैद्धांतिक: 4

7

कुल अंक

अधिकतम अंक: 30 +
70

न्यूनतम उत्तीर्णांक: 35

BOS Members

Signature

Dr. Akhilesh Pathak

Dr. Mita Darbari

Dr. Archana Pasari

Dr. Preeti Nagar

Ms. Sakshi Panjwani

Ms. Abhileka Verma

Signature

[Signature]

[Signature]

[Signature]

[Signature]

[Signature]

[Signature]

BOS Members

Signature

Dr. I. K. Maitra

Dr. Sandeep Tiwari

Dr. Gopal Meena

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Mr. Shakti Patel



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भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 60 घंटे

मॉड्यूल	विषय	घंटे की संख्या
I	I. भारतीय ज्ञान परंपरा: 1.1 कलन के क्षेत्र में भारतीय गणितज्ञों का योगदान 1.1.1 आर्यभट्ट 1.1.2 माधव 1.1.3 ज्येष्ठदेव 1.2 वैदिक कलन 1.2.1 ध्वज-घटा सूत्र का उपयोग करके अवकलन 1.2.2 उर्ध्व-त्रयगभ्यम सूत्र का उपयोग करके उत्तरोत्तर अवकलन 1.2.3 उर्ध्व-त्रयगभ्यम सूत्र का उपयोग करके दो बहुपदों के विभाजन का अवकलन 1.2.4 एकाधिकेन पूर्वेण सूत्र का उपयोग करके समाकलन 1.2.5 परावर्त्य योजयत सूत्र का उपयोग करके आंशिक भिन्न पर आधारित समाकलन 1.2.6 उर्ध्व-त्रयगभ्यम सूत्र का उपयोग करके दो फलनों के गुणनफल का समाकलन	10

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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	1.3 वक्रों के अंतिम बिंदु के बीच को प्राप्त करने के लिए वैदिक दृष्टिकोण	
II	II. अवकलन कलन। 2.1 उत्तरोत्तर अवकलन 2.1.1 लेबनीज प्रयोग 2.1.2 गैवलासिन श्रेणी द्वारा विस्तार 2.1.3 टेलर श्रेणी द्वारा विस्तार 2.2 दो और तीन चरों के आंशिक अवकलज की मूल अवधारणाएँ 2.3 अनंतरस्पर्शी 2.3.1 बीजीय वक्रों की अनंतरस्पर्शियों 2.3.2 अनंतरस्पर्शी के अस्तित्व होने का प्रतिबन्ध 2.3.3 समान्तर अनंतरस्पर्शियों 2.3.4 ध्रुवीय वक्रों की अनंतरस्पर्शियों 2.4 वक्रता 2.4.1 वक्रता त्रिज्या के लिए सूत्र 2.4.2 मूल बिन्दु पर वक्रता 2.4.3 वक्रता केन्द्र	15
III	समाकलन कलन:	15

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maltra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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IV	3.1 अभीजीय फलनों का समाकलन 3.2 समानयन सूत्र 3.3 निश्चित समाकल 3.4 द्विक एवं त्रिक समाकल	
	सदिश कलन: 4.1 सदिश अवकलन 4.1.1 अवकलन के नियम 4.1.2 त्रिक गुणनफलों के अवकलज 4.2 ग्रेडियंट, डायवर्जेंस एवं कर्ल 4.3 दिक् अवकलज 4.4 सदिश सर्वसमिकाएँ 4.5 सदिश समाकलन	15
वस्तु स्थिति अध्ययन / गतिविधि	औद्योगिक अनुप्रयोग: 1. उद्योग, व्यापार और अर्थशास्त्र से संबंधित समस्याओं को हल करने के लिए कलन के अनुप्रयोग। 2. उद्योग और वास्तविक दुनिया से संबंधित समस्याओं को हल करने के लिए सदिश कलन के अनुप्रयोग।	05

सार बिंदु (कीवर्ड)/ टैग:

वैदिक कलन, उत्तरोत्तर अवकलन, आंशिक अवकलन, अनंतस्पर्शी, वक्रता, निश्चित समाकल, द्विक एवं त्रिक समाकल, सदिश अवकलन, सदिश समाकलन।

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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भाग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahabad, 2016.
2. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
3. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad, 1990.
4. Marvin L. Bittinger, David J. Ellenbogen, Scott J. Surgent: Calculus and its Applications, Pearson, 2011.
5. Absos Ali Shaikh and Sanjib Kumar Jana: Vector Analysis with Applications, Narosa Publishing House, 2009.
6. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
7. Bharati Krsna Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
8. Sneha Amit Vaidya: The Contribution of Vedic Mathematics in Advance Calculus, <https://shodhganga.inflibnet.ac.in/>, 2019.
9. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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संदर्भ पुस्तकें:

1. N. Piskunov: Differential and Integral Calculus, CBS Publishers, 1996.
2. Murray R. Spiegel: Vector Analysis, Schaum Publishing Company, New York, 2017.
3. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
4. Larry J. Goldstein, David I. Schneider, David C. Lay, Nakhle H Asmar: Calculus and Its Applications, Pearson Education, 2012.

अनुशंसित डिजिटल प्लेटफॉर्म / वेब लिंक:

<https://epgp.inflibnet.ac.in>

<https://freevideolectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111106146/>

<https://nptel.ac.in/courses/122102004/L02>

<https://nptel.ac.in/courses/111/101/111101080/>

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
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भाग द - अनुशंसित मूल्यांकन विधियाँ

अनुशंसित सतत मूल्यांकन विधियाँ:

अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन:	क्लास टेस्ट	30 अंक
सतत व्यापक मूल्यांकन (CCE):	असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	
आकलन:	अनुभाग (अ): बहुविकल्पीय प्रश्न	70 अंक
विश्वविद्यालयीन परीक्षा	अनुभाग (ब): लघु उत्तरीय प्रश्न	
समय: 03.00 घंटे	अनुभाग (स): दीर्घ उत्तरीय प्रश्न	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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Class: B.Sc. I Semester Minor - 1

Part A: Introduction			
Program: Certificate Course	Class: B.Sc.	Semester: I	Session: 2026-27
Subject: Mathematics			
1	Course Code		
2	Course Title	Basic Calculus and Vector Calculus	
3	Course Type	Minor - 1	
4	Pre-requisite (if any)	To study this course, a student must have the subject Mathematics in class 12 th .	
5	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Understand the differentiation and integration by Vedic approach. 2. Sketch curves in a plane using its Mathematical properties in the different coordinate systems of reference. 3. Using the derivatives in Optimization, Social sciences, Physics and Life sciences etc.	

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Dr. Preeti Nagar		Mr. Vinit Jain	
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		4. Learn to differentiate vector-valued functions with respect to scalar variables. 5. Develop a strong understanding of the gradient, divergence, and curl as key operators in vector calculus. 6. Develop an intuitive understanding of how the concepts of vector calculus relate to real-world physical phenomena.	
6	Credit Value	Theory: 4	
7	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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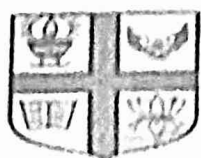
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	2.1.2 Maclaurin's series expansion 2.1.3 Taylor's series expansion 2.2 Basic Concepts of Partial Derivative of two and three variables 2.3 Asymptotes 2.3.1 Asymptotes of algebraic curves 2.3.2 Condition for Existence of Asymptotes 2.3.3 Parallel Asymptotes 2.3.4 Asymptotes of polar curves 2.4 Curvature 2.4.1 Formula for radius of Curvature 2.4.2 Curvature at origin 2.4.3 Centre of Curvature	
III	Integral Calculus: 3.1 Integration of transcendental functions 3.2 Reduction formulae 3.3 Definite Integral 3.4 Double and Triple Integral	15
IV	Vector Calculus: 4.1 Vector differentiation 4.1.1 Rules of differentiation 4.1.2 Derivatives of Triple Products 4.2 Gradient, Divergence and Curl 4.3 Directional derivatives 4.4 Vector Identities 4.5 Vector Integration	15

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maity	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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College with Potential for Excellence (CPE) 2013-14

DSI (DPT) Supported & A++ College Scheme No. 1001

Affiliated to Ram Durgam Vidyalaya, Jabalpur (M.P.)

Case Study/ Activity	Industrial Applications: 1. Applications of Calculus to solve the problems related to Industries, Business and Economics. 2. Applications of Vector Calculus to solve the problems related to Industries and real world.	05
Keywords: Vedic Calculus, Successive differentiation, Partial Differentiation, Asymptotes, Curvature, Definite Integral, Double and Triple Integral, Vector differentiation, Vector integration.		

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Dr. Akhilesh Pathak		Dr. J. K. Maltra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Moona	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhiteka Verma			



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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahabad, 2016.
2. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
3. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad, 1990.
4. Marvin L. Bittinger, David J. Ellenbogen, Scott J. Sargent: Calculus and its Applications, Pearson, 2011.
5. Absos Ali Shaikh and Sanjib Kumar Jana: Vector Analysis with Applications, Narosa Publishing House, 2009.
6. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
7. Bharati KrsnaTirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
8. Sneha Amit Vaidya: The Contribution of Vedic Mathematics in Advance Calculus, <https://shodhganga.inflibnet.ac.in/2019>.
9. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak	<i>AK</i>	Dr. J. K. Maitra	<i>J.K.</i>
Dr. Mita Darbari	<i>MD</i>	Dr. Sandeep Tiwari	
Dr. Archana Pasari	<i>Archana</i>	Dr. Gopal Meena	<i>GP</i>
Dr. Preeti Nagar	<i>Preeti</i>	Mr. Vinit Jain	
Ms. Sakshi Panjwani	<i>Sakshi</i>	Mr. Shakti Patel	
Ms. Abhiloka Verma	<i>Abhiloka</i>		



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Reference Books:

1. N. Piskunov: Differential and Integral Calculus, CBS Publishers, 1996.
2. Murray R. Spiegel: Vector Analysis, Schaum Publishing Company, New York, 2017.
3. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
4. Larry J. Goldstein, David I. Schneider, David C. Lay, Nakhle H. Asmar: Calculus and Its Applications, Pearson Education, 2012.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://freevideolectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

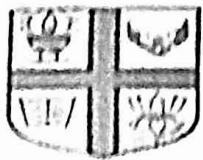
Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111106146/>

<https://nptel.ac.in/courses/122102004/L02>

<https://nptel.ac.in/courses/111/101/111101080/>

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Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	30 Marks
University Exam (UE):	70 Marks
Internal Assessment:	Total Marks: 30
Continuous Comprehensive Evaluation (CCE)	
External Assessment:	Total Marks: 70
University Exam Section	Section (A): Multiple Choice Questions
Time: 03.00 Hours	Section (B): Short Questions
	Section (C): Long Questions

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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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बी.एससी. द्वितीय सेमेस्टर कोर कोर्स (मेजर - 2)

भाग अ - परिचय			
कार्यक्रम-प्रमाण पत्र	कक्षा -बी.एससी.	द्वितीय सेमेस्टर	सत्र: 2026-2027
विषय-गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	कलन और सदिश विश्लेषण	
3	पाठ्यक्रम का प्रकार	कोर कोर्स (मेजर - 2)	
4	पूर्वापेक्षा (Prerequisite):	इस कोर्स का अध्ययन करने के लिए, विद्यार्थियों ने गणित विषय का अध्ययन कक्षा 12 वीं में किया हो।	
5	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम - CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: - वैदिक दृष्टिकोण से अवकलन और समाकलन को समझने में। - विभिन्न निर्देशांक प्रणालियों में गणितीय गुणों का उपयोग करके समतल में वक्रों को रेखांकित करने में। - इष्टमीकरण, सामाजिक विज्ञान, भौतिकी और जीवन विज्ञान आदि में अवकलज का उपयोग करने में।	

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Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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		4. सदिश चर के सम्बन्ध में सदिश - मान फलनों को अवकलित करना सिखने में। 5. सदिश कलन में प्रमुख संकारको के रूप में ग्रेडिएंट , डाइवर्जेंस और कर्ल की प्रबल समझ विकसित करने में। 6. सदिश कलन की अवधारणाएं वास्तविक दुनिया की भौतिक घटनाओं से कैसे सम्बंधित हैं, इसकी सहज समझ विकसित करने में।	
6	क्रेडिट मान	सैद्धांतिक: 6	
7	कुल अंक	अधिकतम अंक: 30 + 70	न्यूनतम उत्तीर्णांक: 35

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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 90 घंटे

मॉड्यूल	विषय	घण्टों की संख्या
I	भारतीय ज्ञान परंपरा: 1.1 कलन के क्षेत्र में भारतीय गणितज्ञों का योगदान 1.1.1 आर्यभट्ट 1.1.2 माधव 1.1.3 ज्येष्ठदेव 1.2 वैदिक कलन 1.2.1 ध्वज घटा सूत्र का उपयोग करके अवकलन 1.2.2 उर्ध्व -त्रयगभ्यम् सूत्र का उपयोग करके उत्तरोत्तर अवकलन 1.2.3 उर्ध्व -त्रयगभ्यम् सूत्र का उपयोग करके दो बहुपदों के विभाजन का अवकलन 1.2.4 एकाधिकेन पूर्वेण सूत्र का उपयोग करके समाकलन	25

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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- 1.2.5 परावर्त्य योजयत सूत्र का उपयोग करके
आंशिक भिन्न पर आधारित समाकलन
- 1.2.6 उत्थ - चरययययय सूत्र का उपयोग करके दो
फलनों के गुणनफल का समाकलन
- 1.3 वक्रों के अंतर्गत के क्षेत्र को प्राप्त करने के लिए
वैदिक दृष्टिकोण
- अवकल कलन - I**
- 2.1 उत्तरोत्तर अवकलन
- 2.1.1 लैबनीज प्रमेय
- 2.1.2 मैक्लॉरिन श्रेणी द्वारा विस्तार
- 2.1.3 टेलर श्रेणी द्वारा विस्तार
- 2.2 दो और तीन चरों के आंशिक अवकलज की मूल
अवधारणाएं
- 2.3 अनन्तस्पर्शी
- 2.3.1 बीजीय वक्रों की अनन्तस्पर्शीयाँ
- 2.3.2 अनन्तस्पर्शी के अस्तित्व होने का प्रतिबन्ध
- 2.3.3 समान्तर अनन्तस्पर्शीयाँ
- 2.3.4 ध्रुवीय वक्रों की अनन्तस्पर्शीयाँ

II

अवकल कलन - II

15

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak	<i>Ak</i>	Dr. J. K. Maltra	<i>JK</i>
Dr. Mita Darbari	<i>MD</i>	Dr. Sandeep Tiwari	
Dr. Archana Pasari	<i>Archana</i>	Dr. Gopal Meena	<i>Gm</i>
Dr. Preeti Nagar	<i>Preeti</i>	Mr. Vinit Jain	
Ms. Sakshi Panjwani	<i>Sakshi</i>	Mr. Shakti Patel	
Ms. Abhileka Verma	<i>Abhileka</i>		



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	3.1 वक्रता 3.1.1 वक्रता त्रिज्या के लिए सूत्र 3.1.2 मूल बिंदु पर वक्रता 3.1.3 वक्रता केंद्र 3.3 उत्तलता एवं अवतलता 3.2.1 वक्रों की उत्तलता एवं अवतलता 3.2.2 नति परिवर्तन बिंदु 3.2.3 विचित्र बिंदु 3.2.4 बहुल बिंदु 3.3 वक्रों का अनुरेखण 3.3.1 कार्तीय समीकरणों द्वारा निरूपित वक्र 3.3.2 ध्रुवीय समीकरणों द्वारा निरूपित वक्र	
III	समाकल कलन 4.1 अबीजीय फलनों का समाकलन 4.2 द्विक एवं त्रिक समाकल की आधारभूत अवधारणाएं 4.3 समानयन सूत्र 4.4 क्षेत्रकलन 4.4.1 कार्तीय निर्देशांकों के लिए	15

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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	4.4.2 धुवीय निर्देशांकों के लिए 4.5 चापकलन 4.5.1 कार्तीय निर्देशांकों के लिए 4.5.2 धुवीय निर्देशांकों के लिए 4.6 आयतन और पृष्ठ 4.6.1 परिक्रमण ठोस का आयतन 4.6.2 परिक्रमण ठोस का पृष्ठ	
IV	सदिश विश्लेषण-I 5.1 सदिश अवकलन 5.1.1 अवकलन के नियम 5.1.2 त्रिक गुणनफलों के अवकलज 5.2 ग्रेडिएंट, डायवर्जेंस एवं कर्ल 5.3 द्विक अवकलज 5.4 सदिश सर्वसमिकाएँ	15
V	सदिश विश्लेषण - II 6.1 सदिश समाकलन 6.2 गॉस प्रमेय (बिना उपपत्ति) एवं इस पर आधारित प्रश्न	15

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	6.3 ग्रीन प्रमेय (बिना उपपत्ति) एवं इस पर आधारित प्रश्न 6.4 स्टोक प्रमेय (बिना उपपत्ति) एवं इस पर आधारित प्रश्न 6.5 ज्यामिति में अनुप्रयोग 6.5.1 समष्टि में वक्र 6.5.2 वक्रता और मरोड़ 6.5.3 फ्रेनेट - सेरेट सूत्र	
वस्तु स्थिति अध्ययन / गतिविधि विधि	औद्योगिक अनुप्रयोग: 1. उद्योग, व्यापार और अर्थशास्त्र से सम्बंधित समस्याओं को हल करने के लिए कलन के अनुप्रयोग 2. उद्योग और वास्तविक दुनिया से सम्बंधित समस्याओं को हल करने के लिए सदिश कलन के अनुप्रयोग	05

सार बिंदु (कीवर्ड)/ टैग:

वैदिक कलन, उत्तरोत्तर अवकलन, आंशिक अवकलन, अनन्तस्पर्शी, वक्रता, वक्रों का अनुरेखण, क्षेत्रकलन, चापकलन, आयतन और पृष्ठ, सदिश अवकलन, सदिश सर्वसमिकाएँ, सदिश समाकलन, ज्यामिति में अनुप्रयोग।

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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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भाग रा - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahabad, 2016.
2. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
3. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad, 1990.
4. Marvin L. Bittinger, David J. Ellenbogen, Scott J. Surgent: Calculus and its Applications, Pearson, 2011.
5. Absos Ali Shaikh and Sanjib Kumar Jana: Vector Analysis with Applications, Narosa Publishing House, 2009.
6. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
7. Bharati Krsna Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
8. Sneha Amit Vaidya: The Contribution of Vedic Mathematics in Advance Calculus, <https://shodhganga.inflibnet.ac.in/>, 2019.
9. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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संदर्भ पुस्तकें:

1. N. Piskunov: Differential and Integral Calculus, CBS Publishers, 1996.
2. Murray R. Spiegel: Vector Analysis, Schaum Publishing Company, New York, 2017.
3. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
4. Larry J. Goldstein, David I. Schneider, David C. Lay, Nakhle H. Asmar: Calculus and Its Applications, Pearson Education, 2012.

अनुशंसित डिजिटल प्लेटफॉर्म / वेब लिंक:

<https://epgp.inflibnet.ac.in>

<https://freevideolectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

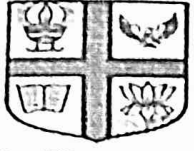
अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111106146/>

<https://nptel.ac.in/courses/122102004/L02>

<https://nptel.ac.in/courses/111/101/111101080/>

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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भाग द - अनुशंसित मूल्यांकन विधियाँ

अनुशंसित सतत मूल्यांकन विधियाँ:

अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन:	क्लास टेस्ट	30 अंक
सतत व्यापक मूल्यांकन (CCE):	असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	
आकलन:	अनुभाग (अ): बहुविकल्पीय प्रश्न	70 अंक
विश्वविद्यालयीन परीक्षा	अनुभाग (ब): लघु उत्तरीय प्रश्न	
समय: 03.00 घंटे	अनुभाग (स): दीर्घ उत्तरीय प्रश्न	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitya	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhileka Verma			



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BACHELOR OF SCIENCE (B.Sc. II Semester, Major - 2)

Part A: Introduction			
Program: Certificate Course	Class: B.Sc.	Semester: II	Session: 2026-27
Subject: Mathematics			
1	Course Code		
2	Course Title	Calculus and Vector Analysis	
3	Course Type	Core Course (Major - 2)	
4	Pre-requisite (if any)	To study this course, a student must have the subject Mathematics in class 12 th .	
5	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Understand the differentiation and integration by Vedic approach. 2. Sketch curves in a plane using Mathematical properties in the different coordinate systems. 3. Using the derivatives in Optimization, Social sciences, Physics and Life sciences etc.	

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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		4. Learn to differentiate vector-valued functions with respect to scalar variables. 5. Develop a strong understanding of the gradient, divergence, and curl as key operators in vector calculus. 6. Develop an intuitive understanding of how the concepts of vector calculus relate to real-world physical phenomena.
6	Credit Value	Theory: 6
7	Total Marks	Max. Marks: 30 + 70 Min. Passing Marks: 35

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Part B: Content of the Course

Total Lectures: 90 hours

Module	Topics	No. of hours
I	Indian Knowledge System: 1.1 Contribution of Indian Mathematicians in the field of Calculus 1.1.1 Aryabhata 1.1.2 Madhava 1.1.3 Jyeshthadeva 1.2 Vedic Calculus 1.2.1 Differentiation using Dhvaja Ghata Sūtra 1.2.2 Successive Differentiation using Urdhva-Triyagbhyam Sūtra 1.2.3 Derivative of the division of two polynomials using Urdhva-Triyagbhyam Sūtra 1.2.4 Integration by using Ekādhikena Pūrveṇa Sūtra 1.2.5 Integration based on partial fraction using Parāvartya Yojayet Sūtra	25

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	1.2.6 Integration of the product of two functions using Urdhva- TriyagbhyamSūtra 1.3 Vedic Approach to obtaining Areas under Curves Differential Calculus-I: 2.1 Successive differentiation 2.1.1 Leibnitz theorem 2.1.2 Maclaurin's series expansion 2.1.3 Taylor's series expansion 2.2 Basic Concepts of Partial Derivative of two and three variables 2.3 Asymptotes 2.3.1 Asymptotes of algebraic curves 2.3.2 Condition for Existence of Asymptotes 2.3.3 Parallel Asymptotes 2.3.4 Asymptotes of polar curves	
II	Differential Calculus-II: 3.1 Curvature 3.1.1 Formula for radius of Curvature 3.1.2 Curvature at origin	15

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	3.1.3. Centre of Curvature 3.2 Concavity and Convexity 3.2.1 Concavity and Convexity of curves 3.2.2 Point of Inflexion 3.2.3 Singular point 3.2.4 Multiple points 3.3 Tracing of curves 3.3.1 Curves represented by Cartesian equation 3.3.2 Curves represented by Polar equation	
III	Integral Calculus: 4.1 Integration of transcendental functions 4.2 Basic Concepts of Double and Triple Integral 4.3 Reduction formulae 4.4 Quadrature 4.4.1 For Cartesian coordinates 4.4.2 For Polar coordinates 4.5 Rectification 4.5.1 For Cartesian coordinates 4.5.2 For Polar coordinates	15

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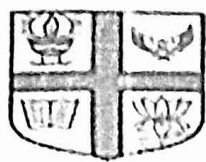
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	4.6 Volumes and Surfaces 4.6.1 Volume of Solids of Revolution 4.6.2 Surface of Revolution	
IV	Vector Analysis-I: 5.1 Vector differentiation 5.1.1 Rules of differentiation 5.1.2 Derivatives of Triple Products 5.2 Gradient, Divergence and Curl 5.3 Directional derivatives 5.4 Vector Identities	15
V	Vector Analysis-II: 6.1 Vector Integration 6.2 Gauss theorem (without proof) and problems based on it 6.3 Green theorem (without proof) and problems based on it 6.4 Stoke theorem (without proof) and problems based on it	15

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	6.5 Application to Geometry 6.5.1 Curve in Space 6.5.2 Curvature and Torsion 6.5.3 Frenet-Serret Formulae	
Case Study/Activity	Industrial Applications: 1. Applications of Calculus to solve the problems related to Industries, Business and Economics. 2. Applications of Vector Calculus to solve the problems related to Industries and real world.	05

Keywords/Tags:

Vedic Calculus, Successive differentiation, Partial Differentiation, Asymptotes, Curvature, Tracing of curves, Quadrature, Rectification, Volume and Surface, Vector differentiation, Vector identities, Vector integration, Application to Geometry.

