



Yogoda Satsanga Mahavidyalaya

JAGANNATHPUR, DHURWA, RANCHI – 834004

Email address: ysmranchi4@gmail.com

(NAAC Accredited, Grade: B++, CGPA: 2.89)

COURSEPLAN

NAME OF THE DEPARTMENT	: MATHEMATICS
NAME OF THE FACULTY	: Dr. R.C.L Das Prof Shekhar Suman Dr. Kandarp Vidyasagar
ACADEMIC SESSION	: 2022-2026
YEAR	: 2023
PROGRAMME	: B.Sc.
SEMESTER	: 2
COURSE TYPE	: Major
COURSE	: Multivariate calculus
COURSE CODE	: MJ-2
TOTAL CREDIT	: 6 (5+1)



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PROGRAMME OUTCOMES (POs):

Student will be able:

PO1: Develop in-depth knowledge of algebra, analysis, calculus, geometry, differential equations and several other branches of mathematics. This also leads to study of related areas like computer science and statistics.

PO2: Analyze intrinsic beauty which can be utilized for solving real life problems through the use of mathematical modeling, cryptography and coding.

PO3: Apply knowledge of mathematical science in understanding and skills to identify the difficult/unsolved problems in mathematics. Realize the given scientific data critically and systematically and to do research so that to get the ability to draw the objective conclusions.

PO4: Understand logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society.

PO5: This program will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

PO6: Design solutions for complex scientific problems and design processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, legal, constitutional and environmental considerations.

PO7: Demonstrate fundamental systematic knowledge of mathematics and its applications in engineering, science, technology and mathematical sciences. It should also enhance the subject specific knowledge and help in creating jobs in various sectors.

PO8: Demonstrate knowledge and understanding of the scientific principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.



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PO9: Communicate effectively on complex science activities with the science community and the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO10: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of scientific development, technological advancement and global changes.

PO11: Use research-based knowledge and research-based methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO12: To value and foster physical, physiological and psychological well-being by staying committed through personal practice and conduct. Apply the learning for life-long committing to ethics, to fulfill professional and social obligations.

PO13: Apply academic learning for a sustainable living, initiation of entrepreneurial adventures through innovation to create opportunities and wealth for self and society.

PO14: Value and support social causes and rural development through service and philanthropic activities.

PROGRAMME SPECIFIC OUTCOMES (PSO):

PSO1: Understand the requirements in mathematics, drawing from a range of contemporary research works and their applications in diverse areas of mathematical sciences and demonstrate educational skills in the areas of analysis, geometry, algebra, mechanics, differential equations etc.

PSO2: Apply skills and knowledge through on-the-job training, research projects and internships to use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion and creating Mathematical models, algorithms, etc. to facilitate application of mathematics in different professions and knowledge domains.

PSO3: Analyze the applications of Mathematics and computing methods using MATLAB, PYTHON, MATHEMATICA etc. to solve the problems of Science in general and Mathematics in particular.



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COURSE OUTCOMES (COs):

Semester-2

Paper: Multivariate calculus (MJ-2)

This course will enable the students to:

1. **Apply:** Students will be able to apply the chain rule of differentiation and directional derivatives to solve problems related to functions of several variables and tangent planes.
2. **Analyze:** Students will analyze and interpret the gradient, maxima, and normal properties of the gradient to determine extremas of functions of two or more variables using the method of Lagrange multipliers.
3. **Evaluate:** Students will evaluate double and triple integrals over various regions in rectangular, polar, cylindrical, and spherical coordinates, including volume and change of variables.
4. **Create:** Students will create mathematical models and algorithms for solving real-world problems involving partial differentiation, Taylor's theorem, and vector functions, fostering innovation and critical thinking skills.
5. **Understand:** Students will demonstrate understanding of fundamental mathematical concepts such as limits, continuity, Jacobians, and vector derivatives, enhancing their comprehension of advanced mathematical principles.