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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahabad, 2016.
2. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
3. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad, 1990.
4. Marvin L. Bittinger, David J. Ellenbogen, Scott J. Surgent: Calculus and its Applications, Pearson, 2011.
5. Absos Ali Shaikh and Sanjib Kumar Jana: Vector Analysis with Applications, Narosa Publishing House, 2009.
6. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
7. Bharati KrsnaTirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
8. Sneha Amit Vaidya: The Contribution of Vedic Mathematics in Advance Calculus, <https://shodhganga.inflibnet.ac.in/>, 2019.
9. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

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Reference Books:

1. N. Piskunov: Differential and Integral Calculus, CBS Publishers, 1996.
2. Murray R. Spiegel: Vector Analysis, Schaum Publishing Company, New York, 2017.
3. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
4. Larry J Goldstein, David I Schneider, David C Lay, Nakhle H Asmar: Calculus and Its Applications, Pearson Education, 2012.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://freevidelectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111106146/>

<https://nptel.ac.in/courses/122102004/L02>

<https://nptel.ac.in/courses/111/101/111101080/>

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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	30 Marks
University Exam (UE):	70 Marks
Internal Assessment:	Total Marks: 30
Continuous Comprehensive Evaluation (CCE)	
External Assessment:	Total Marks: 70
University Exam Section	Section (A) : Multiple Choice Questions
Time: 03.00 Hours	Section (B) : Short Questions
	Section (C) : Long Questions

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बी.एससी. द्वितीय सेमेस्टर कोर कोर्स (मेजर - 3)

भाग 3A - परिचय			
कार्यक्रम-प्रमाण पत्र	कक्षा -बी.एससी.	द्वितीय सेमेस्टर	सत्र: 2026-2027
विषय गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	अवकल समीकरण और ज्यामिति	
3	पाठ्यक्रम का प्रकार	कोर कोर्स (मेजर - 3)	
4	पूर्वापेक्षा (Prerequisite):	इस कोर्स का अध्ययन करने के लिए, विद्यार्थियों ने गणित विषय का अध्ययन कक्षा 12 वीं में किया हो।	
5	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम - CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: - विभिन्न गणितीय प्रतिरूपों के लिए अवकल समीकरण के सूत्रीकरण करने में। - भौतिकी, जीव विज्ञान, इंजीनियरिंग और अर्थशास्त्र में व्यवहारिक समस्याओं का प्रतिरूपीकरण करने और हल करने के लिए साधारण अवकल समीकरणों को लागू करने में। - वैदिक ज्यामिति को समझने में। - त्रि-आयामी ज्यामितीय आकृतियों (जैसे शंकु और बेलन) के ज्ञान संवर्द्धन में।	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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		5. यह पहचानने में कि ज्यामितीय संदर्भ में अवकल समीकरण कैसे उत्पन्न होते हैं और ज्यामिति अवकल समीकरणों के अध्ययन को कैसे प्रभावित करती है। 6. अवकल समीकरणों का उपयोग करके यांत्रिक प्रणालियों, जैविक प्रणालियों, विद्युत परिपथ आदि के गणितीय प्रतिरूप को निर्मित करने में।	
6	क्रेडिट मान	सैद्धांतिक: 6	
7	कुल अंक	अधिकतम अंक: 30 + 70	न्यूनतम उत्तीर्णांक: 35

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भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 90 घंटे

मॉड्यूल	विषय	घण्टों की संख्या
I	भारतीय ज्ञान परंपरा: 1.1 अवकल समीकरणों की ऐतिहासिक पृष्ठभूमि 1.2 अवकल समीकरण के क्षेत्र में भारतीय गणितज्ञों का योगदान 1.2.1. आर्यभट 1.2.2 भास्कराचार्य 1.2.3 माधव 1.3 प्राचीन ज्यामिति (शुल्ब सूत्र) 1.4 ज्यामिति के क्षेत्र में भारतीय गणितज्ञों का योगदान: 1.4.1 बौधायन 1.4.2 कात्यायन 1.4.3 नीलकंठ सोमयाजी 1.4.4 परमेश्वरन 1.4.5 शंकर वारियर 1.5 वैदिक ज्यामिति: 1.5.1 त्रिक का परिचय 1.5.2 त्रिक का योग और घटाव	25

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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	1.5.3 द्विक कोणों के लिए त्रिक 1.5.4 अर्द्ध कोणों के लिए त्रिक	
	अवकल समीकरण - I: 2.1 रैखिक अवकल समीकरण 2.1.1 रैखिक समीकरण 2.1.2 रैखिक समीकरण में समानेन अवकल समीकरण 2.1.3 चरों का परिवर्तन 2.2 यथातथ अवकल समीकरण 2.3 प्रथम कोटि एवं उच्च घातीय अवकल समीकरण 2.3.1 x , y और p में हल होने योग्य 2.3.2 x और y में समघात समीकरण 2.3.3 क्लेरो का समीकरण 2.3.4 विचित्र हल 2.3.5 अवकल समीकरणों के ज्यामितीय अर्थ 2.3.6 लाम्बिक संक्षेदियाँ	
II	अवकल समीकरण - II: 3.1 अचर गुणांक वाले रैखिक अवकल समीकरण 3.2 साधारण रैखिक समघात अवकल समीकरण 3.3 द्वितीय कोटि के रैखिक अवकल समीकरण	15
III	अवकल समीकरण - III: 4.1 प्राचल विचरण विधि 4.2 प्रथम कोटि का साधारण युगपत अवकल समीकरण	10
IV	ज्यामिति - I: 5.1 द्वितीय घात का व्यापक समीकरण 5.2 शंकवों का अनुरेखन	15

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Ms. Abhileka Verma			



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	5.3 शांकवों का निकाय 5.4 शांकव का ध्रुवीय समीकरण	
V	ज्यामिति - II: 6.1 शंकु: 6.1.1 दिए गए आधार के साथ शंकु का समीकरण 6.1.2 शंकु के जनक 6.1.3 तीन परस्पर लंबवत जनकों हेतु प्रतिबंध 6.1.4 लंबवृतीय शंकु 6.2 बेलन: 6.2.1 बेलन का समीकरण और इसके प्रगुण 6.2.2 लंबवृतीय बेलन 6.2.3 अन्वालोप बेलन	20
वस्तु स्थिति अध्ययन / गतिविधि विधि	औद्योगिक अनुप्रयोग: 1. उद्योग, व्यापार और अर्थशास्त्र से संबंधित समस्याओं को हल करने के लिए अवकल समीकरण के अनुप्रयोग। 2. उद्योग और वास्तविक दुनिया से संबंधित समस्याओं को हल करने के लिए ज्यामिति के अनुप्रयोग।	05

सार बिंदु (कीवर्ड)/ टैग:

रेखिक अवकल समीकरण, प्राचल विचरण विधि, वैदिक ज्यामिति, द्वितीय घात के व्यापक समीकरण, शांकवों का अनुरेखण, शांकवों का निकाय, शंकु का समीकरण, बेलन का समीकरण

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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Dr. Archana Pasari		Dr. Gopal Meena	
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भाग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
2. M. D. Raisinghania: Ordinary and Partial Differential Equations, S Chand & Co Ltd, 2017.
3. S. L. Loney: The Elements of Coordinate Geometry Part-1, New Age International (P) Ltd., Publishers, New Delhi, 2016.
4. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Three Dimensions, Willey Eastern Ltd, 1999.
5. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
6. Bharati Krsna Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
7. Udayan S. Patankar & sunil S. Patankar: Elements of Vedic Mathematics, TTU Press, 2018.
8. Enrique Fernández-Cara: Ordinary Differential Equations and Applications, World Scientific, 2024.
9. McGraw Hill: Geometry, Real World Application Transparencies and Masters, McGraw-Hill, 2003.
10. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. G. F. Simmons: Differential Equations, Tata McGraw Hill. 1972.
2. E. A. Codington: An Introduction to Ordinary Differential Equation, Prentice Hall of India, 1961.

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3. D. A. Murray: Introductory Course in Differential Equations, Orient Longman (India) 1967.
4. H. T. H Piaggio: Elementary Treatise on Differential Equations and their Application, C. B.S. Publisher & Distributors, Delhi. 1985.
5. Gorakh Prasad and H. C. Gupta: Text Book on Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad, 2000.
6. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
7. Balachandra Rao: Differential Equations with Applications, Universities Press, 1996.
8. Georg Glaeser: Geometry and its Applications in Arts, Nature and Technology, Springer Nature Switzerland AG, 2020.

अनुशंसित डिजिटल प्लेटफॉर्म / वेब लिंक:

<https://epgp.inflibnet.ac.in>

<https://freevideolectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111106100/>

<https://nptel.ac.in/courses/111104164>

<https://nptel.ac.in/courses/111/101/111101080/>

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भाग द - अनुशंसित मूल्यांकन विधियाँ

अनुशंसित सतत मूल्यांकन विधियाँ:

अधिकतम अंक: 100
सतत व्यापक मूल्यांकन (CCE): 30 अंक
विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन:	क्लास टेस्ट	30 अंक
सतत व्यापक मूल्यांकन (CCE):	असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन)	
आकलन:	अनुभाग (अ): बहुविकल्पीय प्रश्न	70 अंक
विश्वविद्यालयीन परीक्षा	अनुभाग (ब): लघु उत्तरीय प्रश्न	
समय: 03.00 घंटे	अनुभाग (स): दीर्घ उत्तरीय प्रश्न	

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhileka Verma			



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B.Sc. II Semester, Core Course (Major - 3)

Part A : Introduction		
Program: Certificate Course	Class: B.Sc.	II Semester Session: 2026-27
Subject: Mathematics		
1	Course Code	
2	Course Title	Differential Equations and Geometry
3	Course Type	Core Course (Major - 3)
4	Pre-requisite (if any)	To study this course, a student must have the subject Mathematics in class 12th.
5	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Formulate the Differential equations for various Mathematical models. 2. Apply ordinary differential equations to model and solve practical problems in physics, biology, engineering, and economics. 3. Understand the Vedic geometry.

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		4. Enhance the knowledge of three-dimensional geometrical figures (eg. cone and cylinder). 5. Recognize how differential equations arise in geometric contexts and how geometry influences the study of differential equations. 6. Formulate mathematical models of mechanical systems, biological systems, electrical circuits, and more using differential equations.
6	Credit Value	Theory: 6
7	Total Marks	Max. Marks: 30 + 70 Min. Passing Marks: 35

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Part B: Content of the Course

Total Lectures: 90 hours

Module	Topics	No. of hours
I	Indian Knowledge System: 1.1 Historical Background of Differential Equations 1.2 Contribution of Indian Mathematicians in the field of Differential Equations: 1.2.1 Aryabhata 1.2.2 Bhaskracharya 1.2.3 Madhava 1.3 Ancient Geometry (Shulb Sutra) 1.4 Contribution of Indian Mathematicians in the field of geometry: 1.4.1 Baudhayana 1.4.2 Katyayana 1.4.3 NilkanthSomayaji 1.4.4 Parmeshwaran 1.4.5 Shankar Variyar 1.5 Vedic Geometry: 1.5.1 Introduction to triplets 1.5.2 Addition and subtraction of triplets 1.5.3 Triplet for double angles 1.5.4 Triplet for half angles	25

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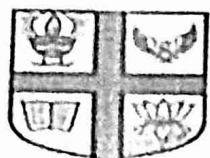
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	Differential Equations-I: 2.1 Linear differential equations 2.1.1 Linear equation 2.1.2 Equations reducible to the linear form 2.1.3 Change of variables 2.2 Exact differential equations 2.3 First order and higher degree differential equations 2.3.1 Equations solvable for x, y and p 2.3.2 Equations homogenous in x and y 2.3.3 Clairaut's equation 2.3.4 Singular solutions 2.3.5 Geometrical meaning of differential equations 2.3.6 Orthogonal trajectories	
II	Differential Equations-II: 3.1 Linear differential equation with constant coefficients 3.2 Homogeneous linear ordinary differential equations 3.3 Linear differential equations of second order	15
III	Differential Equations-III: 4.1 Method of variation of parameters 4.2 Ordinary Simultaneous Differential Equation of First Order	10
IV	Geometry - I: 5.1 General equation of second degree 5.2 Tracing of conics 5.3 System of conics 5.4 Polar equation of a conic	15

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V	Geometry - II: 6.1 Cone: 6.1.1 Equation of cone with given base 6.1.2 Generators of cone 6.1.3 Condition for three mutually perpendicular generators 6.1.4 Right circular cone 6.2 Cylinder: 6.2.1 Equation of cylinder and its properties 6.2.2 Right Circular Cylinder 6.2.3 Enveloping Cylinder	20
Case Study	Industrial Applications: 1. Applications of Differential equations to solve the problems related to Industries, Business and Economics. 2. Applications of Geometry to solve the problems related to Industries and real world.	05

Keywords/Tags:

Linear differential equations, Method of variation of parameters. Vedic geometry, General equation of second degree, Tracing of conics, System of conics, Equation of cone, Equation of cylinder.

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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
2. M. D. Raisinghania: Ordinary and Partial Differential Equations, S Chand & Co Ltd, 2017.
3. S. L. Loney: The Elements of Coordinate Geometry Part-1, New Age International (P) Ltd., Publishers, New Delhi, 2016.
4. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Three Dimensions, Willey Eastern Ltd, 1999.
5. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
6. Bharati Krishna Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
7. Udayan S. Patankar & sunil S. Patankar: Elements of Vedic Mathematics, TTU Press, 2018.
8. Enrique Fernández-Cara: Ordinary Differential Equations and Applications, World Scientific, 2024.
9. McGraw Hill: Geometry, Real World Application Transparencies and Masters, McGraw-Hill, 2003.

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Dr. Mila Darbari		Dr. Sahdeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Prioti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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10. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. G. F. Simmons: Differential Equations, Tata McGraw Hill. 1972.
2. E. A. Codington: An Introduction to ordinary differential Equation, Prentice Hall of India, 1961.
3. D. A. Murray: Introductory Course in Differential Equations, Orient Longman (India) 1967.
4. H. T. H Piaggio: Elementary Treatise on Differential Equations and their Application, C. B.S. Publisher & Distributors, Delhi. 1985.
5. Gorakh Prasad and H. C. Gupta: Text Book on Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad, 2000.
6. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
7. Balachandra Rao: Differential Equations with Applications, Universities Press, 1996.
8. Georg Glaeser: Geometry and its Applications in Arts, Nature and Technology, Springer Nature Switzerland AG, 2020.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://freevideolectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111106100/>

<https://nptel.ac.in/courses/111104164>

<https://nptel.ac.in/courses/111/101/111101080/>

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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:

100

Continuous Comprehensive Evaluation (CCE): 30 Marks

University Exam (UE):

70 Marks

Internal Assessment:

Total Marks: 30

Continuous Comprehensive Evaluation (CCE)

External Assessment:

Section (A) : Multiple Choice
Questions

Total Marks: 70

University Exam Section

Time: 03.00 Hours

Section (B) : Short Questions

Section (C) : Long Questions

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



ST. ALOYSIUS' COLLEGE

JABALPUR (MADHYA PRADESH)

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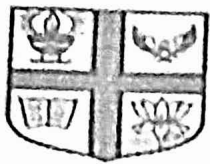
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बी.एससी. द्वितीय, रोगेस्टर, माइन्स-2

भाग 3 - परिचय			
कार्यक्रम-प्रमाण पत्र	कक्षा -बी.एससी.	द्वितीय रोगेस्टर	सत्र: 2026-2027
विषय : गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	साधारण अवकल समीकरण	
3	पाठ्यक्रम का प्रकार	माइन्स-2	
4	पूर्वापेक्षा (Prerequisite):	इस कोर्स का अध्ययन करने के लिए, विद्यार्थी ने विषय गणित का अध्ययन कक्षा 12 वीं में किया हो।	
5	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम - CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: - साधारण अवकल समीकरणों को पहचानें और उन्हें कोटि (प्रथम-कोटि, द्वितीय-कोटि, आदि) और प्रकार (रैखिक, अरैखिक) के आधार पर वर्गीकृत करने में। - विभिन्न गणितीय प्रतिरूपों के लिए अवकल समीकरण के सूत्रीकरण करने में। - भौतिकी, जीव विज्ञान, इंजीनियरिंग और अर्थशास्त्र में व्यावहारिक समस्याओं का प्रतिरूपीकरण करने और हल करने के लिए साधारण अवकल समीकरणों को लागू करने में।	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Virnit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
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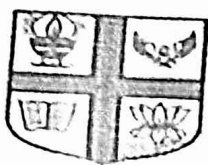
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		4. अवकल राशीकरणों का उपयोग करके यांत्रिक प्रणालियों, जैविक प्रणालियों, विद्युत् परिपथ आदि के गणितीय प्रतिरूप को निर्मित करने में।	
6	क्रेडिट मान	सैद्धांतिक: 4	
7	कुल अंक	अधिकतम अंक: 30 + 70	न्यूनतम उत्तीर्णांक: 35

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 60 घंटे

मॉड्यूल	विषय	घंटे की संख्या
I	भारतीय ज्ञान परंपरा: 1.1 अवकल समीकरणों की ऐतिहासिक पृष्ठभूमि 1.2 अवकल समीकरण के क्षेत्र में भारतीय गणितज्ञों का योगदान: 1.2.1 आर्यभट्ट 1.2.2 भास्कराचार्य 1.2.3 माधव	05
II	अवकल समीकरण-I: 2.1 रैखिक अवकल समीकरण 2.1.1 रैखिक समीकरण 2.1.2 रैखिक समीकरण में समानेय अवकल समीकरण 2.1.3 चरों का परिवर्तन 2.2 यथातथ अवकल समीकरण 2.3 प्रथम कोटि एवं उच्च घातीय अवकल समीकरण 2.3.1 x, y और p में हल होने योग्य	20

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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	2.3.2 x और y में समघात समीकरण 2.3.3 क्लेरो का समीकरण 2.3.4 विचित्र हल	
III	अवकल समीकरण -II: 3.1 अचर गुणांकों वाले रैखिक अवकल समीकरण 3.2 साधारण रैखिक समघात अवकल समीकरण 3.3 द्वितीय कोटि के रैखिक अवकल समीकरण	20
IV	अवकल समीकरण - III: 4.1 प्राचल विचरण विधि 4.2 प्रथम कोटि का साधारण युगपत अवकल समीकरण	10
वस्तु स्थिति अध्ययन / गतिविधि	औद्योगिक अनुप्रयोग: उद्योग, व्यापार और अर्थशास्त्र से संबंधित समस्याओं को हल करने के लिए अवकल समीकरण के अनुप्रयोग।	05
सार बिंदु (कीवर्ड)/ टैग: रैखिक अवकल समीकरण, यथातथ अवकल समीकरण, प्रथम कोटि एवं उच्च घातीय अवकल समीकरण, अचर गुणांकों वाले रैखिक अवकल समीकरण, प्राचल विचरण विधि।		

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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भाग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
2. M. D. Raisinghania: Ordinary and Partial Differential Equations, S. Chand & Co Ltd, 20
3. Gerard G. Emch, R. Sridharan and M. D. Srinivas. Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.
4. Bharati Krana Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi 1994.
5. Udayan S. Patankar & sunil S. Patankar: Elements of Vedic Mathematics, TTU Press, 2018.
6. Enrique Fernández-Cara: Ordinary Differential Equations and Applications, World Scientific, 2024.
7. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. G. F. Simmons: Differential Equations, Tata McGraw Hill, 1972.
2. E. A. Codington: An Introduction to Ordinary Differential Equation, Prentice Hall of India, 1961.

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
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Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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Affiliated to Ram Durgavan Vishwavidyalaya, Jabalpur (M.P.)

3. D. A. Murray: Introductory Course in Differential Equations, Orient Longman (India) 1967.
4. H. T. H Piaggio: Elementary Treatise on Differential Equations and their Application, C. B. S. Publisher & Distributors, Delhi. 1985.
5. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
6. Balachandra Rao: Differential Equations with Applications, Universities Press, 1996.

अनुशंसित डिजिटल प्लेटफॉर्म / वेब लिंक:

<https://epgp.inflibnet.ac.in>

<https://freevideolectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111106100/>

<https://nptel.ac.in/courses/111/101/111101080/>

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



ST. ALOYSIUS' COLLEGE JABALPUR (MADHYA PRADESH)

Autonomous Re-accredited A++ Grade by NAAC (CGPA 3.38/4.00)

College with Potential for Excellence (CPE) by UGC

DSE 11ST Superschool & Star College Scheme by DIT

Affiliated to Ram Durgawan Vishwavidyalaya, Jabalpur (M.P.)

भाग द - अनुशंसित मूल्यांकन विधियाँ

अनुशंसित सतत मूल्यांकन विधियाँ:

अधिकतम अंक 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन:	क्वैसा टेस्ट	30 अंक
सतत व्यापक मूल्यांकन (CCE):	असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	
आकलन:	अनुभाग (अ): बहुविकल्पीय प्रश्न	70 अंक
विश्वविद्यालयीन परीक्षा	अनुभाग (ब): लघु उत्तरीय प्रश्न	
समय: 03.00 घंटे	अनुभाग (स): दीर्घ उत्तरीय प्रश्न	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maltra	
Dr. Mita Darbari		Dr. Sandoep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



ST. ALOYSIUS' COLLEGE JABALPUR (MADHYA PRADESH)

Recognized by the Government of India, Ministry of Education, New Delhi (U-1584-003)

College with Potential for Excellence (CPE) - 1st Grade

On 11.11.2017 Surrounded & Star College Scheme by 1984

Affiliated to St. Xavier's (Autonomous) Vishwavidyalaya, Jabalpur (M.P.)

B.Sc. Second Semester Minor - 2

Part A: Introduction

Program: Certificate Course	Class: B.Sc.	Second Semester	Session: 2026- 2027
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Subject: Mathematics

1	Course Code	
2	Course Title	Ordinary Differential Equations
3	Course Type	Minor - 2
4	Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics in class 12 th .
5	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Recognize ordinary differential equations and classify them based on order (first-order, second-order, etc.) and type (linear, nonlinear). 2. Formulate the Differential equations for various Mathematical models. 3. Apply ordinary differential equations to model and solve practical problems in physics, biology, engineering, and economics.

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Dasgupta		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



ST. ALOYSIUS' COLLEGE JABALPUR (MADHYA PRADESH)

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		5. Formulate mathematical models of mechanical systems, biological systems, electrical circuits, and more using differential equations.	
6	Credit Value	Theory: 4	
7	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

Part B: Content of the Course

Total Lectures: 60 hours

Unit	Topics	No. of Lectures
I	Indian Knowledge System: 1.1 Historical Background of Differential Equations 1.2 Contribution of Indian Mathematicians in Differential Equations: 1.2.1 Aryabhata 1.2.2 Bhaskracharya 1.2.3 Madhava	05
II	Differential Equations - I: 2.1 Linear differential equations	20

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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Dr. Archana Pasari		Dr. Gopal Meena	
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Ms. Abhileka Verma			



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	2.1.1 Linear equation 2.1.2 Equations reducible to the linear form 2.1.3 Change of variables 2.2 Exact differential equations 2.3 First order and higher degree differential equations 2.3.1 Equations solvable for x, y and p 2.3.2 Equations homogenous in x and y 2.3.3 Clairaut's equation 2.3.4 Singular solutions	
III	Differential Equations - II: 3.1 Linear differential equation with constant coefficients 3.2 Homogeneous linear ordinary differential equations 3.3 Linear differential equations of second order	20
IV	Differential Equations - III: 4.1 Method of variation of parameters 4.2 Ordinary Simultaneous Differential Equation of First Order	10
Case Study/ Activity	Industrial Applications:	05

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Dr. Archana Pasari		Dr. Gopal Meena	
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Case Study/ Activity	Industrial Applications: Applications of Differential equations to solve the problems related to Industries, Business and Economics.	05
Keywords/Tags: Linear differential equations, Exact differential equations, First order and higher degree differential equations, Linear differential equation with constant coefficients, Method of variation of parameters.		

Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
2. M. D. Raisinghania: Ordinary and Partial Differential Equations, S Chand & Co Ltd, 2017.
3. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
4. Bharati KrsnaTirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
5. Udayan S. Patankar & sunil S. Patankar: Elements of Vedic Mathematics, TTU Press, 2018.

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6. Enrique Fernández-Cara: Ordinary Differential Equations and Applications, World Scientific, 2024.
7. मध्य प्रदेश हिंदी श्रंखला अकादमी की पुस्तकें।

Reference Books:

1. G. F. Simmons: Differential Equations, Tata McGraw Hill. 1972.
2. E. A. Coddington: An Introduction to ordinary differential Equation, Prentice Hall of India, 1961.
3. D. A. Murray: Introductory Course in Differential Equations, Orient Longman (India) 1967.
4. H. T. H Piaggio: Elementary Treatise on Differential Equations and their Application, C. B.S. Publisher & Distributors, Delhi. 1985.
5. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
6. Balachandra Rao: Differential Equations with Applications, Universities Press, 1996.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://freevidelectures.com/university/iit-roorkee>

<https://www.eshiksha.mp.gov.in/mpdhe>

Suggested Equivalent online courses:

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbāri		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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<https://nptel.ac.in/courses/111106100/>

<https://nptel.ac.in/courses/111/101/111101080/>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:

100

Continuous Comprehensive Evaluation (CCE): 30 Marks

University Exam (UE):

70 Marks

Internal Assessment:

Total Marks: 30

Continuous Comprehensive Evaluation (CCE)

External Assessment:

University Exam Section

Time: 03.00 Hours

Section (A): Multiple Choice
Questions

Section (B): Short Questions

Section (C): Long Questions

Total Marks: 70

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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhileka Verma			



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Part A : Introduction			
Program: Certificate Course		Class: B.Sc. I Semester	Year: 2026 Session: 2026-2027
Subject: Mathematics			
1	Course Code		
2	Course Title	Mathematical Logic	
3	Course Type	Multi/Inter Disciplinary	
4	Pre-requisite (if any)	Open for all	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Using the principles of logic to distinguish between sound and unsound reasoning in discourse of everybody. 2. Construct truth tables for logical expressions; test statements for logical equivalence and represent mathematical statements in the language of predicate language. 3. Using the appropriate set theoretic concepts, thinking process, tools and techniques in the solution to various conceptual or real-world problems. 4. Learn the operations involved in fuzzy logic systems, including fuzzy intersection, union, and complement. 5. Apply fuzzy logic to various real-world applications across different fields.	
6	Credit Value	Theory: 3	
7	Total Marks	Max. Marks: 100	Min. Passing Marks: 35

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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Part B: Content of the Course

Total Lectures: 45 hours

Module	Topics	No. of Hours
I	Indian Knowledge System: 1.1 Basic concepts of Mathematical Logic in ancient India 1.2 Panini's Logical Structure 1.3 Avaktavtakta 1.4 Navya-Nyaya Logic	05
II	Language of Mathematics: 2.1 Propositions and Truth table 2.2 Negation, Conjunction and Disjunction 2.3 Implications and Double implication 2.4 Bi-conditional propositions 2.5 Contrapositive Implication and converse 2.6 Contrapositive and inverse propositions 2.7 Tautology and Contradiction 2.8 Logical equivalences 2.9 Predicates and quantifiers 2.10 De-Morgan Law	15
III	Formal Language: 3.1 Language 3.1.1 String 3.1.2 Length of String 3.2 Phrase Structure Grammars 3.2.1 Derivation 3.2.2 Language of a Grammar 3.3 Types of Grammar and Languages 3.3.1 Type-3 Grammar 3.3.2 Type-2 Grammar 3.3.3 Type-1 Grammar 3.3.4 Type-0 Grammar 3.3.5 Type-i Language	10

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IV	Fuzzy Logic: 4.1 Introduction to Fuzzy Logic 4.1.1 Fuzzy Propositions 4.1.2 Logical Connectives in Fuzzy Logic 4.1.3 Types of Fuzzy Propositions 4.2 Comparison with Classical Logic 4.3 Applications of Fuzzy Logic 4.4 Advantages of Fuzzy Logic	10
Case Study	1. Applications of mathematical logic to solved real world problems. 2. Applications of Fuzzy logic to solved real world problems.	05
Keywords/ Tags: Panini's Logical Structure, Navya-Nyaya Logic, Mathematical Logic, Formal Language, Fuzzy Logic		

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Part C – Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. R. M. Somasundaram: Discrete Mathematical Structures, PHI Learning Pvt. Ltd., 2003.
2. Samar Ballav Bhoi: A Text Book of Logic and Sets, Educreation Publishing, 2018.
3. Ganesh: Introduction to Fuzzy Sets and Fuzzy Logic, Prentice Hall India Learning Private Limited, 2006.
4. Rosen H: Discrete Mathematics and its Applications, McGraw Hill Education, 2017.
5. Lotfi A Zadeh and Rafik A Aliev: Fuzzy Logic Theory and Applications, World Scientific Publishing, 2018.
6. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. Ajit Kumar, S. Kumaresan, Bhaba Kumar Sarma: A Foundation Course in Mathematics, Alpha Science International Ltd, 2018.
2. R. P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998.
3. Jean-Paul Tremblay, R Manohar: Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill Education, 1st edition, 2017.
4. G. J. Klir and B. Yuan: Fuzzy sets and Fuzzy logic, Pearson, 2015.

Suggested Digital Platforms Web links:

<https://www.eshiksha.mp.gov.in/mpdhe>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111/106/111106052/>

<https://nptel.ac.in/courses/108104157>

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Ms. Abhileka Verma			



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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

University Exam (UE): 100 Marks

Internal Assessment:	Section (A) : Multiple Choice Questions	Total Marks: 100
University Exam Section	Section (B) : Short Questions	
Time: 02:00 Hours	Section (C) : Long Questions	

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DSEI IIT/I Supported & Star College Scheme by DBT

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Part A : Introduction

Program:

Certificate Course

Class: B.Sc. I Semester

Year: 2026

Session: 2026-2027

Subject: Mathematics

1	Course Code	Foundational Mathematics for Industry	
2	Course Title		
3	Course Type		
4	Pre-requisite (if any)	SEC/VOC	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand the basic concepts of industry in ancient India and modern era 2. Understand the basic concepts of small cottage industries. 3. Understand the basic concepts and terminology used in linear programming, including optimization, objective functions, constraints, and feasible regions, 4. Learn how to translate real-world problems into linear programming models. 5. Solve LP problems using the Simplex algorithm, a powerful method for solving linear programs with more than two variables. 6. Understand the concept of duality in LP, including the relationship between primal and dual problems. 7. Apply linear programming to solve real-world problems in areas such as manufacturing, transportation, finance, and resource allocation.	
6	Credit Value	Theory: 3	
7	Total Marks	Max. Marks: 100	Min. Passing Marks: 35

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Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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Part B: Content of the Course

Total Lectures: 45 hours

Module	Topics	No. of Lectures
I	Indian Knowledge System: 1.1 Basic concepts of industry in ancient India 1.1.1 Agriculture 1.1.2 Textile 1.1.3 Metallurgy 1.1.4 Stonework 1.1.5 Trade 1.2 Various types of industries in modern era	05
II	Linear Programming Problems: 2.1 Basic concepts of LPP 2.2 Mathematical formulation of LPP 2.3 Solving LPP 2.3.1 Corner Point Method 2.3.2 Graphical Method 2.4 Simplex method for solving LPP 2.4.1 Maximization Problem 2.4.2 Minimization or Dual Problem 2.4.3 Mixed Constraints Problem	20
III	Applications of Linear Programming: 3.1 Manufacturing and Production Planning 3.2 Supply Chain Management 3.3 Transportation and Logistics 3.4 Allocation problems 3.5 Telecommunications Network Design 3.6 Agriculture and Food Production Case Study 3.7 Healthcare and Medicine	15

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Case Study	Basic concepts of small cottage industries with minimum cost and maximum profit viz. handicrafts like weaving, pottery, jewelry making, soap making, candle crafting, pickle making, garment stitching, baking, homemade food products, and small-scale vegetable farming.	05
Keywords/ Tags: Industry in ancient and modern India, Linear Programming Problems, Simplex method, Manufacturing problems, Diet problems, Transportation problems, Allocation problems, Small cottage industries.		

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Part C – Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. G. Hadley: Linear Programming, Narosa Publishing House, New Delhi, 2002,
2. Pundir S. K.: Linear Programming with Game Theory, CBS Publications, 2020.
3. Nita H. Shah, Ravi M. Gor, Hardik Soni: Operations Research, PHI Learning Pvt.. Ltd., 2007.
4. Dilip K. Chakrabarti: Economy: Agriculture, Crafts and Trade, Aryan Books International, 2018.
5. Balram Srivastava: Trade and Commerce in Ancient India, Chaukhamba Amarabharati Prakashan, 1968.
6. NIIR Board: Profitable Small, Cottage & Home industries, National Institute Of Industrial Research, 2005.
7. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali: Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
2. S. K. Sharma: Linear Programming, Cyber Tech Publications, 2009.
3. S. D. Sharma – Operations Research, Kedar Nath Publication, 2012.
4. Kanti Swarup, P.K. Gupta and Manmohan: Operations Research, Sultan Chand and Sons, New Delhi, 2014.

Suggested Digital Platforms Web links:

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://epathshala.ncert.org.in/>, <https://epgp.inflibnet.ac.in/>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/112106134>

<https://nptel.ac.in/courses/110106164>

<https://nptel.ac.in/courses/116102005>

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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

University Exam (UE): 100 Marks

Internal Assessment:	Section (A) : Multiple Choice Questions	Total Marks: 100
University Exam Section	Section (B) : Short Questions	
Time: 02:00 Hours	Section (C) : Long Questions	

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भाग 3 - परिचय			
कार्यक्रम: प्रमाण पत्र		कक्षा: बी.एससी. प्रथम सेमेस्टर	वर्ष: 2026
			सत्र: 2026-2027
विषय : गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	गणितीय तर्क	
3	पाठ्यक्रम का प्रकार	बहु/अंतर-संकाय	
4	पूर्वापेक्षा (Prerequisite)	सभी के लिए उपलब्ध	
5	पाठ्यक्रम अध्ययन की परिलक्षितियां (कोर्स लर्निंग आउटकम) (CLO)	पाठ्यक्रम छात्रों को सक्षम करेगा: - प्रत्येक कथन में सत्य और असत्य तर्क के मध्य अंतर करने के लिए तर्क के सिद्धांतों का उपयोग करने में। - तार्किक व्यंजकों के लिए सत्य तालिकाओं का निर्माण करना; तार्किक तुल्यता के लिए कथनों का परीक्षण करना और गणितीय कथनों को विधेय भाषा में प्रस्तुत करने में। - विभिन्न वैचारिक या वास्तविक दुनिया की समस्याओं के समाधान में उपयुक्त सामुच्चय सैद्धांतिक अवधारणाओं, सोच प्रक्रिया, उपकरणों और तकनीकों का उपयोग करने में। - अस्फुट (Fuzzy) तर्क प्रणाली में सम्मिलित संक्रियाओं को जानने में, जिसमें अस्फुट सर्वनिष्ठ, संघ और पूरक सम्मिलित हैं। - विभिन्न क्षेत्रों में वास्तविक दुनिया के अनुप्रयोगों के लिए अस्फुट तर्क लागू करने में।	
6	क्रेडिट मान	सैद्धांतिक : 3	
7	कुल अंक	अधिकतम अंक: 100	न्यूनतम उत्तीर्ण अंक: 35

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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Ms. Abhileka Verma			



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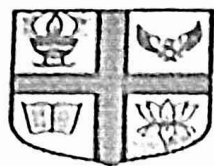
Affiliated to Ram Durgavan Vishwavidyalaya, Jabalpur (M.P.)

भाग ब-पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 45 घंटे

मॉड्यूल	विषय	घंटों की संख्या
I	भारतीय ज्ञान परंपरा: 1.1 प्राचीन भारत में गणितीय तर्क की बुनियादी अवधारणाएँ 1.2 पाणिनि की तार्किक संरचना 1.3 अवक्तव्यवत्ता 1.4 नव्य-न्याय तर्क	05
II	गणित की भाषा: 2.1 साध्य और सत्यता सारणी 2.2 निषेध, संयोजन और वियोजन 2.3 सोपाधिक और द्वि-सोपाधिक 2.4 द्वि-प्रतिबंध साध्य 2.5 प्रतिधनात्मक सोपाधिक और विलोम 2.6 प्रतिधनात्मक एवं प्रतिलोम साध्य 2.7 पुनरुक्ति और विरोध 2.8 तार्किक तुल्यता 2.9 विधेय और प्रमात्रिक 2.10 डी-मॉर्गन का नियम	15
III	औपचारिक भाषा: 3.1 भाषा 3.1.1 स्ट्रिंग 3.1.2 स्ट्रिंग की लंबाई 3.2 वाक्यांश संरचना व्याकरण 3.2.1 व्युत्पत्ति 3.2.2 व्याकरण की भाषा 3.3 व्याकरण और भाषाओं के प्रकार 3.3.1 प्रकार-3 व्याकरण	10

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	3.3.2 प्रकार-2 व्याकरण 3.3.3 प्रकार-1 व्याकरण 3.3.4 प्रकार-0 व्याकरण 3.3.5 प्रकार-भाषा	
IV	अस्फुट (Fuzzy) तर्क: 4.1 अस्फुट तर्क का परिचय 4.1.1 अस्फुट साध्य 4.1.2 अस्फुट तर्क में तार्किक संयोजन 4.1.3 अस्फुट साध्यों के प्रकार 4.2 चिरप्रतिष्ठित तर्क से तुलना 4.3 अस्फुट तर्क के अनुप्रयोग 4.4 अस्फुट तर्क के लाभ	10
वस्तुस्थिति अध्ययन / गतिविधि	1. वास्तविक दुनिया की समस्याओं को हल करने के लिए गणितीय तर्क के अनुप्रयोग। 2. वास्तविक दुनिया की समस्याओं को हल करने के लिए अस्फुट तर्क के अनुप्रयोग।	05

सार बिंदु (की वर्ड)/टैग:
पाणिनि की तार्किक संरचना, नव्य-न्याय तर्क, गणितीय तर्क, औपचारिक भाषा, अस्फुट तर्क।

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
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भाग स- अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तक, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. R. M. Somasundaram: Discrete Mathematical Structures, PHI Learning Pvt. Ltd., 2003.
2. Samar Ballav Bhoi: A Text Book of Logic and Sets, Educreation, Publishing, 2018.
3. Ganesh: Introduction to Fuzzy Sets and Fuzzy Logic, Prentice Hall India Learning Private Limited, 2006.
4. Rosen H: Discrete Mathematics and its Applications, McGraw Hill Education, 2017.
5. Lotfi A Zadeh and Rafik A Aliev: Fuzzy Logic Theory and Applications, World Scientific Publishing, 2018.
6. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

सन्दर्भ पुस्तकें:

1. Ajit Kumar, S. Kumaresan, Bhaba Kumar Sarma: A Foundation Course in Mathematics, Alpha Science International Ltd, 2018.
2. R. P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998.
3. Jean-Paul Tremblay, R Manohar: Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill Education, 1st edition, 2017.
4. G. J. Klir and B. Yuan: Fuzzy sets and Fuzzy logic, Pearson, 2015.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक:

<https://www.eshiksha.mp.gov.in/mpdhe>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111/106/111106052/>

<https://uptel.ac.in/courses/108104157>

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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भाग द-अनुशंसित मूल्यांकन विधियां

अनुशंसित सतत मूल्यांकन विधियां:

अधिकतम अंक: 100

विश्वविद्यालय परीक्षा (UE): 100 अंक

आकलन :

विश्वविद्यालयीन परीक्षा:

समय: 02.00 घंटे

अनुभाग (अ): बहु विकल्पीय प्रश्न

अनुभाग (ब): लघु उत्तरीय प्रश्न

अनुभाग (स): दीर्घ उत्तरीय प्रश्न

100 अंक

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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भाग 3 - परिचय			
कार्यक्रम: प्रमाण पत्र	कक्षा: बी.एससी. प्रथम सेमेस्टर	वर्ष: 2026	सत्र: 2026-2027
विषय : गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	उद्योग के लिए आधारभूत गणित	
3	पाठ्यक्रम का प्रकार	SEC/VOC	
4	पूर्वापेक्षा (Prerequisite)	सभी के लिए उपलब्ध	
5	पाठ्यक्रम अध्ययन की परिलब्धियां (कोर्स लर्निंग आउटकम) (CLO)	पाठ्यक्रम छात्रों को सक्षम करेगा: 1. प्राचीन भारत और आधुनिक युग में उद्योग की बुनियादी अवधारणाओं को समझने में। 2. लघु कुटीर उद्योगों की बुनियादी अवधारणाओं को समझने में। 3. इष्टतमीकरण, उद्देश्य फलनों, बाधाओं और व्यवहार्य क्षेत्रों सहित रैखिक क्रमादेशन में उपयोग की जाने वाली मूलभूत अवधारणाओं और शब्दावली को समझने में। 4. वास्तविक दुनिया की समस्याओं को रैखिक क्रमादेशन प्रतिरूप में अनुवाद करना सीखने में। 5. एकधा कलनविधि का उपयोग करके रैखिक क्रमादेशन समस्याओं को हल करने में, जो दो से अधिक चर वाले रैखिक क्रमादेशन को हल करने के लिए एक शक्तिशाली विधि है। 6. रैखिक क्रमादेशन में द्वैत की अवधारणा को समझने में, जिसमें आद्य और द्वैत समस्याओं के मध्य संबंध सम्मिलित हैं। 7. विनिर्माण, परिवहन, वित्त और संसाधन आवंटन जैसे क्षेत्रों में वास्तविक दुनिया की समस्याओं को हल करने के लिए रैखिक क्रमादेशन को लागू करने में।	
6	क्रेडिट मान	सैद्धांतिक : 3	
7	कुल अंक	अधिकतम अंक: 100	न्यूनतम उत्तीर्ण अंक: 35

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhitoka Verma			



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भाग व-पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 45 घंटे

मॉड्यूल	विषय	घंटों की संख्या
I	भारतीय ज्ञान परंपरा: 1.1 प्राचीन भारत में उद्योग की बुनियादी अवधारणाएँ 1.1.1 कृषि 1.1.2 कपड़ा 1.1.3 धातुकर्म 1.1.4 पत्थर का काम 1.1.5 व्यापार 1.2 आधुनिक युग में विभिन्न प्रकार के उद्योग	05
II	रैखिक क्रमादेशन समस्या: 2.1 रैखिक क्रमादेशन समस्याओं की मूल अवधारणा 2.2 रैखिक क्रमादेशन समस्याओं का गणितीय सूत्रीकरण 2.3 रैखिक क्रमादेशन समस्याओं को हल करना 2.3.1 कोनीय बिन्दु विधि 2.3.2 आलेखीय विधि 2.4 रैखिक क्रमादेशन समस्याओं को हल करने के लिए एकधा विधि 2.4.1 अधिकतमीकरण समस्या 2.4.2 न्यूनतमीकरण या द्वैत समस्या 2.4.3 मिश्रित व्यवरोध समस्या	20
III	रैखिक क्रमादेशन के अनुप्रयोग: 3.1 विनिर्माण और उत्पादन योजना 3.2 आपूर्ति श्रृंखला प्रबंधन 3.3 परिवहन और रसद 3.4 आवंटन समस्याएं 3.5 दूरसंचार और नेटवर्क अभिकल्पना 3.6 कृषि और खाद्य उत्पादन 3.7 स्वास्थ्य सेवा और चिकित्सा	15

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Ms. Abhilekha Verma			



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वस्तुस्थिति अध्ययन / गतिविधि	न्यूनतम लागत और अधिकतम लाभ वाले लघु कुटीर उद्योगों की मूल अवधारणाएँ जैसे, हस्तशिल्प जैसे बुनाई, मिट्टी के बर्तन का निर्माण, आभूषण निर्माण, साबुन बनाना, गोमबत्ती शिल्पकला, अचार बनाना, परिधान शिलाई, बेकिंग, घर पर बने खाद्य उत्पाद और छोटे पैमाने पर सब्जी की खेती।	05
सार बिंदु (की बर्त) / टैग: प्राचीन एवं आधुनिक भारत में उद्योग, ऐतिहासिक क्रमादेशन समस्याएँ, एकता विधि, विनिर्माण समस्याएँ, आहार समस्याएँ, परिवहन समस्याएँ, आवंटन समस्याएँ, लघु कुटीर उद्योग।		

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भाग स- अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तक, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / ग्रन्थ अन्य पाठ्य संसाधन/पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. G. Hadley: Linear Programming, Narosa Publishing House, New Delhi, 2002.
2. Pundir S. K.: Linear Programming with Game Theory, CBS Publications, 2020.
3. Nita H. Shah, Ravi M. Gor, Hardik Soni: Operations Research, PHI Learning Pvt. Ltd., 2007.
4. Dilip K. Chakrabarti: Economy: Agriculture, Crafts and Trade, Aryan Books International, 2018.
5. Balram Srivastava: Trade and Commerce in Ancient India, Chaukhamba Amarabharati Prakashan, 1968.
6. NIIR Board: Profitable Small, Cottage & Home industries, National Institute Of Industrial Research, 2005.
7. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

सन्दर्भ पुस्तकें:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali: Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
2. S. K. Sharma: Linear Programming, Cyber Tech Publications, 2009.
3. S. D. Sharma Operations Research, Kedar Nath Publication, 2012.
4. Kanti Swarup, P.K. Gupta and Manmohan: Operations Research, Sultan Chand and Sons, New Delhi, 2014.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक:

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://epgp.inflibnet.ac.in/>

<https://epathshala.ncert.org.in/>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/112106134>

<https://nptel.ac.in/courses/110106164>

<https://nptel.ac.in/courses/116102005>

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhileka Verma			



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भाग द-अनुशंसित मूल्यांकन विधियां

अनुशंसित सतत मूल्यांकन विधियां:

अधिकतम अंक: 100

विश्वविद्यालय परीक्षा (UE): 100 अंक

आकलन :

विश्वविद्यालयीन परीक्षा:

समय: 02.00 घंटे

अनुभाग (अ): बहु विकल्पीय प्रश्न

अनुभाग (ब): लघु उत्तरीय प्रश्न

अनुभाग (स): दीर्घ उत्तरीय प्रश्न

100 अंक

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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BACHELOR OF SCIENCE (B.Sc. III, अमूर्त बीजगणित, कोर कोर्स (मेजर C-4),)

भाग अ - परिचय			
कार्यक्रम- स्नातक	कक्षा -बी.एससी. द्वितीय वर्ष	सेमेस्टर - III	सत्र: 2026-2027
विषय गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	अमूर्त बीजगणित	
3	पाठ्यक्रम	कोर कोर्स (मेजर C-4)	
4	पाठ्यक्रम का प्रकार	टाइप - 1	
5	पूर्वापेक्षा (Prerequisite):	इस पाठ्यक्रम का अध्ययन करने के लिए, विद्यार्थी के पास स्नातक प्रथम वर्ष में गणित विषय (मेजर या माइनर) होना चाहिए।	
6	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: - बीजीय संरचनाओं की समूह के रूप में पहचान करना, और उन्हें आबेली, चक्रीय और क्रमचय समूहों आदि के रूप में वर्गीकृत करना। - समूहों और सममित आकृतियों की मूलभूत अवधारणाओं का संयोजन करना। - चक्रीय समूहों के उपसमूहों का विश्लेषण करना। - सहसमुच्चयों, प्रसामान्य उपसमूहों और विभाग समूहों के अंकन के महत्व की व्याख्या करना।	

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Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhileka Verma			



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		5. वलय, क्षेत्र, उपवलय, पूर्णांकीय प्रांत और संगत आकारिता की आधारभूत अवधारणा की समझ।
7	क्रेडिट मान	सैद्धांतिक: 6
8	कुल अंक	अधिकतम अंक: 30 + 70 न्यूनतम उत्तीर्णांक: 35

भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 90 घंटे

मॉड्यूल	विषय	घंटे की संख्या
1	भारतीय ज्ञान परंपरा: 1.1 अमूर्त बीजगणित की ऐतिहासिक पृष्ठभूमि 1.2 वैदिक सूत्र द्वारा किसी भी भाजक की विभाज्यता की परीक्षण 1.2.1 निखिलं नवतश्चरमं दशतः 1.2.2 परावर्त्य योजयेत् 1.3 वैदिक सूत्र द्वारा दो और तीन चरों वाले द्वितीय घात समरूप बहुपदों का गुणनखंडन 1.3.1 ऊर्ध्व-तिर्यग्भ्यम् 1.3.2 आद्यम् आद्येन अन्त्यम् अन्त्येन 1.4 'डायोफेन्टाइन समीकरणों' को हल करने की प्राचीन भारतीय कुट्टक विधि (आर्यभट्ट और भास्कराचार्य द्वारा प्रतिपादित)	21

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	2.1 समूह, उपसमूह तथा उनके आधारभूत गुणधर्म 2.2 चक्रीय समूह 2.3 सहसमुच्चय वियोजन 2.4 लॉग्रांज एवं फर्मा की प्रमेय 2.5 प्रसामान्य उपसमूह 2.6 विभाग समूह	
II	3.1 समूहों की समाकारिता एवं तुल्यकारिता 3.2 समाकारिता की मूलभूत प्रमेय 3.3 रूपान्तरण एवं क्रमचय समूह S_n ($n < 5$) 3.4 कैली का प्रमेय 3.5 समूह स्वकारिता 3.6 अंतः स्वकारिता 3.7 स्वकारिताओं का समूह	18
III	4.1 संयुग्मी संबंध और केंद्रक 4.2 प्रसामान्यक 4.3 गणना सिद्धांत और परिमित समूह का वर्ग समीकरण 4.4 परिमित आबेलीय समूहों और अ-आबेलीय समूहों के लिए कॉशी प्रमेय	15
IV	5.1 वलय की परिभाषा एवं सामान्य गुणधर्म 5.2 वलय समाकारिता 5.3 उपवलय 5.4 गुणजावली 5.5 विभाग वलय 5.6 बहुपद वलय	18

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V	6.1 पूर्णांकीय प्रान्त 6.2 यूक्लिडीय प्रान्त 6.3 अद्वितीय गुणनखंडन प्रान्त 6.4 क्षेत्र 6.5 विभाग क्षेत्र	18
अध्ययन गतिविधियाँ	1. चर्चा करें कि समूह, उपसमूह, समूहों की समाकारिता, वलय, गुणजावली, यूक्लिडीय प्रांत, अद्वितीय गुणनखंडन प्रांत और क्षेत्र भारतीय गणितज्ञों के कार्य से कैसे जुड़े हैं। 2. विश्लेषित करें कि समूह, उपसमूह, समूहों की समाकारिता, वलय, गुणजावली, यूक्लिडीय प्रांत, अद्वितीय गुणनखंडन प्रांत और क्षेत्र को वास्तविक दुनिया की समस्याओं को हल करने के लिए कैसे लागू किया जा सकता है। 3. शिक्षक अन्य गतिविधियाँ भी आवंटित कर सकते हैं।	17
सार बिंदु (की वर्ड)/ टैग: समूह, उपसमूह, समूहों की समाकारिता एवं तुल्यकारिता, वलय, गुणजावली, क्षेत्र।		

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भाग रा - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सागरी:

पाठ्य पुस्तकें:

1. Bharati Krishna Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
2. Dr. Satya Dev Sharma: Aryabhatiyam, Chaukhambha Surbharati prakashan, Varanasi, 2013.
3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1977.
4. Shanti Narayan: A text Book of Modern Abstract Algebra, S. Chand and Company. New Delhi, 1967.
5. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. Udayan S. Patankar & sunil S. Patankar: Elements of Vedic Mathematics, TTU Press, 2018.
2. Surjeet Singh and Qazi Zameeruddin: Modern Algebra, Vikas Publishing House Pvt Ltd; Eighth edition, 2006.
3. N. Jacobson: Basic Algebra. Vol. I and II, W. H Freeman, 1980.
4. I. S. Luther and I. B. S. Passi: Algebra. Vol. I and II, Narosa Publishing House, 1997.
5. A. K. Vasishtha and A. R. Vasishtha: Modern Algebra, Krishna Publication; 68th edition, 2015.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक :

<https://epgp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swayam.gov.in>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम :

<https://nptel.ac.in/courses/111105112>

https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/32

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भाग द - आकलन एवं मूल्यांकन

(उन पाठ्यक्रमों के लिए जिनमें 70 अंकों की बाह्य सैद्धांतिक परीक्षा होती है)

अनुशासित सतत मूल्यांकन विधियाँ:

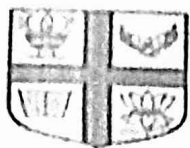
अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन: सतत व्यापक मूल्यांकन (CCE):	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	30 अंक
आकलन: विश्वविद्यालयीन परीक्षा समय: 03.00 घंटे	अनुभाग (अ): बहुविकल्पीय प्रश्न अनुभाग (ब): लघु उत्तरीय प्रश्न अनुभाग (स): दीर्घ उत्तरीय प्रश्न	70 अंक

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BACHELOR OF SCIENCE (B.Sc. III Semester, Core (Major C-4), Abstract Algebra)

Part A : Introduction			
Program : UG	Class: B.Sc. II Year	Semester: III	Session: 2026-27
Subject: Mathematics			
1	Course Code		
2	Course Title	Abstract Algebra	
3	Course	Core (Major C-4)	
4	Course Type	Type I	
5	Pre-requisite (if any)	To study this course, a student must have the subject Mathematics (Major or Minor) in first year.	
6	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Recognize the algebraic structures as a group, and classify them as abelian, cyclic and permutation groups, etc. 2. Link the fundamental concepts of groups and symmetrical figures. 3. Analyze the subgroups of cyclic groups. 4. Explain the significance of the notion of cosets, normal subgroups, and quotient groups. 5. The fundamental concept of rings, fields, subrings, integral domains and the corresponding morphisms.	
7	Credit Value	Theory: 6	
8	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

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Part B: Content of the Course

Total Lectures: 90 hours

Module	Topics	No. of Hours
I	Indian Knowledge System: 1.1 Historical Background of Abstract Algebra 1.2 Divisibility tests for any divisor by following Vedic Sutra 1.2.1 Nikhilam Navataścaramam Daśataḥ 1.2.2 Parāvartya Yojayet 1.3 Factorization of second-degree homogeneous polynomials in two and three variables by following Vedic Sutra 1.3.1 Urdhva-Tiryagbhyām 1.3.2 Ādyamādyena Antyamantyena 1.4 The ancient Bhartiya 'Kuttaka Method' (Propounded by Aryabhata and Bhaskaracharya) for solving 'Diophantine Equations'	21
	2.1 Groups, Subgroups and their basic properties 2.2 Cyclic groups 2.3 Coset decomposition 2.4 Lagrange's and Fermat's theorem 2.5 Normal subgroups 2.6 Quotient groups	
II	3.1 Homomorphism and Isomorphism of groups 3.2 Fundamental theorem of homomorphism 3.3 Transformation and permutation group S_n ($n < 5$) 3.4 Cayley's theorem 3.5 Group automorphism 3.6 Inner automorphism 3.7 Group of automorphisms	18
III	4.1 Conjugacy relation and centralizer 4.2 Normaliser 4.3 Counting principle and the class equation of a finite group 4.4 Cauchy's theorem for finite abelian groups and non abelian groups	15
IV	5.1 Definition and basic properties of rings 5.2 Ring homomorphism	18

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	5.3 Subring 5.4 Ideals 5.5 Quotient ring 5.6 Polynomial ring	
V	6.1 Integral domain 6.2 Euclidean Domain 6.3 Unique Factorization Domain 6.4 Field 6.5 Quotient Field	18

Suggested Activities:

1. Discuss how Groups, Subgroups, Homomorphism of groups, Ring, Ideals, Euclidean Domain, Unique Factorization Domain and Field are connected with the work of Bhartiya Ganitagya.
2. Analyse how Groups, Subgroups, Homomorphism of groups, Ring, Ideals, Euclidean Domain, Unique Factorization Domain and Field can be applied to solve real world problems.
3. Teacher can allot other activities also.

Keywords/Tags:

Groups, Subgroups, Homomorphism and Isomorphism of groups, Ring, Ideals, Field.

Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Bharati Krisna Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
2. Dr. Satya Dev Sharma: Aryabhatiyam, Chaukhambha Surbharati prakashan, Varanasi, 2013.
3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd. New Delhi. 1977.
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1. Udayan S. Patankar & sunil S. Patankar: Elements of Vedic Mathematics, TTU Press, 2018.
2. Surjeet Singh and Qazi Zameeruddin: Modern Algebra, Vikas Publishing House Pvt Ltd; Eighth edition, 2006.
3. N. Jacobson: Basic Algebra. Vol. I and II, W. II Freeman, 1980.
4. I. S. Luther and I. B. S. Passi: Algebra. Vol. I and II, Narosa Publishing House, 1997.
5. A. K. Vasishtha and A. R. Vasishtha: Modern Algebra, Krishna Publication; 68th edition, 2015.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>
<https://www.eshiksha.mp.gov.in/mpdhe>
<https://onos.gov.in>
<https://eg4.nic.in/mpelibrary>
<https://swayam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111105112>

https://ugemoocs.inflibnet.ac.in/index.php/courses/view_ug/32

Part D: ASSESSMENT AND EVALUATION

(For courses having External theory Examination of 70 marks)

Suggested Continuous Evaluation Methods:

Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 30 Marks
University Exam (UE): 70 Marks

Internal Assessment:

Continuous Comprehensive Evaluation (CCE)

Total Marks: 30

External Assessment:

University Exam Section
Time: 03.00 Hours

Section (A) : Multiple Choice Questions
Section (B) : Short Questions
Section (C) : Long Questions

Total Marks: 70

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BACHELOR OF SCIENCE

(B.Sc. III Semester, DSE-1 (विकल्प 1), आंशिक अवकल समीकरण)

भाग 3A - परिचय			
कार्यक्रम- स्नातक	कक्षा -बी.एससी. द्वितीय वर्ष	सेमेस्टर - III	सत्र: 2026-2027
विषय गणित			
1	पाठ्यक्रम का कोड	आंशिक अवकल समीकरण DSE-1 (विकल्प 1)	
2	पाठ्यक्रम का शीर्षक		
3	पाठ्यक्रम		
4	पाठ्यक्रम का प्रकार	टाइप - 1	
5	पूर्वापेक्षा (Prerequisite):	इस पाठ्यक्रम का अध्ययन करने के लिए, विद्यार्थी के पास स्नातक प्रथम वर्ष में गणित विषय (मेजर या माइनर) होना चाहिए।	
6	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: 1. आंशिक अवकल समीकरणों, प्रतिरूपण, हलों की सामान्य संरचना और हलों के लिए विश्लेषणात्मक और संख्यात्मक विधियों के ज्ञान का उपयोग करने में। 2. संरक्षण नियमों का उपयोग करके भौतिक समस्याओं को PDEs के रूप में सूत्रबद्ध करने में। 3. भौतिकी और इंजीनियरिंग में विभिन्न (तरंग) परिघटनाओं के गणितीय विवरणों के मध्य समानताओं को समझने में।	

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		4. PDEs को वर्गीकृत करने, विश्लेषणात्मक विधियों को लागू करने, और हलों की भौतिक व्याख्या करने में। 5. वास्तविक दुनिया की समस्याओं से संबंधित व्यावहारिक PDE समस्याओं को हल करने में। 6. वास्तविक दुनिया की समस्याओं को हल करने के लिए एक-आयामी ऊष्मा चालन और एक-आयामी तरंग समीकरण को लागू करने में।
7	क्रेडिट मान	
8	कुल अंक	सैद्धांतिक: 04 अधिकतम अंक: 30+70 न्यूनतम उत्तीर्णांक: 35

भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 60 घंटे

(नोट: प्रत्येक क्रेडिट के लिए 15 घंटे का शिक्षण आवश्यक है)

मॉड्यूल	विषय	घंटे की संख्या
1	1. भारतीय ज्ञान परंपरा: 1.1 आंशिक अवकल समीकरणों की ऐतिहासिक पृष्ठभूमि 1.2 आंशिक अवकल समीकरणों के क्षेत्र में निम्नलिखित भारतीय गणितज्ञों का योगदान: 1.2.1 के. आनंद राउ 1.2.2 एस. चंद्रशेखर	12

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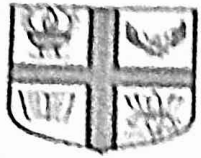
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	1.2.3 हरीश चंद्र 1.2.4 एम. एस. नरसिम्हन	
	2.1 आंशिक अवकल समीकरणों की संरचना 2.2 आंशिक अवकल समीकरणों की कोटि और घात 2.3 प्रथम कोटि के रैखिक और अ-रैखिक आंशिक अवकल समीकरण 2.4 आंशिक अवकल समीकरणों के विभिन्न प्रकार के हल	
II	3.1 लैंग्रांज हल 3.2 कुछ विशेष प्रकार के समीकरण जिन्हें सामान्य विधि के अतिरिक्त अन्य विधियों द्वारा आसानी से हल किया जा सकता हो 3.3 चारपिट की व्यापक विधि	12
III	4.1 द्वितीय एवं उच्च कोटि के रैखिक आंशिक अवकल समीकरण 4.2 निरीक्षण विधि द्वारा द्वितीय कोटि के रैखिक आंशिक अवकल समीकरणों का हल और विहित रूपों में समानयन 4.3 द्वितीय कोटि के आंशिक अवकल समीकरणों का वर्गीकरण	12
IV	5.1 अचर गुणांकों के समघात एवं असमघात आंशिक अवकल समीकरण 5.2 अचर गुणांकों में समानेय आंशिक अवकल समीकरण	12

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Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhileka Verma			



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V	6.1 लाप्लास समीकरण 6.2 एक-विमीय ऊष्मा चालन समीकरण की व्युत्पत्ति और हल 6.3 एक-विमीय तरंग समीकरण की व्युत्पत्ति और हल	12
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गतिविधियाँ

1. चर्चा करें कि आंशिक अवकल समीकरण, लैंग्रांज विधि, चारपिट विधि, एक-विमीय ऊष्मा चालन समीकरण और एक-विमीय तरंग समीकरण भारतीय गणितज्ञों के कार्य से किस प्रकार जुड़े हैं।
2. विश्लेषण करें कि आंशिक अवकल समीकरण, लैंग्रांज विधि, चारपिट विधि, एक-विमीय ऊष्मा चालन समीकरण और एक-विमीय तरंग समीकरण वास्तविक दुनिया की समस्याओं को हल करने के लिए किस प्रकार लागू किए जा सकते हैं।
3. भौतिक संदर्भ में हलों की व्याख्या करें, जैसे प्रगामी तरंगों, अप्रगामी तरंगों और प्रघात तरंगों की पहचान करना।
4. शिक्षक अन्य गतिविधियाँ भी दे सकते हैं।

सार बिंदु (कीवर्ड)/ टैग:

आंशिक अवकल समीकरण, लैंग्रांज विधि, चारपिट विधि, एक आयामी ऊष्मा चालन समीकरण, एक आयामी तरंग समीकरण।

भाग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.

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2. M. D. Raysinghania: Ordinary and Partial Differential Equations, S. Chand & Company, New Delhi, 2017.
3. R. V. Churchill, J. W. Brown: Fourier Series and boundary value problems, McGraw Hill International edition, 1987.
4. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. Shah Nita H.: Ordinary and Partial Differential Equations: Theory and Applications, PHI Learning Private Limited, Second edition, 2015.
3. K. Sankara Rao: Introduction to Partial Differential Equations, PHI, 3rd edition, 2010.
4. I. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
5. Frank Ayres: Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972.
6. J. W. Brown, R. V. Churchill: Fourier Series and boundary value problems, Tata McGraw Hill Edition, 2008.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक:

<https://epgp.inflibnet.ac.in>
<https://www.eshiksha.mp.gov.in/mpdhe>
<https://onos.gov.in>
<https://eg4.nic.in/mpelibrary>
<https://swayam.gov.in>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111101153/>

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भाग द - अनुशासित मूल्यांकन विधियाँ		
अनुशासित सतत मूल्यांकन विधियाँ:		
अधिकतम अंक: 100		
सतत व्यापक मूल्यांकन (CCE): 30 अंक		
विश्वविद्यालय परीक्षा (UE): 70 अंक		
आंतरिक मूल्यांकन: सतत व्यापक मूल्यांकन (CCE):	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	30 अंक
आकलन: विश्वविद्यालयीन परीक्षा समय: 03.00 घंटे	अनुभाग (अ): बहुविकल्पीय व्यापक प्रश्न अनुभाग (ब): लघु उत्तरीय प्रश्न अनुभाग (स): दीर्घ उत्तरीय प्रश्न	70 अंक

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BACHELOR OF SCIENCE

(B.Sc. III Semester, DSE-1 (Option - 1), Partial Differential Equations)

Part A : Introduction			
Program : UG	Class: B.Sc. II Year	Semester: III	Session: 2026-2027
Subject: Mathematics			
1	Course Code	Partial Differential Equations	
2	Course Title	DSE-1 (Option - 1)	
3	Course	Core Course (Major - 1)	
4	Course Type		
5	Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics (Major or Minor) in first year..	
6	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Use knowledge of partial differential equations (PDEs), modelling, the general structure of solutions, and analytic and numerical methods for solutions. 2. Formulate physical problems as PDEs using conservation laws. 3. Understand analogies between mathematical descriptions of different (wave) phenomena in physics and engineering. 4. Classify PDEs, apply analytical methods, and physically interpret the solutions. 5. Solve practical PDE problems related to real world problems. 6. Apply the one-dimensional Heat conduction and one-dimensional wave equation to solve real world problems.	
7	Credit Value	Theory: 04	
8	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

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Autonomous, Re-accredited 'A++' Grade by UGC (12 UPE 150-155)

College with Potential for Excellence (CPE) List

DST FIST Supported & Star College Scheme by DST

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Part B: Content of the Course		
Total Lectures: 60 hours		
(Note: 15 hours of teaching for each credit)		
Module	Topics	No. of Hours
I	Indian Knowledge System: 1.1 Historical Background of Partial Differential Equations 1.2 Contribution of following Bhartiya Ganitagya in the field of Partial Differential Equations: 1.2.1 K. Ananda Rau 1.2.2 S. Chandrasekhar 1.2.3 Harish-Chandra 1.2.4 M. S. Narasimhan 2.1 Formation of Partial differential equations 2.2 Order and degree of Partial differential equations 2.3 Linear and Non-Linear Partial differential equations of the first order 2.4 Different types of solutions of Partial differential equations	12
II	3.1 Lagrange's solution 3.2 Some special types of equations which can be solved easily by methods other than the general method 3.3 Charpit's general method	12
III	4.1 Linear Partial differential equations of second and higher orders 4.2 Solution of Linear partial differential equations of second order by inspection method and reduction to canonical forms 4.3 Classification of partial differential equations of second order	12
IV	5.1 Homogeneous and non-homogeneous partial differential equations of constant coefficients 5.2 Partial differential equations reducible to equations with constant coefficients	12
V	6.1 Laplace Equation 6.2 Derivation and solution of one-dimensional Heat conduction equation 6.3 Derivation and solution of one-dimensional wave equation	12

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Suggested Activities:

1. Discuss how Partial differential equations, Lagrange's method, Charpit's method, one-dimensional Heat conduction equation and one-dimensional wave equation are connected with the work of Bhartiya Ganitagya.
2. Analyse how Partial differential equations, Lagrange's method, Charpit's method, one-dimensional Heat conduction equation and one-dimensional wave equation can be applied to solve real world problems.
3. Interpret solutions in a physical context, such as identifying travelling waves, standing waves, and shock waves.
4. Teacher can allot other activities also.

Keywords/Tags:

Partial differential equations, Lagrange's method, Charpit's method, One dimensional Heat conduction equation, one dimensional wave equation.

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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. M. D. Raysinghania: Ordinary and Partial Differential Equations, S. Chand & Company, New Delhi, 2017.
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Reference Books:

1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. Shah Nita H.: Ordinary and Partial Differential Equations: Theory and Applications, PHI Learning Private Limited, Second edition, 2015.
3. K. Sankara Rao: Introduction to Partial Differential Equations, PHI, 3rd edition, 2010.
4. I. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
5. Frank Ayres: Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972.
6. J. W. Brown, R. V. Churchill: Fourier Series and boundary value problems, Tata McGraw Hill Edition, 2008.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swayam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111101153/>

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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	30 Marks
University Exam (UE):	70 Marks

Internal Assessment:

Continuous Comprehensive Evaluation (CCE)

Total Marks: 30

External Assessment:

University Exam Section
Time: 03.00 Hours

Section (A) : Multiple Choice Questions
Section (B) : Short Questions
Section (C) : Long Questions

Total Marks: 70

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BACHELOR OF SCIENCE

(B.Sc. III Semester, DSE-1 (विकल्प - 2), यांत्रिकी)

भाग अ - परिचय			
कार्यक्रम- स्नातक	कक्षा -बी.एससी. द्वितीय वर्ष	सेमेस्टर- III	सत्र: 2026-2027
विषय - गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	यांत्रिकी	
3	पाठ्यक्रम	DSE-1 (विकल्प - 2)	
4	पाठ्यक्रम का प्रकार	टाइप - 1	
5	पूर्वापेक्षा (Prerequisite):	इस पाठ्यक्रम का अध्ययन करने के लिए, विद्यार्थी के पास स्नातक प्रथम वर्ष में गणित विषय (मेजर या माइनर) होना चाहिए।	
6	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: 1. बलों, समांतर बलों, आघूर्णों और युग्मों की मूल अवधारणाओं को समझना। 2. बलों, वेग, त्वरण और सरल आवर्त गति के संतुलन को समझना। 3. बलों द्वारा क्रियान्वित अ-त्वरित कणों के लिए संतुलन संबंधों को लागू करना। 4. त्रिविम में बलों का विश्लेषण करना। 5. वेग और त्वरण से संबंधित विभिन्न समस्याओं का मूल्यांकन करना।	
7	क्रेडिट मान	सैद्धांतिक: 4	
8	कुल अंक	अधिकतम अंक: 30 + 70	न्यूनतम उत्तीर्णक: 35

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भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 60 घंटे

(नोट: प्रत्येक क्रेडिट के लिए 15 घंटे का शिक्षण आवश्यक है)

मॉड्यूल	विषय	घंटे की संख्या
I	I. भारतीय ज्ञान परंपरा: 1.1 यांत्रिकी की ऐतिहासिक पृष्ठभूमि 1.2 यांत्रिकी के क्षेत्र में निम्नलिखित भारतीय गणितज्ञों का योगदान: 1.2.1 सी. बी. रमन 1.2.2 सत्येन्द्र नाथ बोस 1.2.3 मेघनाद साहा 1.2.4 सुब्रह्मण्यम चन्द्रशेखर	02
II	बलों का संतुलन: 2.1 विश्लेषणात्मक विधि 2.2 तुल्य बल और युग्मन 2.3 तीन बलों द्वारा क्रियान्वित दृढ़ पिंड का संतुलन 2.4 त्रिकोणमितीय प्रमेय 2.5 संतुलन की सामान्य स्थिति 2.6 प्रतिबंध के अधीन कण का संतुलन 2.7 अस्थैतिक संतुलन	15
III	त्रिविम में बल: 3.1 प्रारंभिकी	15

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DST-FIST Supported & Star College Scheme by DRD