1. CORRELATION BETWEEN POs AND COs

POs Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	-	3	3	3	3	3	2	-	-	-	3	-	3
CO2	3	-	3	3	-	3	-	-	3	-	3	2	-	2	-	3	3
CO3	-	3	-	2	-	3	3	-	3	3	-	-	2	2	3	-	3
CO4	3	-	3	3	-	3	3	-	-	3	3	2	2	2	-	-	3
CO5	-	-	3	2	1	3	-	3	3	3	2	-	2	2	3	3	-



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COURSE TEACHING AND LEARNING ACTIVITIES

A. PEDAGOGY

- i. Whiteboard
- ii. PPT
- iii. Zoom, Google meet

B. COURSE COMPLETION PLAN

UNIT	NO. OF LECTURES		TEST	QUIZ	ASSIGNMENT
	Lectures	Tutorial Lectures			
1	15	1	1	1	1
2	12	1	1	1	1
3	18	2	2	1	1
4	12	1	1	1	1
5	15	1	1	1	1
6	11	1	1	1	1

A. COURSE DELIVERY PLAN:

UNIT	TOPIC/SUBTOPIC	LECTURE REQUIRED	CO ADDRESSED
1	Functions of several variables, Level curves and surfaces, Limits and continuity, Partial differentiation, Tangent planes	11	CO1, CO2
2	Chain rule, Directional derivatives, The gradient, Maximal and normal properties of the gradient, Tangent planes and normal lines	9	CO1, CO2
3	Higher order partial derivatives, Total differential and differentiability, Jacobians, Change of variables	8	CO2, CO1
4	Euler's theorem for homogeneous functions, Taylor's theorem for functions of two variables and more variables, Envelopes and evolutes	9	CO2



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5	Vector point function, Scalar point function, Differentiation of a vector function. Derivatives of a sum of vectors. Derivatives of a product of vectors	11	CO3, CO4
6	Extrema of functions of two and more variables, Method of Lagrange multipliers	6	CO3, CO2
7	Constrained optimization problems, Definition of vector field, Divergence, curl, gradient and vector identities	7	CO1, CO5
8	Double integration over rectangular and non rectangular regions, Double integrals in polar coordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals	7	CO4, CO5
9	Triple integration in cylindrical and spherical coordinates, Change of variables in double and triple integrals, Dirichlet integral	7	CO4
10	Line integrals, Applications of line integrals :Mass and Work, Fundamental theorem for line integrals, Conservative vector fields	8	CO5
11	Green's theorem, Area as a line integral, Surface integrals, Stokes 'theorem, The Gauss divergence theorem	7	CO5

B. COURSE OUTCOME ASSESSMENT PLAN

a. DIRECT ASSESSMENT

(Please tick the appropriate column)

COURSE OUTCOME	ASSESSMENT				REMARKS
	QUIZ	TEST	MID SEMESTER	Term Exam	
CO1	1	1	1	1	
CO2	1	1	1	1	
CO3	1	1	1	1	
CO4	1	1	1	1	
CO5	1	1	1	1	
CO6	1	1	1	1	

b. INDIRECT ASSESSMENT (STUDENT SURVEY)

Name of the Student:
University Roll no/ Class roll no.:
Name of the Programme:



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Semester and Session:

Course and Course Code:

Rate the following aspects of course outcomes. Use the scale 1-3

S. No	Course Outcome	1	2	3
1.	CO1			
2.	CO2			
3.	CO3			
4.	CO4			
5.	CO5			
6.	CO6			

1. Average
2. Good
3. Very Good

B. SUGGESTED READINGS

a. TEXT BOOKS:

1. Jerrold Marsden, Anthony J. Tromba & Alan Weinstein (2009). Basic Multivariable Calculus, Springer India Pvt. Limited
2. Vector Calculus–Dasgupta

b. REFERENCE BOOKS

1. James Stewart (2012). Multivariable Calculus (7th edition). Brooks/Cole. Cengage.
2. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2011). Calculus (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd.
3. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). Thomas' Calculus (14th edition). Pearson Education

c. VIDEO RESOURCE

1. <https://archive.nptel.ac.in/courses/111/105/111105122/>
2. <https://nptel.ac.in/courses/111106113>
3. <https://archive.nptel.ac.in/courses/111/106/111106100/>



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a. **WEB RESOURCES:-**

1. <https://testbook.com/maths/vector-algebra>
2. <https://www.dbrailibrary.org.in/RareBooks/Advanced%20Trigonometry.pdf>

b. **E-RESOURCES**

1. <https://www.lehman.edu/faculty/anchordoqui/VC-1.pdf>
2. <https://www.govst.edu/uploadedFiles/Academics/Colleges and Programs/CAS/Trigonometry Short Course Tutorial Lauren Johnson.pdf>