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	3.2 प्वाइंट्स का वैक्यूय अक्षा 3.3 परिणागी रिच 3.4 शून्य रेखाएँ और तल	
IV	वेग और त्वरण: 4.1 प्रारंभिकी 4.2 निज्य वेग और त्वरण 4.3 अनुप्रस्थ वेग और त्वरण 4.4 कोणीय वेग और त्वरण 4.5 स्पर्शरखीय और अभिलंब त्वरण	13
V	सरल आवर्त गति और प्रत्यास्थ डोरी: 5.1 सरल आवर्त गति 5.2 सरल आवर्त गति का ज्यामितीय निरूपण 5.3 हुक का नियम 5.4 क्षैतिज प्रत्यास्थ डोरी 5.5 ऊर्ध्वाधर प्रत्यास्थ डोरी	15

गतिविधियाँ:

- वास्तविक जीवन के उदाहरणों (पुल ट्रस, लटकता हुआ लैंप, क्रेन प्रणाली) के साथ संतुलन की स्थितियों का प्रदर्शन करें।
- दीवार के सहारे लटके हुए पुल के केबल या सीढ़ी के संतुलन का विश्लेषण करें।
- किसी घन या चतुष्फलक पर कार्यरत बल प्रणालियों को देखने के लिए 3D प्लॉटिंग सॉफ्टवेयर (MATLAB/Python/GeoGebra 3D) का उपयोग करें।
- ड्रोन के प्रोपेलर विन्यास या क्रेन बूम में बल प्रणाली का विश्लेषण करें।
- वास्तविक जीवन की घटनाओं से संबंधित: वाहन त्वरण परीक्षण या खेल गति विश्लेषण (गेंद का प्रक्षेप पथ, स्प्रिंट स्टार्ट)।

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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6. SHM अवधारणा को विद्युत दोलनों (स्व परिपथ) या ट्यूनिंग कांटा के कंपन पर लागू करें।

7. शिक्षक अन्य गतिविधियाँ भी दे सकते हैं।

सार बिंदु (की बर्क)/ टैग:

बलों का संतुलन, त्रिविम में बल, वेग और त्वरण, सरल आवर्त गति और प्रत्यास्थ डोरी।

भाग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Parameswaran, S.: The Golden Age of Indian Mathematics, Swadeshi Science Movement, 1998.
2. S. L. Loney, Statics, Macmillan Company, London.
3. S. L. Loney, An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956.
4. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. R. S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad..
2. F. Chorlton, Dynamics, CBS Publishers, New Delhi.
3. A. S. Ramsey, Dynamics Part-1 & 2, CBS Publisher & Distributors.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक:

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swayam.gov.in>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/115104094>

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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भाग द - अनुशंसित मूल्यांकन विधियाँ

अनुशंसित सतत मूल्यांकन विधियाँ:

अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन: सतत व्यापक मूल्यांकन (CCE):	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	30 अंक
आकलन: विश्वविद्यालयीन परीक्षा समय: 03.00 घंटे	अनुभाग (अ): बहुविकल्पीय प्रश्न अनुभाग (ब): लघु उत्तरीय प्रश्न अनुभाग (स): दीर्घ उत्तरीय प्रश्न	70 अंक

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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Dr. Archana Pasari		Dr. Gopal Meena	
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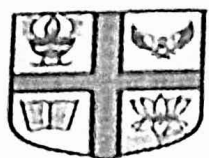
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BACHELOR OF SCIENCE

(B.Sc. II Semester, DSE-1 (Option - 2), Mechanics)

Part A: Introduction			
Program: UG	Class: B.Sc. II Year	Semester: III	Session: 2026-2027
Subject: Mathematics			
1	Course Code	Mechanics DSE-1 (Option - 2) Type 1 To study this course, a student must have had the subject Mathematics (Major or Minor) in first year.	
2	Course Title		
3	Course		
4	Course Type		
5	Pre-requisite (if any)		
6	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Understand the basic concepts of forces, Parallel forces, Moments and Couples. 2. Understand the equilibrium of forces, velocity, acceleration and simple harmonic motion. 3. Apply the equilibrium relationships for non-accelerating particles acted on by forces. 4. Analyze the forces in three dimensions. 5. Evaluate the various problems related to velocity and acceleration.	
7	Credit Value	Theory: 4	
8	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

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Dr. Akhilesh Pathak	<i>Akhilesh</i>	Dr. J. K. Maitra	
Dr. Mita Darbari	<i>Mita</i>	Dr. Sandeep Tiwari	
Dr. Archana Pasari	<i>Archana</i>	Dr. Gopal Meena	
Dr. Preeti Nagar	<i>Preeti</i>	Mr. Vinit Jain	
Ms. Sakshi Panjwani	<i>Sakshi</i>	Mr. Shakti Patel	
Ms. Abhileka Verma	<i>Abhileka</i>		



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Part B: Content of the Course

Total Lectures: 60 hours

(Note: 15 hours of teaching for each credit)

Module	Topics	No. of Hours
I	Indian Knowledge System: 1.1 Historical Background of Mechanics 1.2 Contribution of following Bhartiya Ganitagya in the field of Mechanics: 1.2.1 C. V. Raman 1.2.2 Satyendra Nath Bose 1.2.3 Meghnad Saha 1.2.4 Subrahmanyan Chandrasekhar	02
II	Equilibrium of Forces: 2.1 Analytical Method 2.2 Equivalent Force and Couple 2.3 Equilibrium of a Rigid Body acted on by three forces 2.4 Trigonometrical theorem 2.5 General condition of equilibrium 2.6 Equilibrium of a particle under constraint 2.7 Astatic Equilibrium	15
III	Forces in Three Dimensions: 3.1 Preliminary 3.2 Poinso's Central Axis 3.3 Resultant Wrench 3.4 Null Lines and Planes	15
IV	Velocity and Acceleration: 4.1 Preliminary 4.2 Radial Velocity and Acceleration 4.3 Transverse Velocity and Acceleration 4.4 Angular Velocity and Acceleration 4.5 Tangential and Normal Acceleration	13
V	Simple Harmonic Motion and Elastic String: 5.1 Simple Harmonic Motion 5.2 Geometrical representation of the SHM 5.3 Hooke's Law 5.4 Horizontal Elastic String 5.5 Vertical Elastic String	15

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Suggested Activities:

1. Demonstrate equilibrium conditions with real-life examples (bridge truss, hanging lamp, crane system).
2. Analyze the equilibrium of a suspension bridge cable or ladder against a wall.
3. Use 3D plotting software (MATLAB/Python/GeoGebra 3D) to visualize force systems acting on a cube or tetrahedron.
4. Analyze the force system in a drone's propeller configuration or crane boom.
5. Relate to real-life phenomena: Vehicle acceleration test or sports motion analysis (ball trajectory, sprint start).
6. Apply SHM concept to electrical oscillations (LC circuit) or vibration of tuning fork.
7. Teacher can allot other activities also.

Keywords/Tags:

Equilibrium of Forces, Forces in Three Dimensions, Velocity and Acceleration, Simple Harmonic Motion and Elastic String.

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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Parameswaran, S.: The Golden Age of Indian Mathematics, Swadeshi Science Movement, 1998.
2. S. L. Loney, Statics, Macmillan Company, London.
3. S. L. Loney, An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956.
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2. F. Chorlton, Dynamics, CBS Publishers, New Delhi.
3. A. S. Ramsey, Dynamics Part-1 & 2, CBS Publisher & Distributors.

Suggested Digital Platforms Web links:

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swayam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/115104094>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 30 Marks

University Exam (UE): 70 Marks

Internal Assessment:

Continuous Comprehensive Evaluation (CCE)

Total Marks: 30

External Assessment:

University Exam Section

Time: 03.00 Hours

Section (A) : Multiple Choice Questions

Section (B) : Short Questions

Section (C) : Long Questions

Total Marks: 70

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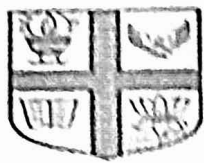
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BACHELOR OF SCIENCE (B.Sc. III Semester, Minor (M-3), उच्च कलन के सिद्धांत)

भाग अ -- परिचय			
कार्यक्रम- स्नातक	कक्षा -बी.एससी. द्वितीय वर्ष	सेमेस्टर-III	सत्र: 2026-2027
विषय गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	उच्च कलन के सिद्धांत	
3	पाठ्यक्रम	Minor M(3)	
4	पाठ्यक्रम का प्रकार	Type - 1	
5	पूर्वापेक्षा (Prerequisite):	इस पाठ्यक्रम का अध्ययन करने के लिए, विद्यार्थी के पास स्नातक प्रथम वर्ष में गणित विषय (मेजर या माइनर) होना चाहिए।	
6	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: 1. वास्तविक रेखा R के कई प्रणुओं एवं अनुक्रमों की समझ। 2. उपरि सीमा, निम्न सीमा तथा परिबद्ध अनुक्रम की सीमा की गणना करना। 3. माध्यमान प्रमेय और टेलर प्रमेय का उपयोग करना।	

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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		4. वास्तविक संख्याओं की अपरिमित श्रेणी के अभिसरण और निरपेक्ष अभिसरण के लिए विभिन्न परीक्षणों का उपयोग करना 5. वास्तविक दुनिया की समस्याओं को हल करने के लिए जैकोबियन और बीटा और गामा फलनों का उपयोग करना	
7	क्रेडिट मान	सैद्धांतिक: 04	
8	कुल अंक	अधिकतम अंक: 30 + 70	न्यूनतम उत्तीर्णांक: 35

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भाग ब – पाठ्यक्रम की विषयवस्तु

व्याख्यान की कुल संख्या): L - 60 घंटे

(नोट: प्रत्येक क्रेडिट के लिए 15 घंटे का शिक्षण आवश्यक है)

मॉड्यूल	विषय	घंटे की संख्या
I	I. भारतीय ज्ञान परंपरा: भारतीय ज्ञान परंपरा: 1.1 उच्च कलन की ऐतिहासिक पृष्ठभूमि 1.2 उच्च कलन के क्षेत्र में निम्नलिखित भारतीय गणितज्ञों का योगदान: 1.2.1 संगमग्राम के माधव 1.2.2 परमेश्वर 1.2.3 नीलकंठ सोमयाजी 1.2.4 ज्येष्ठदेव 1.2.5 अच्युत पिशरति 2.1 क्षेत्र संरचना और R की क्रमबद्ध संरचना, अंतराल, परिवर्द्ध और अपरिवर्द्ध समुच्चय, उच्चक और निम्नक, R में पूर्णता, वास्तविक संख्या का निरूपण माना 2.2 वास्तविक संख्याओं के अनुक्रम	20

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II	2.3 अनुक्रम की सीमा	18
	2.4 परिबद्ध एवं एकदिष्ट अनुक्रम	
	2.5 कौशी का अभिसरण का व्यापक सिद्धांत	
	2.6 अनुक्रम का बीजगणित एवं कुछ महत्वपूर्ण प्रमेय	
III	3.1 ऋणोत्तर पदों की श्रेणी	08
	3.2 धनात्मक पदों की श्रेणी का अभिसरण	
	3.3 एकान्तर श्रेणी और लेबनीज परीक्षण	
	4.1 एकसमान सांतत्य	
IV	4.2 माध्य मान प्रमेय एवं उसकी ज्यामितीय व्याख्या	08
	4.3 दो चरों के फलनों की सीमा एवं सांतत्य	
	5.1 समघात फलनों पर आयलर का प्रमेय	
	5.2 दो चरों के फलनों के लिए टेलर का प्रमेय	
V	6.1 दो चरों के फलनों का उच्चिष्ठ एवं निनिष्ठ	06
	6.2 लेप्रांज गुणक की विधि	
	7.1 जैकोबियन	
	7.2 बीटा एवं गामा फलन	

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Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



ST. ALOYSIUS' COLLEGE JABALPUR (MADHYA PRADESH)

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गतिविधियाँ

1. चर्चा करें कि अनुक्रम, श्रेणी, जैकोबियन, उच्चिष्ठ एवं निनिष्ठ, बीटा और गामा फलन, भारतीय गणितज्ञोंके कार्य से कैसे जुड़े हैं।
2. विश्लेषण करेंकि अनुक्रम, श्रेणी, जैकोबियन, उच्चिष्ठ एवं निनिष्ठ, बीटा और गामा फलन को वास्तविक दुनिया की समस्याओं को हल करने के लिए कैसे लागू किए जा सकते हैं।
3. शिक्षक अन्य गतिविधियाँ भी दे सकतेहैं।

सार बिंदु (कीवर्ड)/ टैग:

अनुक्रम, श्रेणी, जैकोबियन, उच्चिष्ठ एवं निनिष्ठ, बीटा एवं गामा फलन।

भाग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्य पुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. Parameswaran, S.: The Golden Age of Indian Mathematics, Swadeshi Science Movement, 1998.
3. Devi Prasad: Advanced Calculus, Prentice Hall India Learning Private Limited, 2009.
4. SC Malik and Savita Arora: Mathematical Analysis, New Age International Private Limited, 1st edition, 2017.

4. मध्य प्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maltra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. R. R. Goldbeg: Methods of Real Analysis, Oxford & I.B.H. Publishing co. New Delhi, 2020.
3. T. M. Apostol: Mathematical Analysis, Narosa Publishing House. New Delhi. 1985.
4. D. Soma Sundaram and B. Choudhary: A first Course in mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. Murray R. Spiegel: Theory and problems of advance Calculus, Schauma Publishing Co. New York, 1974.
6. Donald R. Sherbert, Robert G. Bartle: Introduction to Real Analysis, Wiley, 4th edition, 2011.
7. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd. Allahabad, 2015.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक:

<https://engp.inflibnet.ac.in>

<https://www.esiksha.mp.gov.in/mpdhe>

<https://enos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://awavam.gov.in>

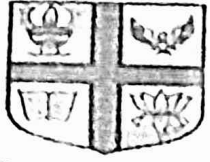
अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम :

<https://nptel.ac.in/courses/111104125/>

भाग द - अनुशंसित मूल्यांकन विधियाँ

अनुशंसित सतत मूल्यांकन विधियाँ:

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन:	क्लास टेस्ट	30 अंक
सतत व्यापक मूल्यांकन (CCE):	असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	
आकलन:	अनुभाग (अ): बहुविकल्पीय प्रश्न	70 अंक
विश्वविद्यालयीन परीक्षा	अनुभाग (ब): लघु उत्तरीय प्रश्न	
समय: 03.00 घंटे	अनुभाग (स): दीर्घ उत्तरीय प्रश्न	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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BACHELOR OF SCIENCE

(B.Sc. III Semester, Principles of Advanced Calculus

, Minor (M-3))

Part A : Introduction		
Program : UG	Class: B.Sc.	Semester: III
Session: 2026-2027		
Subject: Mathematics		
1	Course Code	
2	Course Title	Principles of Advanced Calculus
3	Course	Minor M (3)
4	Course Type	Type-1
5	Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics (Major or Minor) in first year.
6	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Understand many properties of the real line $\mathbb{R}$ and sequences. 2. Calculate the limit superior, the limit inferior, and the limit of a bounded sequence. 3. Apply the mean value theorems and Taylor's theorem. 4. Apply the various tests to determine convergence and absolute convergence of an infinite series of real numbers.

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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		5. Using Jacobians and Beta and Gamma Functions to solve real world problems.	
7	Credit Value	Theory: 04	
8	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

Part B: Content of the Course

Total Lectures: 60 hours

Module	Topics	No. of Hours
I	Indian Knowledge System: 1.1 Historical Background of Advanced Calculus 1.2 Contribution of following Bhartiya Ganitagya in the field of Advanced Calculus: 1.2.1 Madhava of Sangamagrama 1.2.2 Parameshvara 1.2.3 Nilakantha Somayaji 1.2.4 Jyeshthadeva 1.2.5 Achyuta Pisharati	20
	2.1 Field structure and ordered structure of $\mathbb{R}$, intervals, bounded and unbounded sets, supremum and infimum, completeness in $\mathbb{R}$, absolute value of a real number. 2.2 Sequence of real numbers 2.3 Limit of a sequence 2.4 Bounded and monotonic sequences	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Dandhari		Dr. Sandeep Tiwari	
Dr. Archana Dasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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	2.5 Cauchy's general principle of convergence 2.6 Algebra of sequence and some important theorems	
II	3.1 Series of non-negative terms 3.2 Convergence of positive term series 3.3 Alternating series and Leibnitz's test	18
	4.1 Uniform continuity 4.2 Mean value theorems and their geometrical interpretations 4.3 Limit and continuity of functions of two variables	
III	5.1 Euler's theorem on homogeneous functions 5.2 Taylor's theorem for functions of two variables	08
IV	6.1 Maxima and Minima of functions of two variables 6.2 Lagrange's multiplier method	08
V	7.1 Jacobians 7.2 Beta and Gamma Functions	06

Suggested Activities:

1. Discuss how Sequence, Series, Jacobians, Maxima and Minima, Beta and Gamma functions are connected with the work of Bhartiya Ganitagya.
2. Analyse how Sequence, Series, Jacobians, Maxima and Minima, Beta and Gamma functions can be applied to solve real world problems.
3. Teacher can allot other activities also.

Keywords:

Sequence, Series, Jacobians, Maxima and Minima, Beta and Gamma functions.

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. Parameswaran, S.: The Golden Age of Indian Mathematics, Swadeshi Science Movement, 1998.
3. Devi Prasad: Advanced Calculus, Prentice Hall India Learning Private Limited, 2009.
4. SC Malik and Savita Arora: Mathematical Analysis, New Age International Private Limited, 1st edition, 2017.
5. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. R. R. Goldbeg: Methods of Real Analysis, Oxford & I.B.H. Publishing co. New Delhi, 2020.
3. T. M. Apostol: Mathematical Analysis, Narosa Publishing House. New Delhi. 1985.
4. D. Soma Sundaram and B. Choudhary: A first Course in mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. Murray R. Spiegel: Theory and problems of advance Calculus, Schauma Publishing Co. New York, 1974.
6. Donald R. Sherbert, Robert G. Bartle: Introduction to Real Analysis, Wiley, 4th edition, 2011.
7. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd. Allahabad, 2015.

Suggested Digital Platforms Web links:

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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<https://epgp.inlibnet.ac.in>

<https://www.e-shiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.mic.in/mpelibrary>

<https://swayam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111104125/>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 30 Marks

University Exam (UE): 70 Marks

Internal Assessment:

Continuous Comprehensive Evaluation (CCE)

Total Marks: 30

External Assessment:

University Exam Section

Time: 03.00 Hours

Section (A) : Multiple Choice Questions

Section (B) : Short Questions

Section (C) : Long Questions

Total Marks: 70

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Mishra		Dr. J. K. Maltra	
Dr. Mita Das		Dr. Sandeep Tiwari	
Dr. Archana Mishra		Dr. Gopal Meena	
Dr. Preeti Mishra		Mr. Vinit Jain	
Ms. Sakshi Mishra		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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Part A : Introduction

Program: UG		Class: B.Sc. III Semester	Year: II Year	Session: 2026-2027
Subject: Mathematics				
1	Course Code			
2	Course Title	Foundational Mathematics		
3	Course	Multi/Inter Disciplinary (MD/ID-2)		
4	Course Type	Type-I		
4	Pre-requisite (if any)	Open for all		
5	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Use the Matrices and Determinants in different areas of business and science like budgeting, sales projection, cost estimation, analyzing the results of an experiment etc. 2. Solve simple problems related to real-life situations by using calculus. 3. Understanding and use the terminology of probability. 4. Applying the mean, median, mode, addition and multiplication rules to Calculate probabilities. 5. Apply ordinary differential equations to model and solve practical problems in physics, biology, engineering, and economics.		
6	Credit Value	03		
7	Total Marks	Max. Marks: 100		Min. Passing Marks: 35

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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Affiliated to Rani Durgavati Vishwavidyalaya, Jabalpur (M.P.)

Part B: Content of the Course

Total Lectures: 45 hours

Module	Topics	No. of Lectures
I	Bhartiya Gyan Parampra: Contributions of following Ancient Bhartiya Ganitagya in Differentiation and Integration, Differential Equations and Probability: 1.1 Aryabhata 1.2 Brahmagupta 1.3 Bhāskaracharya II	10
	Matrices & Determinants: 2.1 Concept of Matrices 2.2 Notation, order and equality of Matrices 2.3 Types of Matrices 2.4 Operations on Matrices 2.5 Addition and multiplication 2.6 Multiplication with a scalar 2.7 Simple properties of addition, multiplication and scalar multiplication 2.8 Transpose of a Matrix 2.9 Determinants and its Basic Properties 2.10 Rank of Matrices 2.11 Adjoint and inverse of a square Matrix	
II	Calculus: 3.1 Definition of derivative 3.2 Derivative of sum, difference, product and quotient of functions 3.3 The derivative of polynomial and trigonometric functions 3.4 Integration of various functions by using substitution, partial fractions and by parts 3.5 Evaluation of simple integrals 3.6 Basic properties of definite integrals	11

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maltra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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III	Differential Equations: 4.1 Introduction 4.2 Basic Concepts 4.3 General and Particular Solutions of a Differential Equations. 4.4 Methods of Solving First Order, First Degree Differential Equations	08
IV	Statistics: 5.1 Frequency distribution 5.2 Measures of central tendency: Mean, Median, Mode,	08
V	Probability: 6.1 Random experiments: outcomes, sample spaces (set representation). 6.2 Events: Occurrence of events, 'not', 'and' & 'or' events, exhaustive events, mutually exclusive events. 6.3 Probability of an event, probability of 'not', 'and', & 'or' events.	08
Suggested Activities	1. Discuss how Determinants, Matrices, Differentiation and Integration, Differential Equations, Mean, Median, Mode, Sample space and Probability of an event are connected with the work of Bhartiya Ganitagya 2. Analyse how Determinants, Matrices, Differentiation and Integration, Differential Equations, Mean, Median, Mode, Sample space and Probability of an event can be applied to solve real world problems. 3. Teacher can allot other activities also.	
Keywords/ Tags: Determinants, Matrices, Differentiation and Integration, Differential Equations, Mean, Median, Mode, Sample space, Probability of an event.		

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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Part C – Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. Bharati Krsna Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
3. Nita H. Shah, Foram A. Thakkar: Matrix and Determinant Fundamentals and Applications, CRC Press, 2020.
4. Gorakh Prasad: Differential Calculus, Pothishasla Pvt. Ltd., Allahabad, 2016.
5. Gorakh Prasad: Integral Calculus, Pothishasla Pvt. Ltd., Allahabad, 2015.
6. E. Rukmangadachari: Probability and Statistics, Pearson Education India; First edition, 2012.
7. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

सन्दर्भ पुस्तकें:

1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. Udayan S. Patankar & sunil S. Patankar: Elements of Vedic Mathematics, TTU Press, 2018.
3. Parameswaran, S.: The Golden Age of Indian Mathematics, Swadeshi Science Movement, 1998.
4. Hari Kishan: A Textbook of Matrices, Atlantic Publishers & Dist, 2008,
5. Shanti Narayan: Differential and Integral Calculus, S. Chand & Company, 1942.
6. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh: An Introduction to Probability and Statistics, Wiley, 3rd edition, 2015.
7. Biswal, Purna Chandra: Ordinary Differential Equations, PHI Learning Private Limited, 2012.
8. NCERT Books.

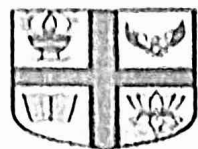
Suggested Digital Platforms Web links:

<https://freevideolectures.com/university/iit-roorkee/>
<https://epathshala.nic.in/>, <https://www.eshiksha.mp.gov.in/mpdhe>
<https://onos.gov.in/>, <https://eg4.nic.in/mpelibrary>
<https://swayam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111106112/>, <https://nptel.ac.in/courses/111105090/>
https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/327
<https://nptel.ac.in/courses/111108081/>

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

University Exam (UE): 100 Marks

External Assessment: University Exam Section Time: 02:00 Hours	Section (A) : Objective Type Questions Section (B) : Short Questions Section (C) : Long Questions	Total Marks: 100
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BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhiteka Verma			



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भाग 3 - परिचय			
प्रोग्राम - स्नातक	कक्षा: बी.एससी. III सेमेस्टर	वर्ष: द्वितीय वर्ष	सत्र: 2026-2027
विषय: गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	मूलभूत गणित	
3	पाठ्यक्रम	Multi/Inter Disciplinary (MD/ID-2)	
4	पाठ्यक्रम का प्रकार	टाइप - 1	
4	पूर्वापेक्षा (Prerequisite)	सभी के लिए	
5	पाठ्यक्रम अध्ययन की परिलब्धियां (कोर्स लर्निंग आउटकम) (CLO)	पाठ्यक्रम छात्रों को सक्षम करेगा: - व्यवसाय और विज्ञान के विभिन्न क्षेत्रों जैसे बजट, बिक्री प्रक्षेपण, लागत अनुमान, प्रयोग के परिणामों का विश्लेषण आदि में आव्यूहों और सारणिक का उपयोग करना। - कलन का उपयोग करके वास्तविक जीवन की स्थितियों से संबंधित सरल समस्याओं को हल करें। - प्रायिकता की शब्दावली को समझना और उसका उपयोग करना। - प्रायिकता की गणना करने के लिए माध्य, माध्यिका, बहुलक, योग और गुणन नियमों को लागू करना। - भौतिकी, जीव विज्ञान, इंजीनियरिंग और अर्थशास्त्र में व्यावहारिक समस्याओं का प्रतिरूपण करने और हल करने के लिए साधारण अवकल समीकरणों को लागू करना।	
6	क्रेडिट मान	3	
7	कुल अंक	अधिकतम अंक: 100	न्यूनतम उत्तीर्ण अंक: 35

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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhileka Verma			



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भाग ब-पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 45 घंटे

मॉड्यूल	विषय	घंटों की संख्या
I	भारतीय ज्ञान परंपरा: अवकलन और समाकलन, अवकल समीकरण और प्रायिकता में निम्नलिखित प्राचीन भारतीय गणितज्ञों का योगदान: 1.1 आर्यभट्ट 1.2 ब्रह्मगुप्त 1.3 भास्कराचार्य द्वितीय	10
	आव्यूह और सारणिक: 2.1 आव्यूह की अवधारणा 2.2 आव्यूहों का संकेतन, कोटि और समानता 2.3 आव्यूहों के प्रकार 2.4 आव्यूहों पर संक्रियाएँ 2.5 योग और गुणन 2.6 अदिश से गुणन 2.7 योग, गुणन और अदिश गुणन के सरल गुणधर्म 2.8 आव्यूह का परिवर्त 2.9 सारणिक और उसके मूल गुणधर्म 2.10 आव्यूहों की जाति 2.11 वर्ग आव्यूह का सहखंडज और व्युत्क्रम	
II	कलन: 3.1 अवकलज की परिभाषा 3.2 फलनों के योग, अंतर, गुणनफल और भागफल का अवकलज 3.3 बहुपद और त्रिकोणमितीय फलनों का अवकलज 3.4 प्रतिस्थापन, आंशिक भिन्नों और भागों द्वारा विभिन्न फलनों का समाकलन 3.5 सरल समाकलों का मूल्यांकन 3.6 निश्चित समाकलों के मूल गुणधर्म	11

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III	अवकल समीकरण: 4.1 परिचय 4.2 मूल अवधारणाएँ 4.3 अवकल समीकरणों के व्यापक और विशिष्ट हल 4.4 प्रथम कोटि, प्रथम घात अवकल समीकरणों को हल करने की विधियाँ	08
IV	सांख्यिकी: 5.1 आवृत्ति बंटन 5.2 केंद्रीय प्रवृत्ति के माप: माध्य, माधिका, बहुलक,	08
V	प्रायिकता: 6.1 यादृच्छिक प्रयोग: परिणाम, प्रतिदर्श समष्टि (समुच्चय निरूपण)। 6.2 घटनाएँ: घटनाओं का घटित होना, 'नहीं', 'और' तथा 'या' घटनाएँ, निश्शेष घटनाएँ, परस्पर अपवर्जी घटनाएँ। 6.3 किसी घटना की प्रायिकता, 'नहीं', 'और' और 'या' घटनाओं की प्रायिकता।	08
गतिविधि	1. चर्चा करें कि सारणिक, आव्यूह, अवकलन और समाकलन, अवकल समीकरण, माध्य, माधिका, बहुलक, प्रतिदर्श समष्टि और किसी घटना की प्रायिकता भारतीय गणितज्ञों के कार्य से किस प्रकार जुड़े हैं। 2. विश्लेषण करें कि सारणिक, आव्यूह, अवकलन और समाकलन, अवकल समीकरण, माध्य, माधिका, बहुलक, प्रतिदर्श समष्टि और किसी घटना की प्रायिकता को वास्तविक विश्व की समस्याओं को हल करने में किस प्रकार लागू किया जा सकता है। 3. शिक्षक अन्य गतिविधियाँ भी दे सकते हैं।	
सार बिंदु (की वर्ड)/टैग: सारणिक, आव्यूह, अवकलन और समाकलन, अवकल समीकरण, माध्य, माधिका, बहुलक, प्रतिदर्श समष्टि, किसी घटना की प्रायिकता।		

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Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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भाग स- अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तक, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / अन्य अन्य पाठ्य संसाधन/पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. Bharati Krsna Tirthaji Maharaja, "Vedic Mathematics", Motilal Banarasidas Publisher, Delhi, 1994.
3. Nita H. Shah, Forum A. Thakkar: Matrix and Determinant Fundamentals and Applications, CRC Press, 2020.
4. Gorakh Prasad: Differential Calculus, Pothishasla Pvt. Ltd., Allahabad, 2016.
5. Gorakh Prasad: Integral Calculus, Pothishasla Pvt. Ltd., Allahabad, 2015.
6. E. Rukmangadachari: Probability and Statistics, Pearson Education India; First edition, 2012.
7. मध्य प्रदेश हिन्दी शोध अकादमी की पुस्तकें।

सन्दर्भ पुस्तकें:

1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. Udayan S. Patankar & sunil S. Patankar: Elements of Vedic Mathematics, TTU Press, 2018.
3. Parameswaran, S.: The Golden Age of Indian Mathematics, Swadeshi Science Movement, 1998.
4. Hari Kishan: A Textbook of Matrices, Atlantic Publishers & Dist, 2008.
5. Shanti Narayan: Differential and Integral Calculus, S. Chand & Company, 1942.
6. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh: An Introduction to Probability and Statistics, Wiley, 3rd edition, 2015.
7. Biswal, Purna Chandra: Ordinary Differential Equations, PHI Learning Private Limited, 2012.
8. NCERT Books.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक:

<https://freevideolectures.com/university/iit-roorkee/>
<https://epathshala.nic.in/>, <https://www.eshiksha.mp.gov.in/mpdhe>
<https://onos.gov.in>, <https://eg4.nic.in/mpelibrary>
<https://swayam.gov.in>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111106112/>
<https://nptel.ac.in/courses/111105090/>
https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/327
<https://nptel.ac.in/courses/111108081/>

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भाग द अनुशासित मूल्यांकन विधियां

अनुशासित सतत मूल्यांकन विधियां:

अधिकतम अंक: 100

विश्वविद्यालय परीक्षा (UE): 100 अंक

आकलन:

विश्वविद्यालयीन परीक्षा:

समय: 02.00 घंटे

अनुभाग (अ): बहु विकल्पीय प्रश्न

अनुभाग (ब): लघु उत्तरीय प्रश्न

अनुभाग (स): दीर्घ उत्तरीय प्रश्न

100 अंक

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Dr. Nita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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BACHELOR OF SCIENCE (B.Sc. IV Semester, Core - (Major C-5), बहुचर कलन)

भाग अ - परिचय			
कार्यक्रम-स्नातक	कक्षा - बी.एससी. द्वितीय वर्ष	सेमेस्टर- IV	सत्र: 2026-27
विषय गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	बहुचर कलन	
3	पाठ्यक्रम	Core - (Major C-5)	
4	पाठ्यक्रम का प्रकार	टाइप - I	
5	पूर्वापेक्षा (Prerequisite):	इस पाठ्यक्रम का अध्ययन करने के लिए, विद्यार्थी के पास स्नातक प्रथम वर्ष में गणित विषय (मेजर या माइनर) होना चाहिए।	
6	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: 1. वास्तविक रेखा R के कई प्रगुणों एवं अनुक्रमों की समझ। 2. उपरि सीमा, निम्न सीमा तथा परिबद्ध अनुक्रम की सीमा की गणना करना। 3. माध्यमान प्रमेय और टेलर प्रमेय का उपयोग करना। 4. वास्तविक संख्याओं की अपरिमित श्रेणी के अभिसरण और निरपेक्ष अभिसरण के लिए विभिन्न परीक्षणों का उपयोग करना। 5. वास्तविक दुनिया की समस्याओं को हल करने के लिए जैकोबियन और बीटा और गामा फलनों का उपयोग करना।	

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7	क्रेडिट मान	सैद्धांतिक: 6	
8	कुल अंक	अधिकतम अंक: 30 + 70	न्यूनतम उत्तीर्णांक: 35

भाग ब – पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 90 घंटे

(नोट: प्रत्येक क्रेडिट के लिए 15 घंटे का शिक्षण आवश्यक है)

मॉड्यूल	विषय	घंटे की संख्या
I	I. भारतीय ज्ञान परंपरा: 1.1 उच्च कलन की ऐतिहासिक पृष्ठभूमि 1.2 उच्च कलन के क्षेत्र में निम्नलिखित भारतीय गणितज्ञों का योगदान: 1.2.1 संगमग्राम के माधव 1.2.2 परमेश्वर 1.2.3 नीलकंठ सोमयाजी 1.2.4 ज्येष्ठदेव 1.2.5 अच्युत पिशरति	20

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	2.1 क्षेत्र संरचना और R की क्रमबद्ध संरचना, अंतराल, परिबद्ध और अपरिबद्ध समुच्चय, उच्चक और निम्नक, R में पूर्णता, वास्तविक संख्या का निरपेक्ष मान। 2.2 वास्तविक संख्याओं के अनुक्रम 2.3 अनुक्रम की सीमा 2.4 परिबद्ध एवं एकदिष्ट अनुक्रम 2.5 कौशी का अभिसरण का व्यापक सिद्धांत 2.6 अनुक्रम का बीजगणित एवं कुछ महत्वपूर्ण प्रमेय	
II	3.1 ऋणोत्तर पदों की श्रेणी 3.2 धनात्मक पदों की श्रेणी का अभिसरण 3.3 एकान्तर श्रेणी और लेबनीज परीक्षण 3.4 वास्तविक पदों की श्रेणियों का निरपेक्ष एवं सप्रतिबंधी अभिसरण	14
III	4.1 एकसमान सांतत्य 4.2 अवकलनीयता का श्रृंखला नियम 4.3 माध्य मान प्रमेय एवं उसकी ज्यामितीय व्याख्या 4.4 दो चरों के फलनों की सीमा एवं सांतत्य	12
IV	5.1 चरों का परिवर्तन 5.2 समघात फलनों पर आयलर का प्रमेय 5.3 दो चरों के फलनों के लिए टेल्सर का प्रमेय	20

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V	6.1 अन्वालोप और केन्द्रज	
	6.2 दो चरों के फलनों का उच्चिष्ठ एवं निनिष्ठ	
	6.3 लेप्रांज गुणक की विधि	
	7.1 जैकोबियन	24
	7.2 बीटा एवं गामा फलन	
	8.1 द्विक और त्रिक समाकल	
	8.2 डिरिले समाकल	
	8.3 परिक्रमणीय ठोस का आयतन और पृष्ठ	
	8.4 द्विक समाकलनों में समाकलन क्रम में परिवर्तन	

गतिविधियाँ :

- चर्चा करें कि अनुक्रम, श्रेणी, अभिसरण, सांतत्य, जैकोबियन उच्चिष्ठ एवं निनिष्ठ, बीटा और गामा फलन, द्विक और त्रिक समाकल, आयतन और पृष्ठ भारतीय गणितज्ञों के कार्य से कैसे जुड़े हैं।
- विश्लेषण करें कि अनुक्रम, श्रेणी, अभिसरण, सांतत्य, जैकोबियन, उच्चिष्ठ एवं निनिष्ठ, बीटा और गामा फलन, द्विक और त्रिक समाकल, आयतन और पृष्ठ को वास्तविक दुनिया की समस्याओं को हल करने के लिए कैसे लागू किए जा सकते हैं।
- शिक्षक अन्य गतिविधियाँ भी दे सकते हैं।

सार बिंदु (कीवर्ड)/ टैग:

अनुक्रम, श्रेणी, अभिसारी, सांतत्य, जैकोबियन, उच्चिष्ठ एवं निनिष्ठ, बीटा एवं गामा फलन, द्विक और त्रिक समाकल, आयतन और पृष्ठ।

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhiteka Verma			



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भाग रा - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. Parameswaran, S.: The Golden Age of Indian Mathematics, Swadeshi Science Movement, 1998.
3. Devi Prasad: Advanced Calculus, Prentice Hall India Learning Private Limited, 2009.
4. S C Malik and Savita Arora: Mathematical Analysis, New Age International Private Limited, 1st edition, 2017.
5. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. R. R. Goldbeg: Methods of Real Analysis, Oxford & I.B.H. Publishing co. New Delhi, 2020.
3. T. M. Apostol: Mathematical Analysis, Narosa Publishing House. New Delhi. 1985.
4. D. Soma Sundaram and B. Choudhary: A first Course in mathematical Analysis, Narosa Publishing. House, New Delhi, 1997.
5. Murray R. Spiegel: Theory and problems of Advance Calculus, Schauma Publishing Co. New York, 1974.
6. Donald R. Sherbert, Robert G. Bartle: Introduction to Real Analysis, Wiley, 4th edition, 2011.

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7. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd. Allahabad, 2015.

अनुशसित डिजिटल प्लेटफॉर्म वेब लिंक :

<https://cpqp.inlibnet.ac.in>

<https://www.eschiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swayam.gov.in>

अनुशसित सम्पदक ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111104125/>

भाग द - अनुशसित मूल्यांकन विधियाँ

अनुशसित सतत मूल्यांकन विधियाँ:

अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन:	क्लास टेस्ट	30 अंक
सतत व्यापक मूल्यांकन (CCE):	असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	
आकलन:	अनुभाग (अ): बहुविकल्पीय प्रश्न	70 अंक
विश्वविद्यालयीन परीक्षा	अनुभाग (ब): लघु उत्तरीय प्रश्न	
समय: 03.00 घंटे	अनुभाग (स): दीर्घ उत्तरीय प्रश्न	

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Dr. Archana Pasari		Dr. Gopal Meena	
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BACHELOR OF SCIENCE

(B.Sc. IV Semester, Core - (Major C-5), Multivariate Calculus)

Part A: Introduction			
Program: UG	Class: B.Sc. II Year	Semester: IV	Session: 2026-2027
Subject: Mathematics			
1	Course Code		
2	Course Title	Multivariate Calculus	
3	Course	Core - (Major C-5)	
4	Course Type	Type - 1	
5	Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics (Major or Minor) in first year.	
6	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Understand many properties of real line $\mathbb{R}$ and sequences. 2. Calculate the limit superior, the limit inferior, and the limit of a bounded sequence. 3. Apply the mean value theorems and Taylor's theorem. 4. Apply the various tests to determine convergence and absolute convergence of an infinite series of real numbers. 5. Using Jacobians and Beta and Gamma Functions to solve real world problems.	

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7	Credit Value	Theory: 6	
8	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

Part B: Content of the Course

Total Lectures: 90 hours

(Note: 15 hours of teaching for each credit)

Module	Topics	No. of Hours
I	Bhartiya Gyan Parampra: 1.1 Historical Background of Advanced Calculus 1.2 Contribution of following Bhartiya Ganitagya in the field of Advanced Calculus: 1.2.1 Madhava of Sangamagrama 1.2.2 Parameshvara 1.2.3 Nilakantha Somayaji 1.2.4 Jyeshthadeva 1.2.5 Achyuta Pisharati	20
	2.1 Field structure and ordered structure of $\mathbb{R}$, intervals, bounded and unbounded sets, supremum and infimum, completeness in $\mathbb{R}$, absolute value of a real number. 2.2 Sequence of real numbers 2.3 Limit of a sequence	

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II	2.4 Bounded and monotonic sequences	14
	2.5 Cauchy's general principle of convergence	
	2.6 Algebra of sequence and some important theorems	
III	3.1 Series of non-negative terms	12
	3.2 Convergence of positive term series	
	3.3 Alternating series and Leibnitz's test	
	3.4 Absolute and Conditional Convergence of Series of real terms.	
IV	4.1 Uniform continuity	20
	4.2 Chain rule of differentiability	
	4.3 Mean value theorems and their geometrical interpretations	
	4.4 Limit and continuity of functions of two variables	
V	5.1 Change of variables	24
	5.2 Euler's theorem on homogeneous functions	
	5.3 Taylor's theorem for functions of two variables	
	6.1 Envelopes and Evaluates	
	6.2 Maxima and Minima of functions of two variables	
	6.3 Lagrange's multiplier method	
	7.1 Jacobians	24
	7.2 Beta and Gamma Functions	
	8.1 Double and Triple Integrals	
	8.2 Dirichlet Integral	
	8.3 Volume and Surface of Solid of Revolution	
	8.4 Change of Order of Integration in Double Integrals	

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Suggested Activities:

1. Discuss how Sequence, Series, Convergence, Continuity, Jacobians, Maxima and Minima, Beta and Gamma functions, Double and Triple Integrals, Volume and Surface are connected with the work of Bhartiya Ganitagya.
2. Analyse how Sequence, Series, Continuity, Jacobians, Maxima and Minima, Beta and Gamma functions, Double and Triple Integrals, Volume and Surface can be applied to solve real world problems.
3. Teacher can allot other activities also.

Keywords:

Sequence, Series, Convergence, Continuity, Jacobians, Maxima and Minima, Beta and Gamma functions, Double and Triple Integrals, Volume and Surface.

Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. Parameswaran, S.: The Golden Age of Indian Mathematics, Swadeshi Science Movement, 1998.
3. Devi Prasad: Advanced Calculus, Prentice Hall India Learning Private Limited, 2009.
4. S C Malik and Savita Arora: Mathematical Analysis, New Age International Private Limited, 1st edition, 2017.
5. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें

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Reference Books:

1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. R. R. Goldbeg: Methods of Real Analysis, Oxford & I.B.H. Publishing co. New Delhi, 2020.
3. T. M. Apostol: Mathematical Analysis, Narosa Publishing House. New Delhi. 1985.
4. D. Soma Sundaram and B. Choudhary: A first Course in mathematical Analysis, Narosa Publishing. House, New Delhi, 1997.
5. Murray R. Spiegel: Theory and problems of Advance Calculus, Schauma Publishing Co. New York. 1974.
6. Donald R. Sherbert, Robert G. Bartle: Introduction to Real Analysis, Wiley, 4th edition, 2011.
7. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd. Allahabad, 2015.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swavam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111104125/>

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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	30 Marks
University Exam (UE):	70 Marks

Internal Assessment:

Continuous Comprehensive Evaluation (CCE)

Total Marks: 30

External Assessment:

University Exam Section
Time: 03.00 Hours

Section (A): Multiple Choice
Questions

Section (B): Short Questions

Section (C): Long Questions

Total Marks: 70

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BACHELOR OF SCIENCE

(B.Sc. IV Semester, DSE-2 (विकल्प - 1), समाकल रूपांतर)

भाग अ - परिचय			
कार्यक्रम-स्नातक	कक्षा -बी.एससी. द्वितीय वर्ष	सेमेस्टर- IV	सत्र: 2026-2027
विषय गणित			
1	पाठ्यक्रम का कोड	समाकल रूपांतर DSE-2 (विकल्प - 1) टाइप - 1	
2	पाठ्यक्रम का शीर्षक		
3	पाठ्यक्रम		
4	पाठ्यक्रम का प्रकार		
5	पूर्वापेक्षा (Prerequisite):	इस पाठ्यक्रम का अध्ययन करने के लिए, विद्यार्थी के पास स्नातक प्रथम वर्ष में गणित विषय (मेजर या माइनर) होना चाहिए।	
6	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: 1. लॉप्लास रूपांतर और उसके गुणों के बारे में समझ। 2. लॉप्लास रूपांतर का उपयोग करके साधारण अवकल समीकरणों को हल करना। 3. फलनों के फूरियर रूपांतर से परिचित होना, लॉप्लास और फूरियर रूपांतर के मध्य संबंध। 4. पारसेवल की सर्वसमिका और सीमान्त मान समस्याओं में फूरियर रूपांतर के अनुप्रयोगों की व्याख्या करना।	

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		5. पाठ्यक्रम की अवधारणाओं को वास्तविक जीवन की समस्याओं में लागू करना।	
7	क्रेडिट गान	सैद्धांतिक: 4	
8	कुल अंक	अधिकतम अंक: 30+70	न्यूनतम उत्तीर्णांक: 35

भाग ब - पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 60 घंटे

(नोट: प्रत्येक क्रेडिट के लिए 15 घंटे का शिक्षण आवश्यक है)

मॉड्यूल	विषय	घंटे की संख्या
I	I. भारतीय ज्ञान परंपरा: 1.1 समाकल रूपांतर की ऐतिहासिक पृष्ठभूमि 1.2 समाकल रूपांतर के क्षेत्र में निम्नलिखित भारतीय गणितज्ञों का योगदान: 1.2.1 के. आनंद राउ 1.2.2 श्रीनिवास रामानुजन 1.2.3 एस. चंद्रशेखर 1.2.4 हरीशचंद्र 1.2.5 कल्याम्पुडी राधाकृष्ण राव	02
II	लॉप्लास रूपांतर: 2.1 रैखिकता प्रगुण 2.2 अस्तित्व प्रमेय 2.3 स्थानान्तरी प्रमेय 2.4 स्केल परिवर्तन प्रगुण	13

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	2.5 अवकलजों एवं समाकलों का लॉप्लास रूपांतर 2.6 लॉप्लास रूपांतर का अवकलन एवं समाकलन 2.7 t के द्वारा गुणन एवं भाग 2.8 आवर्ती फलन	
III	प्रतिलोम लॉप्लास रूपांतर: 3.1 रैखिक प्रगुण 3.2 स्थानान्तरी प्रमेय 3.3 स्केल परिवर्तन प्रगुण 3.4 अवकलजों और समाकलों का प्रतिलोम लॉप्लास रूपांतर 3.5 p के घात द्वारा गुणन एवं भाग 3.6 संवलन प्रमेय 3.7 हेवीसाइड विस्तार प्रमेय	15
IV	फूरियर रूपांतर: 4.1 रैखिकता प्रगुण 4.2 स्थानान्तरी प्रमेय 4.3 स्केल परिवर्तन प्रगुण 4.4 प्रतिरूपकता 4.5 संवलन प्रमेय 4.6 अवकलजों का फूरियर रूपांतर 4.7 फूरियर रूपांतर और लॉप्लास रूपांतर के मध्य संबंध 4.8 फूरियर रूपांतर के लिए पारसेवल सर्वसमिका	15
V	अनुप्रयोग:	15

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Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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5.1 लाप्लास रूपांतर

5.1.1 स्थिर और चर गुणांकों वाले साधारण

अवकल समीकरणों का हल

5.1.2 ऊष्मा चालन और तरंग समीकरणों का हल

5.2 फूरियर रूपांतर

5.2.1 अवकल समीकरणों का हल

5.2.2 ऊष्मा चालन और तरंग समीकरणों का हल

गतिविधियाँ

1. चर्चा करें कि लाप्लास रूपांतर, व्युत्क्रम लाप्लास रूपांतर, फूरियर रूपांतर, रैखिकता गुण, विस्थापन प्रमेय, स्केल परिवर्तन गुण और संवलन प्रमेय भारतीय गणितज्ञों के कार्य से कैसे जुड़ी हैं।

2. विश्लेषण करें कि लाप्लास रूपांतर, व्युत्क्रम लाप्लास रूपांतर, फूरियर रूपांतर, रैखिकता गुण, विस्थापन प्रमेय, स्केल परिवर्तन गुण और संवलन प्रमेय को वास्तविक दुनिया की समस्याओं को हल करने के लिए कैसे लागू किया जा सकता है।

3. शिक्षक अन्य गतिविधियाँ भी दे सकते हैं।

सार बिंदु (कीवर्ड)/ टैग:

लॉप्लास रूपांतर, प्रतिलोम लॉप्लास रूपांतर, फूरियर रूपांतर, रैखिकता प्रगुण, स्केल परिवर्तन प्रगुण, स्थानान्तरी प्रमेय, संवलन प्रमेय, पारसेवल सर्वसमिका।

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maltra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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भाग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Sreenadh S., Ranganatham S., Prasad M.V.S.S.N. & Babu, Ramesh V.: Fourier Series and Integral Transforms, S. Chand Publishing, 2014.
2. Lokenath Debnath, Dambaru Bhatta: Integral Transforms and Their Applications, Chapman and Hall/CRC; 3rd edition, 2014.
3. A. N. Srivastava: Integral Transforms and Fourier Series, Narosa Publications, 2012.
4. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. N. Sneddon: The use of integral transform, McGraw Hill, 1972.
2. Murray R. Spiegel, Laplace transform, Schaum's Series, McGraw-Hill Education, 1st edition, 1965.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/mpdlhe>

व्यापक <https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swayam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111102129/>

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भाग द - अनुशंसित मूल्यांकन विधियाँ

अनुशंसित सतत मूल्यांकन विधियाँ:

अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन: सतत व्यापक मूल्यांकन (CCE):	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	30 अंक
आकलन: विश्वविद्यालयीन परीक्षा समय: 03.00 घंटे	अनुभाग (अ): बहुविकल्पीय प्रश्न अनुभाग (ब): लघु उत्तरीय प्रश्न अनुभाग (स): दीर्घ उत्तरीय प्रश्न	70 अंक

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Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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BACHELOR OF SCIENCE

(B.Sc. IV Semester; DSE 2 (Option 1), Integral Transform)

Part A : Introduction			
Program : UG	Class: B.Sc. II Year	Semester: IV	Session: 2026-2027
Subject: Mathematics			
1	Course Code		
2	Course Title	Integral Transform	
3	Course	DSE-2 (Option - 1)	
4	Course Type	Type - 1	
5	Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics (Major or Minor) in first year.	
6	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Understanding about Laplace transform and its properties. 2. Solve ordinary differential equations using Laplace transform. 3. Familiarise with Fourier transform of functions, relation between Laplace and Fourier transform. 4. Explain Parseval's identity and applications of Fourier transform to boundary value problems. 5. Apply the concepts of the Laplace and Fourier transform in real life problems.	
7	Credit Value	Theory: 4	
8	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Part B: Content of the Course

Total Lectures: 60 hours

(Note: 15 hours of teaching for each credit)

Module	Topics	No. of Hours
I	Bhartiya Gyan Parampra: 1.1 Historical Background of Integral Transform 1.2 Contribution of following Bhartiya Ganitagya in the field of Integral Transform: 1.2.1 K. Ananda Rau 1.2.2 Srinivasa Ramanujan 1.2.3 S. Chandrasekhar 1.2.4 Harish-Chandra 1.2.5 Calyampudi Radhakrishna Rao	02
II	Laplace Transform: 2.1 Linearity property 2.2 Existence theorem 2.3 Shifting theorem 2.4 Change of scale property 2.5 Laplace transforms of derivatives and integrals 2.6 Differentiation and integration of the Laplace transforms 2.7 Multiplication and division by 't' 2.8 Periodic function	13
III	Inverse Laplace Transform: 3.1 Linearity property 3.2 Shifting theorem 3.3 Change of scale property 3.4 Inverse Laplace transforms of derivatives and integrals 3.5 Multiplication and division by powers of p 3.6 Convolution theorem 3.7 Heaviside expansion theorem	15
IV	Fourier Transform: 4.1 Linearity property 4.2 Shifting theorem 4.3 Change of scale property 4.4 Modulation 4.5 Convolution theorem	15

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Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari	<i>Archana</i>	Dr. Gopal Meena	
Dr. Preeti Nagar	<i>Preeti</i>	Mr. Vinit Jain	
Ms. Sakshi Panjwani	<i>Sakshi</i>	Mr. Shakti Patel	
Ms. Abhileka Verma	<i>Abhileka</i>		



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	4.6 Fourier transform of derivatives 4.7 Relations between Fourier transform and Laplace transform 4.8 Parseval's identity for Fourier transform	
V	Applications of: 5.1 Laplace Transform 5.1.1 Solution of ordinary differential equations with constant and variable coefficients 5.1.2 Solution of Heat Conduction and Wave equations 5.2 Fourier Transform 5.2.1 Solution of differential equations 5.2.2 Solution of Heat Conduction and Wave equations	15
Suggested Activities: 1. Discuss how Laplace Transform, Inverse Laplace transform, Fourier Transform, Linearity Property, shifting theorem, Change of Scale Property and Convolution theorem are connected with the work of Bhartiya Ganitagya. 2. Analyse how Laplace Transform, Inverse Laplace transform, Fourier Transform, Linearity Property, shifting theorem, Change of Scale Property and Convolution theorem can be applied to solve real world problems. 3. Teacher can allot other activities also.		
Keywords/Tags: Laplace Transform, Inverse Laplace transform, Fourier Transform, Linearity Property, shifting theorem, Change of Scale Property, Convolution theorem, Parseval's identity.		

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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Sreenadh S., Ranganatham S., Prasad M.V.S.S.N. & Babu, Ramesh V.: Fourier Series and Integral Transforms, S. Chand Publishing, 2014.
2. Lokenath Debnath, Dambaru Bhatta: Integral Transforms and Their Applications, Chapman and Hall/CRC; 3rd edition, 2014.
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<https://epgp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swavam.gov.in>

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Ms. Abhileka Verma			



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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	30 Marks
University Exam (UE):	70 Marks

Internal Assessment:

Continuous Comprehensive Evaluation (CCE)

External Assessment:	Section (A) : Multiple Choice	Total Marks: 30
University Exam Section	Questions	Total Marks: 70
Time: 03.00 Hours	Section (B) : Short Questions	
	Section (C) : Long Questions	

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Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhiloka Verma			

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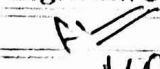
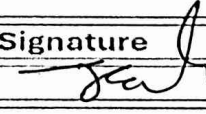
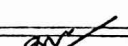
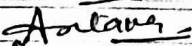
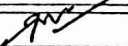
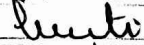
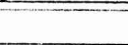
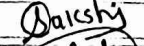
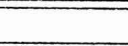
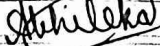
Department of Mathematics

BACHELOR IN SCIENCE

(B.Sc. IV Semester, DSE-2 (विकल्प - 2))

(अवकल ज्यामिति)

भाग अ - परिचय			
कार्यक्रम- स्नातक	कक्षा -बी.एससी. द्वितीय वर्ष	सेमेस्टर- IV	सत्र: 2026-2027
विषय गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	अवकल ज्यामिति	
3	पाठ्यक्रम	DSE-2 (विकल्प - 2)	
4	पाठ्यक्रम का प्रकार	टाइप - 1	
5	पूर्वापेक्षा (Prerequisite):	इस पाठ्यक्रम का अध्ययन करने के लिए, विद्यार्थी के पास स्नातक प्रथम वर्ष में गणित विषय (मेजर या माइनर) होना चाहिए।	
6	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: 1. वक्र और पृष्ठ के प्राचलिक निरूपण, आश्लेषी समतल को समझना। 2. वक्रता और मुख्य अभिलंब को समझना, वक्रता का वृत्त, फ्रेनेट-सेरेट सूत्रों को सिद्ध करने में सक्षम होना।	

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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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		3. वक्रता के केंद्र का बिन्दुपथ, आश्लेषी गोला, वक्र के प्रतिकेन्द्रज और केन्द्रज को समझना। 4. पृष्ठ के लिए स्पर्शरखा तल को व्युत्पन्न करना, रेखज पृष्ठों को समझना। 5. वक्रीय निर्देशांक से परिचित होना, प्रथम कोटि के मौलिक परिमाण को समझना।
7	क्रेडिट मान	सैद्धांतिक: 4
8	कुल अंक	अधिकतम अंक: 30 + 70
		न्यूनतम उत्तीर्णांक: 35

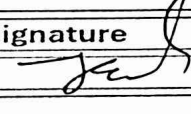
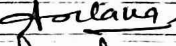
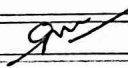
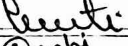
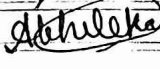
भाग ब - पाठ्यक्रम की विषयवस्तु

व्याख्यान की कुल संख्या (प्रति सप्ताह घंटे में): प्रति सप्ताह 3 घंटे

कुल व्याख्यान : 60 घंटे

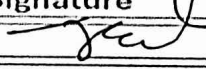
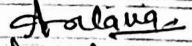
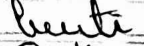
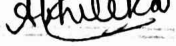
(नोट: प्रत्येक क्रेडिट के लिए 15 घंटे का शिक्षण आवश्यक है)

मॉड्यूल	विषय	घंटे की संख्या
I	भारतीय ज्ञान परंपरा: 1.1 अवकल ज्यामिति की ऐतिहासिक पृष्ठभूमि 1.2 अवकल ज्यामिति के क्षेत्र में निम्नलिखित भारतीय गणितज्ञों का योगदान: 1.2.1 डॉ. के. वरदराजन 1.2.2 डॉ. राजेंद्र भाटिया	02

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagari		Mr. Vinit Jain	
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Ms. Abhileka Verma			

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II	1.2.3 डॉ. एम. एस. नरसिम्हन् अंतरिक्ष में वक्र: 2.1 वक्र की स्पर्शरेखा 2.2 वक्रता और मरोड़ 2.3 फ्रेनेट-सेरेट सूत्र 2.4 वक्र और पृष्ठ का संपर्क	15
III	3.1 आश्लेषी समतल (वक्रता तल) 3.2 हेलिक्स 3.3 आश्लेषी वृत्त (वृत्ताकार वक्रता) 3.4 वृत्ताकार वक्रता के केंद्र का बिन्दुपथ 3.5 आश्लेषी गोला (गोलाकार वक्रता) 3.6 गोलाकार वक्रता के केंद्र का बिन्दुपथ	15
IV	4.1 प्रतिकेन्द्रज और केन्द्रज वक्र 4.2 प्रतिकेन्द्रज वक्र की वक्रता और मरोड़ 4.3 केन्द्रज वक्र की वक्रता और मरोड़	13
V	पृष्ठ: 5.1 प्रथम एवं द्वितीय आधारभूत रूप 5.2 अभिलंब वक्रता 5.3 मुख्य वक्रता 5.4 वक्रता रेखा 5.5 एकक अभिलंब का अवकलज 5.6 रोड्रिग्स सूत्र	15

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गतिविधियाँ:

1. चर्चा करें कि रोबोटिक्स में वक्र की स्पर्शरेखा और मरोड़ का उपयोग कैसे किया जाता है।
2. एयरोरोपेस में आश्लेषी समतल और एयरोडायनामिक्स में आश्लेषी गोला के अनुप्रयोगों पर चर्चा करें।
3. बायोमैकेनिक्स में प्रतिकेन्द्रज की वक्रता और मरोड़, तंत्रिका विज्ञान में केन्द्रज की वक्रता और मरोड़ के अनुप्रयोगों पर चर्चा करें।
4. चर्चा करें कि प्रसामान्य वक्रता का उपयोग बायोमैकेनिक्स में कैसे किया जा सकता है और मुख्य वक्रता का उपयोग मेडिकल इमेजिंग में कैसे किया जा सकता है।
5. शिक्षक अन्य गतिविधियाँ भी दे सकते हैं।

सार बिंदु (कीवर्ड)/ टैग:

अंतरिक्ष में वक्र, फ्रेनेट-सेरेट सूत्र, आश्लेषी समतल, प्रतिकेन्द्रज और केन्द्रज वक्र, पृष्ठ, प्रसामान्य वक्रता, मुख्य वक्रता।

भाग स - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

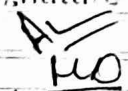
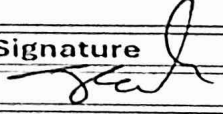
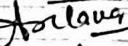
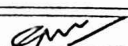
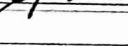
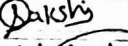
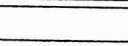
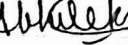
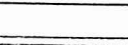
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पाठ्य पुस्तकें:

1. T. J. Willmore: Differential Geometry, Oxford University Press, London, 1959 and Indian XI Edition, New Delhi, 1993.
2. B. B. Sinha: Differential Geometry-An Introduction, Shyam Prakashan Mandir, Allahabad, 1978.
3. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. R. S. Mishra: A course in Tensors with Applications to Riemannian Geometry, Pothishala Pvt. Ltd., Allahabad, 1965.

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2. C. E. Weatherburn: An Introduction to Tensor Calculus and Riemannian Geometry, Cambridge University Press, London, 1942 and Radha Publishing House Calcutta, Indian Edition, 1995.

3. L. P. Eisenhart: Differential Geometry with the use of Tensors, Princeton University Press, New Jersey, 1949.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक :

<https://engp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://opos.gov.in>

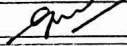
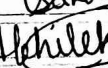
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<https://swayam.gov.in>

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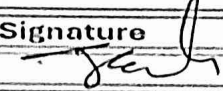
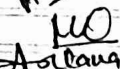
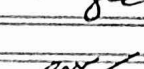
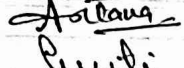
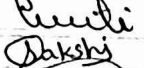
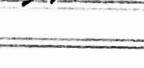
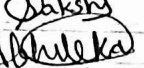
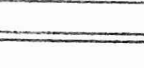
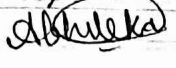
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<https://ugemoocs.inflibnet.ac.in/index.php/courses/view ug/364>

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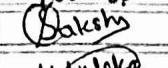
भाग द - अनुशंसित मूल्यांकन विधियाँ		
अनुशंसित सतत मूल्यांकन विधियाँ: अधिकतम अंक: 100 सतत शैक्षिक मूल्यांकन (CCE): 30 अंक विश्वविद्यालय परीक्षा (UE): 70 अंक		
आंतरिक मूल्यांकन: सतत शैक्षिक मूल्यांकन (CCE):	बलारा टेस्ट असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	30 अंक
आकलन: विश्वविद्यालयीन परीक्षा समय: 03.00 घंटे	अनुभाग (अ): अति लघुउत्तरीय प्रश्न अनुभाग (ब): लघु उत्तरीय प्रश्न अनुभाग (स): दीर्घ उत्तरीय प्रश्न	70 अंक

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mitu Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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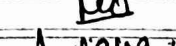
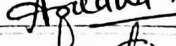
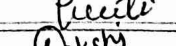
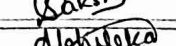
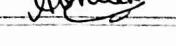
BACHELOR OF SCIENCE
 (B.Sc. IV Semester, DSE - 2 (Option - 2))
 (Differential Geometry)

Part A: Introduction			
Program: UG	Class: B.Sc. II Year	Semester: IV	Session: 2026-2027
Subject: Mathematics			
1	Course Code	Differential Geometry DSE - 2 (Option - 2) Type - I	
2	Course Title		
3	Course		
4	Course Type		
5	Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics (Major or Minor) in first year.	
6	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Understand parametric representation of a curve and a surface, Osculating Plane. 2. Understand curvature and principal normal, Circle of curvature, Able to prove Frenet-Serret formulae. 3. Understand Locus of centre of curvature, Osculating sphere, Involutives and Evolutes of a curve. 4. Derive tangent plane to a surface, Understand Ruled surfaces. 5. Introduce with curvilinear co-ordinates, Understand Fundamental Magnitude of first order.	
7	Credit Value	Theory: 4	
8	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

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Part B: Content of the Course		
Total Lectures: 60 hours		
(Note: 15 hours of teaching for each credit)		
Module	Topics	No. of Hours
I	Bhartiya Gyan Parampara: 1.1 Historical Background of Differential Geometry 1.2 Contribution of following Bhartiya Ganitagya in the field of Differential Geometry: 1.2.1 Dr. K. Varadarajan, 1.2.2 Dr. Rajendra Bhatia, 1.2.3 Dr. M. S. Narasimhan	02
II	Curve in Space: 2.1 Tangent to Curve 2.2 Curvature and Torsion 2.3 Frenet-Serret Formulae 2.4 Contact of a Curve and a Surface	15
III	3.1 Osculating Plane (Plane of Curvature) 3.2 Helix 3.3 Osculating Circle (Circular Curvature) 3.4 Locus of Centre of Circular Curvature 3.5 Osculating Sphere (Spherical Curvature) 3.6 Locus of Centre of Spherical Curvature	15
IV	4.1 Involute and Evolute Curve 4.2 Curvature and Torsion of Involute Curve 4.3 Curvature and Torsion of Evolute Curve	13
V	Surface: 5.1 First and Second Fundamental Form 5.2 Normal Curvature 5.3 Principal Curvature 5.4 Line of Curvature 5.5 Derivative of Unit Normal 5.6 Rodrigues Formula	15

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Suggested Activities:

1. Discuss how Tangent to a Curve and Torsion be used in Robotics.
2. Discuss on applications of Osculating Plane in Aerospace and Osculating Sphere in Aerodynamics.
3. Discuss on applications of Curvature & Torsion of Involute in Biomechanics, Curvature & Torsion of Evolute in Neuroscience.
4. Discuss how Normal Curvature be used in Biomechanics and Principal Curvatures can be used in Medical Imaging.
5. Teacher can allot other activities also.

Keywords/Tags:

Curve in Space, Frenet-Serret Formulae, Osculating Plane, Involute and Evolute Curve, Surface, Normal Curvature, Principal Curvature.

Part C - Learning Resources

Text Books, Reference Books, Other Resources

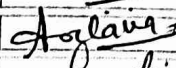
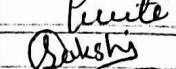
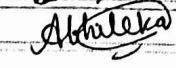
Suggested Readings:

Text Books:

1. T. J. Willmore: Differential Geometry, Oxford University Press, London, 1959 and Indian XI Edition, New Delhi, 1993.
2. B. B. Sinha: Differential Geometry-An Introduction, Shyam Prakashan Mandir, Allahabad, 1978.
3. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. R. S. Mishra: A course in Tensors with Applications to Riemannian Geometry, Pothishala Pvt. Ltd., Allahabad, 1965.
2. C. E. Weatherburn: An Introduction to Tensor Calculus and Riemannian Geometry, Cambridge University Press, London, 1942 and Radha Publishing House Calcutta, Indian Edition, 1995.
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Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

<https://swayam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111104095>

https://ugemoocs.inflibnet.ac.in/index.php/courses/view_ug/364

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 30 Marks

University Exam (UE): 70 Marks

Internal Assessment:

Continuous Comprehensive Evaluation (CCE)

Total Marks: 30

External Assessment:

University Exam Section

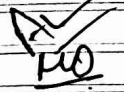
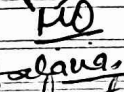
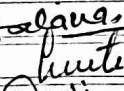
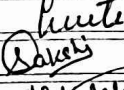
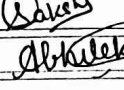
Time: 03.00 Hours

Section (A): Multiple Choice Questions

Section (B): Short Questions

Section (C): Long Questions

Total Marks: 70

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



ST. ALOYSIUS' COLLEGE JABALPUR (MADHYA PRADESH)

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Affiliated to Ram Durgavati Vishwavidyalaya, Jabalpur (M.P.)

BACHELOR OF SCIENCE

(B.Sc. IV Semester, Minor M (4), आंशिक अवकल समीकरण के तत्व)

भाग अ — परिचय			
कार्यक्रम- स्नातक	कक्षा -बी.एससी. द्वितीय वर्ष	सेमेस्टर — IV	सत्र: 2026-2027
विषय गणित			
1	पाठ्यक्रम का कोड		
2	पाठ्यक्रम का शीर्षक	आंशिक अवकल समीकरण के तत्व	
3	पाठ्यक्रम	Minor M (4)	
4	पाठ्यक्रम का प्रकार	टाइप-1	
5	पूर्वापेक्षा (Prerequisite):	इस पाठ्यक्रम का अध्ययन करने के लिए, विद्यार्थी के पास स्नातक प्रथम वर्ष में गणित विषय (मेजर या माइनर) होना चाहिए।	
6	पाठ्यक्रम अध्ययन के परिणाम (कोर्स लर्निंग आउटकम -CLO):	पाठ्यक्रम छात्र/छात्राओं को सक्षम करेगा: - आंशिक अवकल समीकरणों, प्रतिरूपण, हलों की सामान्य संरचना और हलों के लिए विश्लेषणात्मक और संख्यात्मक विधियों के ज्ञान का उपयोग करने में। - संरक्षण नियमों का उपयोग करके भौतिक समस्याओं को PDEs के रूप में सूत्रबद्ध करने में। - भौतिकी और इंजीनियरिंग में विभिन्न (तरंग) परिघटनाओं के गणितीय विवरणों के मध्य समानताओं को समझने में।	

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
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Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
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Ms. Abhileka Verma			



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		4. PDEs को वर्गीकृत करने, विश्लेषणात्मक विधियों को लागू करने, और हलों की भौतिक व्याख्या करने में। 5. वास्तविक दुनिया की समस्याओं से संबंधित व्यावहारिक PDE समस्याओं को हल करने में।	
7	क्रेडिट मान	सैद्धांतिक: 4	
8	कुल अंक	अधिकतम अंक: 30 + 70	न्यूनतम उत्तीर्णांक: 35

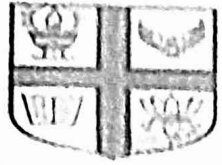
भाग ब – पाठ्यक्रम की विषयवस्तु

कुल व्याख्यान : 60 घंटे

(नोट: प्रत्येक क्रेडिट के लिए 15 घंटे का शिक्षण आवश्यक है)

मॉड्यूल	विषय	घंटे की संख्या
I	I. भारतीय ज्ञान परंपरा: 1.1 आंशिक अवकल समीकरणों की ऐतिहासिक पृष्ठभूमि 1.2 आंशिक अवकल समीकरणों के क्षेत्र में निम्नलिखित भारतीय गणितज्ञों का योगदान: 1.2.1 के. आनंद राउ 1.2.2 एस. चंद्रशेखर 1.2.3 हरीश चंद्र 1.2.4 एम.एस. नरसिम्हन	02
II	2.1 आंशिक अवकल समीकरणों की संरचना	12

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
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	2.2 आंशिक अवकल समीकरणों की कोटि और मात्रा 2.3 प्रथम कोटि के रेखिक और अ-रेखिक आंशिक अवकल समीकरण 2.4 आंशिक अवकल समीकरणों के विभिन्न प्रकार के हल	
III	3.1 लैग्रांज हल 3.2 कुछ विशेष प्रकार के समीकरण जिन्हें सामान्य विधि के अतिरिक्त अन्य विधियों द्वारा आसानी से हल किया जा सकता हो 3.3 चारपिट की व्यापक विधि	15
IV	4.1 द्वितीय एवं उच्च कोटि के रेखिक आंशिक अवकल समीकरण 4.2 निरीक्षण विधि द्वारा द्वितीय कोटि के रेखिक आंशिक अवकल समीकरणों का हल और विहित रूपों में समानयन 4.3 द्वितीय कोटि के आंशिक अवकल समीकरणों का वर्गीकरण	16
V	5.1 अचर गुणांकों के समघात एवं असमघात आंशिक अवकल समीकरण 5.2 अचर गुणांकों में समानेय आंशिक अवकल समीकरण	15

गतिविधियाँ:

- चर्चा करें कि आंशिक अवकल समीकरण, लैग्रांज विधि, चारपिट विधि, भारतीय गणितज्ञों के कार्य से किस प्रकार जुड़े हैं।
- विश्लेषण करें कि आंशिक अवकल समीकरण, लैग्रांज विधि, चारपिट विधि, वास्तविक दुनिया की समस्याओं को हल करने के लिए किस प्रकार लागू किए जा सकते हैं।
- शिक्षक अन्य गतिविधियाँ भी दे सकते हैं।

सार बिंदु (कीवर्ड)/ टैग: आंशिक अवकल समीकरण, लैग्रांज विधि, चारपिट विधि।

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Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhilekha Verma			



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भाग रा - अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित गणित पुस्तकें / पाठ्यपुस्तकें / अन्य पाठ्य सामग्री:

पाठ्य पुस्तकें:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. M. D. Raysinghania: Ordinary and Partial Differential Equations, S. Chand & Company, New Delhi, 2017.
3. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

संदर्भ पुस्तकें:

1. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.
2. Shah Nita H.: Ordinary and Partial Differential Equations: Theory and Applications, PHI Learning Private Limited, Second edition, 2015.
3. K. Sankara Rao: Introduction to Partial Differential Equations, PHI, 3rd edition, 2010.
4. I. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
5. Frank Ayres: Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक:

<https://epgp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/impdhe>

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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<https://onos.gov.in>

<https://eg4.nic.in/impelibrary>

<https://swayam.gov.in>

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

<https://nptel.ac.in/courses/111101153/>

भाग द - अनुशंसित मूल्यांकन विधियाँ

अनुशंसित सतत मूल्यांकन विधियाँ:

अधिकतम अंक: 100

सतत व्यापक मूल्यांकन (CCE): 30 अंक

विश्वविद्यालय परीक्षा (UE): 70 अंक

आंतरिक मूल्यांकन:	क्लास टेस्ट	30 अंक
सतत व्यापक मूल्यांकन (CCE):	असाइनमेंट / प्रस्तुतीकरण (प्रेजेंटेशन):	
आकलन:	अनुभाग (अ): बहुविकल्पीय प्रश्न	70 अंक
विश्वविद्यालयीन परीक्षा	अनुभाग (ब): लघु उत्तरीय प्रश्न	
समय: 03.00 घंटे	अनुभाग (स): दीर्घ उत्तरीय प्रश्न	

BOS Members	Signature	BOS Members	Signature
Dr. Akhilesh Pathak		Dr. J. K. Maitra	
Dr. Mita Darbari		Dr. Sandeep Tiwari	
Dr. Archana Pasari		Dr. Gopal Meena	
Dr. Preeti Nagar		Mr. Vinit Jain	
Ms. Sakshi Panjwani		Mr. Shakti Patel	
Ms. Abhileka Verma			



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BACHELOR OF SCIENCE (B.Sc. IV, Minor M (4), Elements of Partial Differential Equations)

Part A : Introduction			
Program : UG	Class: B.Sc. II Year	Semester: IV	Session: 2026-2027
Subject: Mathematics			
1	Course Code		
2	Course Title	Elements of Partial Differential Equations	
3	Course	Minor M (4)	
4	Course Type	Type – 1	
5	Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics (Major or Minor) in first year.	
6	Course Learning Outcomes (CLO)	The course will enable the students to: 1. Use knowledge of partial differential equations (PDEs), modelling, the general structure of solutions, and analytic and numerical methods for solutions. 2. Formulate physical problems as PDEs using conservation laws. 3. Understand analogies between mathematical descriptions of different (wave) phenomena in physics and engineering. 4. Classify PDEs, apply analytical methods, and physically interpret the solutions.	

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		5. Solve practical PDE problems related to real world problems.	
7	Credit Value	Theory: 4	
8	Total Marks	Max. Marks: 30 + 70	Min. Passing Marks: 35

Part B: Content of the Course

Total Lectures: 60 hours

(Note: 15 hours of teaching for each credit)

Module	Topics	No. of Hours
I	Indian Knowledge System: 1.1 Historical Background of Partial Differential Equations 1.2 Contribution of following Bhartiya Ganitagya in the field of Partial Differential Equations: 1.2.1 K. Ananda Rau 1.2.2 S. Chandrasekhar 1.2.3 Harish-Chandra 1.2.4 M. S. Narasimhan	02
II	2.1 Formation of Partial differential equations 2.2 Order and degree of Partial differential equations 2.3 Linear and Non-Linear Partial differential equations of the first order 2.4 Different types of solutions of Partial differential equations	12

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III	3.1 Lagrange's solution 3.2 Some special types of equations which can be solved easily by methods other than the general method 3.3 Charpit's general method	15
IV	4.1 Linear Partial differential equations of second and higher orders 4.2 Solution of Linear partial differential equations of second order by inspection method and reduction to canonical forms 4.3 Classification of partial differential equations of second order	16
V	5.1 Homogeneous and non-homogeneous partial differential equations of constant coefficients 5.2 Partial differential equations reducible to equations with constant coefficients	15

Suggested Activities:

1. Discuss how Partial differential equations, Lagrange's and Charpit's methods are connected with the work of Bhartiya Ganitagya.
2. Analyse how Partial differential equations, Lagrange's and Charpit's methods can be applied to solve real world problems.
3. Teacher can allot other activities also.

Keywords/Tags:

Partial differential equations, Lagrange's method, Charpit's method.

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Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
2. M. D. Raysinghania: Ordinary and Partial Differential Equations, S. Chand & Company, New Delhi, 2017.
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5. Frank Ayres: Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>

<https://www.eshiksha.mp.gov.in/mpdhe>

<https://onos.gov.in>

<https://eg4.nic.in/mpelibrary>

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<https://swayam.gov.in>

Suggested Equivalent online courses:

<https://nptel.ac.in/courses/111101153/>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 30 Marks

University Exam (UE): 70 Marks

Internal Assessment:

Continuous Comprehensive Evaluation (CCE)

Total Marks: 30

External Assessment:

University Exam Section

Time: 03.00 Hours

Section (A) : Multiple Choice Questions

Section (B) : Short Questions

Section (C) : Long Questions

Total Marks: 70

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ST. ALOYSIUS COLLEGE (AUTO), JABALPUR

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College with Potential for Excellence by UGC

DST-FIST supported

Department of Mathematics

Faculty of Science

Bachelor of Science (B.Sc.)

SUBJECT: Mathematics

B.Sc. V Semester

Paper-Core – Elements of Discrete Mathematics

Course Outcomes

CO. No.	Course Outcomes	Cognitive Level
CO1	Comprehend Indian Logic and its influence on Modern Logic Analyse and Apply Relations and Lattices to Real World	U, An, Ap
CO2	Correlate Boolean Algebra to Switching Circuit and Generate Applications in Real Life. Analyse and Evaluate a Minimal Boolean Function	U, An, Ap
CO3	Deduce the Practicality of Graph Theory and implement the techniques in Real Life perspective.	U, An, Ap
CO4	Understand and Apply Trees and Matrix Representation of Graphs	U, An, Ap

Credit and Marking Scheme

Theory	Credits	Marks		Total Marks
		Internal	External	
	6	40	60	100
Total	6	100		

Evaluation Scheme

Theory	Marks	
	Internal	External
	3 Internal Exams of 20 Marks each during the Semester (Best 2 will be taken)	1 External Exams (At the End of Semester)

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College with Potential for Excellence by UGC

DST-FIST supported
Department of Mathematics



Content of the Course Theory

No. of Lectures Hours per Week: 6 Hours. per Week

Total No. of Lectures: 90 Hours.

Maximum Marks: 60

Unit	Topics	No. of Lectures
I	1.1 Indian Logic 1.1.1 Origins 1.1.2 The schools Vaisheshika 1.1.3 Catuskoti 1.1.4 Nyaya 1.1.5 Jain Logic 1.1.6 Buddhist Logic 1.1.7 Navya-Nyaya 1.1.8 Influence of Indian Logic on Modern Logic 1.1.9 Boolean Logic and Indian Thoughts 1.2 Relations 1.2.1 Binary, Inverse, Composite and Equivalence relation 1.2.2 Equivalence classes and its properties 1.2.3 Partition of a set 1.2.4 Partial order relation 1.2.5 Partially ordered and totally ordered sets 1.2.6 Hasse diagram 1.3 Lattices 1.3.1 Definition and examples 1.3.2 Dual, bounded, distributive and complemented lattices	34
II	2.1 Boolean Algebra 2.1.1 Definition and properties 2.1.2 Switching circuits and its applications 2.1.3 Logic gates and circuits 2.2 Boolean Functions 2.2.1 Disjunctive and conjunctive normal forms 2.2.2 Bool's expansion theorem 2.3 Minimize the Boolean function using Karnaugh Map	34

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III	3. Graphs: 3.1 Definition and types of graphs 3.2 Subgraphs 3.3 Walk, path and circuit 3.4 Connected and disconnected graph 3.5 Euler graph 3.6 Hamiltonian path and circuit 3.7 Dijkstra's Algorithm for shortest paths in weighted graph	28
IV	4. Tree: 4.1 Trees and properties 4.2 Rooted, Binary and Spanning tree 4.3 Rank and nullity of a graph 4.4 Kruskal's and Prim's Algorithm 4.5 Cut- set and Its Properties 4.6 Fundamental Circuits and Cut- set 4.7 Planar graphs 4.8 Kuratowski's two graph 4.9 Matrix representation of graph 4.9.1 Incidence 4.9.2 Adjacency 4.9.3 Circuit 4.9.3 Cut – Set 4.9.4 Path	24

References

Text Books:

1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications To Computer Science, McGraw Hill Education, 1st edition, 2017.
2. Satinder Bal Gupta, C. P. Gandhi: Discrete Structures, Laxmi Publication, 2010.
3. C. L. Liu: Elements of Discrete Mathematics, Mac Graw Hill Education, 4th edition, 2017.
4. Narsingh Deo: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India Learning Private Limited, 1997.
5. मध्यप्रदेश हिंदी ग्रन्थ अकादमी की पुस्तकें

Reference Books:

1. Seymour Lipschutz and Mark Lipson: Discrete Mathematics (Schaums Outline),

Handwritten signatures and initials:
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Mac Graw Hill Education, 3rd edition, 2017.

2. Edgar G. Goodaire and Michael M. Parmenter.

3. Discrete Mathematics with Graph Theory, Pearson Education Pt. Ltd., Indian Reprint 2003

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Faculty of Science

Bachelor of Science (B.Sc.)

SUBJECT: MATHEMATICS

B.Sc. V Semester

Paper- Discipline Specific Elective

Numerical Methods and Scientific Computation

Course Outcomes

CO.No.	Course Outcomes	Cognitive Level
CO1	Understand numerical methods to find the solution of a system of linear equations.	U
CO2	Compute interpolation value for real data.	E
CO3	Find quadrature by using various numerical methods.	E
CO4	Solve system of linear equations by using various numerical techniques.	Ap
CO5	Obtain solutions of ordinary differential equations by using numerical methods.	Ap

Credit and Marking Scheme

	Credits	Marks		Total Marks
		Internal	External	
Theory	4	40	60	100
Total	4	100		

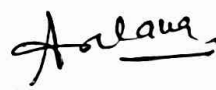
Evaluation Scheme

	Marks	
	Internal	External
Theory	3 Internal Exams of 20 Marks (During the Semester) (Best 2 will be taken)	1 External Exams (At the End of Semester)







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Content of the Course

Theory

No. of Lectures (in hours per week): 4.5 Hrs. per week

Total No. of Lectures: 60 Hrs.

Maximum Marks: 60

Unit	Topics	No. of Lectures
I	Methods for solving Algebraic and Transcendental Equations: 1.1 Ramanujan 1.2 Bisection 1.3 Regula Falsi 1.4 Secant 1.5 Newton-Raphson	16
II	Interpolation and Numerical Integration: 2.1 Lagrange Interpolation 2.2 Finite difference operators 2.3 Interpolation formula using Differences 2.3.1 Gregory-Newton Forward Difference Interpolation 2.3.2 Gregory-Newton Backward Difference Interpolation 2.4 Numerical Integration 2.4.1 Newton-Cote's formulae 2.4.2 Trapezoidal rule 2.4.3 Simpson's 1/3 Rule 2.4.4 Simpson's 3/8 Rule 2.4.5 Gauss Integration	16
III	Methods to Solve System of Linear Equations: 3.1 Direct method for solving system of linear equations 3.1.1 Gauss elimination 3.1.2 LU decomposition 3.1.3 Cholesky decomposition 3.2 Iterative method 3.2.1 Jacobi 3.2.2 Gauss-Seidel	24
IV	Numerical Solution of Ordinary Differential Equations: 4.1 Single step methods 4.1.1 Picard 4.1.2 Taylor's series 4.1.3 Euler 4.1.4 Runge-Kutta	24

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4.2 Multistep methods 4.2.1 Predictor-corrector 4.2.2 Modified Euler 4.2.3 Milne-Simpson	
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References

Text Books:

1. S. S. Sastry: Introductory Methods of Numerical Analysis, Prentice Hall India Learning Private Limited, Fifth edition, 2012.
2. E. Balagurusamy: Numerical Methods, Tata McGraw Hill Publication, 2017.
3. मध्यप्रदेश हिंदी ग्रंथ अकादमी की पुस्तके।

Reference Books:

1. M.K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999.
2. Saxena H. C.: Finite Differences and Numerical Analysis, S Chand, 2010.

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Faculty of Science

Bachelor of Science (B.Sc.)

SUBJECT: Mathematics

B.Sc. VI Semester

Paper-Core – FUZZY SETS AND THEIR APPLICATIONS

Course Outcomes

CO. No.	Course Outcomes	Cognitive Level
CO1	Understand the difference between crisp sets and fuzzy sets, Fuzzy membership function, types and operations of fuzzy sets and their properties.	U, An, Ap
CO2	Fuzzy numbers and fuzzy arithmetic.	U, An
CO3	Basic concepts of fuzzy relations, fuzzy graphs and fuzzy logic.	U, An, Ap
CO4	Knowledge of m fuzzy sets and intuitionistic fuzzy sets. Understand Fuzzy relations, Crisp v/s Fuzzy relations.	U, An, Ap

Credit and Marking Scheme

Theory	Credits	Marks		Total Marks
		Internal	External	
	6	40	60	100
Total	6	100		

Evaluation Scheme

Theory	Marks	
	Internal	External
	3 Internal Exams of 20 Marks each during the Semester (Best 2 will be taken)	1 External Exams (At the End of Semester)

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Content of the Course Theory

No. of Lectures Hours per Week: 6 Hours. per Week

Total No. of Lectures: 90 Hours.

Maximum Marks: 60

Unit	Topics	No. of Lectures
I	Support height nucleus of a fuzzy set, cardinality of a fuzzy set containment of two fuzzy sets, degree of subethood, Fuzzy set, Membership function, Basic definition and concepts, Types of Fuzzy sets- normal subnormal fuzzy set, normalization α -cut set, strong α -cut, convex fuzzy set, necessary and sufficient condition for convexity of a fuzzy set.	34
II	Operations on fuzzy sets, Union, Intersection, Complement of a fuzzy set, Decomposition of fuzzy sets, Cartesian Product, Algebraic product, Product of a fuzzy set with a crisp number, contract intensification and fuzzification Bounded sum and difference, t-norms, t-conorms, Power of a fuzzy set, Disjunctive sum of two fuzzy sets, examples.	34
III	Properties of fuzzy sets- commutative, associative, distributive, idempotent, identity, involution, De-Morgan's laws, and their proofs, equality of two fuzzy sets, examples.	28
IV	The Zadeh Extension Principle, Fuzzy numbers, Fuzzy arithmetic, Fuzzy relations, Crisp v/s Fuzzy relations, Composite Fuzzy relation, Binary Fuzzy relations, Fuzzy equivalence relation, Fuzzy compatibility relation, Fuzzy relation equation, Similarity relations Fuzzy graphs.	24

References

Text Books:

1. I. G.J. Klir and Yuan, Fuzzy sets and Fuzzy Logic: The compositional rule of inference, Prentice Hall of India, New Delhi, 1995.
2. H.J. Zimmermann, Fuzzy set Theory and its Applications, Allied publishers Ltd, New Delhi 1991.

Reference Books:

1. Pundir and Pundir, Fuzzy Sets and their Applications, Pragati Prakashan, Meerut, 2012
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, John Wiley & Sons, 2010

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Department of Mathematics

Bachelor of Science (B.Sc.)

SUBJECT: Mathematics

B.Sc. VI Semester

Paper- Discipline Specific Elective (DSE-1),
Paper-1

Advanced Numerical Methods and Scientific Computation

Course Outcomes

CO.No.	Course Outcomes	Cognitive Level
CO1	Understand and evaluate Hermite Interpolation, Piecewise Interpolation	U, E
CO2	Analyze and evaluate Spline Interpolation, Bivariate Interpolation and Lagrange Bivariate Interpolation.	An, E
CO3	Analyze, evaluate and apply Approximation, Find Least Square approximation	An, E, Ap
CO4	Evaluate, analyze and apply extrapolation methods, Richardson's extrapolation ordinary differential equations and Difference Equations.	E, An, Ap

Credit and Marking Scheme

	Credits	Marks		Total Marks
		Internal	External	
Theory	4	40	60	100
Total	4	100		

Evaluation Scheme

	Marks	
	Internal	External
Theory	3 Internal Exams of 20 Marks (During the Semester) (Best 2 will be taken)	1 External Exams (At the End of Semester)



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Department of Mathematics

Content of the Course

Theory

No. of Lectures (in hours per week): 4.5 Hrs. per week

Total No. of Lectures: 60 Hrs.

Maximum Marks: 60

Unit	Topics	No. Of Lectures
I	1. Interpolation : 1.1 Hermite Interpolation 1.2 Piecewise Interpolation 1.2.1 Piecewise Linear Interpolation 1.2.2 Piecewise Quadratic Interpolation 1.2.3 Piecewise Cubic Interpolation 1.2.4 Piecewise Cubic Interpolation using Hermite Type Data	18
II	2.1 Spline interpolation: 2.1.1 Quadratic spline interpolation 2.1.2 Cubic spline interpolation 2.1.3 Natural Spline 2.2 Bivariate interpolation 2.2.1 Lagrange Bivariate interpolation 2.2.2 Newton's Bivariate interpolation for Equispaced Points	18
III	3.1 Approximation : 3.1.1 L^p Norm for Discrete Data and Continuous Data 3.1.2 Euclidean Norm for Discrete Data and Continuous Data 3.1.3 Uniform Norm for Discrete Data and Continuous Data 3.2 Least squares Approximation 3.2.1 Gram-Schmidt Orthogonalizing Process 3.2.2 Legendre Polynomials	22
IV	4.1 Extrapolation methods : 4.1.1 Richardson's Extrapolation 4.2 Ordinary differential equations 4.2.1 Reduction of Higher order Equations to the system of first order Differential Equations 4.2.2 System of Linear first order Differential Equations with Constant Coefficients	22

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4.3 Difference Equations.	
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References

Text Books:

1. Numerical Method for scientific and Engineering computation by M.K. Jain , S.R.K. Iyenger , R.K. Jain south Edition (2003) , New Age .
2. मध्यप्रदेश हिंदी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. Saxena H.C.: Finite Differences and Numerical Analysis, S Chand, 2010.
2. S.S. Sastry: Introductory Methods of Numerical Analysis, Prentice Hall India Learning Private Limited, Fifth edition, 2012.



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Faculty of Science

Bachelor of Science (B.Sc.)

SUBJECT: MATHEMATICS

B.Sc. VI Semester

Paper- Discipline Specific Elective (DSE)- 2

Integral Transform

Course Outcomes

CO.No.	Course Outcomes	Cognitive Level
CO1	Understanding about Laplace transform and its properties.	U
CO2	Solve ordinary differential equations using Laplace transform.	Ap
CO3	Familiarise with Fourier transform of functions. Relation between Laplace and Fourier transform. Apply the concept of the course in real life problems.	U, Ap
CO4	Explain Parseval's identity and applications of Fourier transform to boundary value problems.	AP

Credit and Marking Scheme

	Credits	Marks		Total Marks
		Internal	External	
Theory	4	40	60	100
Total	4	100		

Evaluation Scheme

	Marks	
	Internal	External
Theory	3 Internal Exams of 20 Marks (During the Semester) (Best 2 will be taken)	1 External Exams (At the End of Semester)

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Content of the Course

Theory

No. of Lectures (in hours per week): 4.5 Hrs. per week

Total No. of Lectures: 60 Hrs.

Maximum Marks: 60

Unit	Topics	No. of Lectures
I	Laplace Transform: 1.1 Linearity property 1.2 Existence theorem 1.3 Shifting theorem 1.4 Change of scale property 1.5 Laplace transform of derivatives and integrals 1.6 Differentiation and integration of the Laplace transforms 1.7 Multiplication and division by 't' 1.8 Periodic function	25
II	Inverse Laplace Transform: 2.1 Linearity property 2.2 Shifting theorem 2.3 Change of scale property 2.4 Inverse Laplace transforms of derivatives and integrals 2.5 Multiplication and division by powers of p 2.6 Convolution theorem 2.7 Heaviside expansion theorem	25
III	Application of Laplace Transform: 3.1 Solution of ordinary differential equation with constant coefficients 3.2 Solution of ordinary differential equation with variable coefficients	15
IV	Fourier Transform: 4.1 Linearity property 4.2 Shifting theorem 4.3 Change of scale property 4.4 Modulation 4.5 Convolution theorem 4.6 Fourier transform of derivatives 4.7 Relations between Fourier transform and Laplace transform 4.8 Parseval's identity for Fourier transform 4.9 Solution of differential equation using Fourier transform	15

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References

Text Books:

- 1 Lokenath Debnath, Dambaru Bhatta: Integral Transforms and Their Applications, Chapman and Hall/CRC; 3rd edition, 2014.
- 2 Sreenadh S. Ranganatham S. Prasad M. V. S. S. N. & Babu, Ramesh V. : Fourier Series and Integral Transforms. S. Chand Publishing, 2014.
- 3 A. N. Srivastava: Integral Transforms and Fourier Series. Narosa Publications, 2012.
- 4 मध्यप्रदेश हिंदी ग्रंथ अकादमी की पुस्तके।

Reference Books:

- 1 I. N. Sneddon: The use of integral transform. McGraw Hill, 1972.
- 2 Murray R. Spiegel. Laplace transform, Schaum's Series, McGraw Hill Education, 1st edition, 1965.

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ST. ALOYSIUS (AUTO) COLLEGE, JABALPUR
DEPARTMENT OF MATHEMATICS
CERTIFICATE COURSE
COMPUTATION BY MATHEMATICA SOFTWARE

S. No.	Title	Maximum Marks	Minimum Marks
I	MATHEMATICA-Theory	50	20
II	MATHEMATICA-Practical	50	20

Note: Total duration of the course is 30 contact hours.

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ST. ALOYSIUS (AUTO) COLLEGE, JABALPUR

DEPARTMENT OF MATHEMATICS

CERTIFICATE COURSE

COMPUTATION BY MATHEMATICA SOFTWARE

THEORY

Maximum Marks: 50

Time: 2 hours

Minimum Marks: 20

Credit : 2

MODULE I – Introduction to Mathematica - Basics, Structure of Mathematica, Mathematica Kernel, Expression Input and Output. Interactive Use of Mathematica, Symbolic calculations, Numerical Calculations.

MODULE II – Mathematics with Mathematica - Algebra, Factoring and Expanding Polynomials, Finding Roots of Polynomials with Solve and NSolve, Solving Equations

MODULE III – Plotting functions of two variables with plot 3D, Linear Algebra, Tensors and Arrays, Matrices Entering and editing matrices, Performing Gaussian Elimination, Matrix Operations

REFERENCES:-

1. Bruce F. Torrence Eve A. Torrence, The Student's Introduction to Mathematica ®A Handbook for Precalculus, Calculus, and Linear Algebra, Second edition (USA, New Yark: Cambridge University Press,2009), Page No.16-44,298-310,40-43

2. Kenneth Shiskowski and Karl Frinkle, Principles of Linear Algebra with Mathematica. (Hoboken, New Jersey: John Wiley & Sons, 2011), Page No.1-96,147- 194,195-250,251-332,335-380

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ST. ALOYSIUS COLLEGE(AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS
CERTIFICATE COURSE
COMPUTATION BY MATHEMATICA SOFTWARE
PRACTICAL

Maximum Marks: 50

Time: 2 hours

Minimum Marks: 20

List of Practicals:

1. Introduction and structure of Mathematica.
2. Kernel and Input-Output Expression.
3. Symbolic and Numerical Calculations using Mathematica.
4. Functions and Graphics.
5. Algebra

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