**COURSE INFORMATION SHEET**

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| **Session:** | Spring 2025 |
| **Course Title:** | Multivariable Calculus |
| **Course Code:** | MS-208 |
| **Credit Hours:** | 3 |
| **Semester:** | 4th |
| **Pre-Requisites:** | MS-102 Calculus & Analytical Geometry |
| **Instructor Name:** | Ms. Fozia Iqbal |
| **Email and Contact Information:** | [foiqbal@ssuet.edu.pk](mailto:foiqbal@ssuet.edu.pk) |
| **WhatsApp Group** | MultiCal CS Spring 2025 |
| **Office Hours:** | 8:30 am-5:30 pm (Monday to Friday) |
| **Mode of Teaching:** | Synchronous |

**COURSE OBJECTIVE:**

The course aims to impart a deep understanding of advanced mathematical concepts including functions of several variables, differentiation and integration, vector calculus, and transform methods to the students of computer science. Students will learn techniques such as limit computation, partial differentiation, gradient vectors, and integral calculus, along with applications in optimization and function approximation. Additionally, the course covers vector fields, fundamental theorems such as Green’s theorem and Stoke’s theorem, and transforms including Laplace transforms, and Z-transforms, preparing students for diverse applications in engineering, physics, and applied mathematics.

**COURSE OUTLINE:**

Functions of Several Variables, limit, continuity, and Partial Differentiation. Mixed derivative theorem, increment theorem, chain rule, implicit differentiation theorem, gradient vector, tangent plane, and normal lines, linearization, extreme values, Lagrange multipliers, Taylors formula, Multiple Integrals, Line and Surface, Cylindrical and spherical coordinates, vector fields, Green’s and Stoke’s Theorem., divergence theorem, vector algebra, Fourier Transform; Laplace Transform, Z-Transform.

**COURSE LEARNING OUTCOMES (CLOs) and its mapping with Program Learning Outcomes (PLOs):**

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| --- | --- | --- | --- |
| **CLO No.** | **Course Learning Outcomes (CLOs)** | **PLOs** | **Bloom’s Taxonomy** |
| 1 | **Understand** the concept of the functions of Several Variables, limit, continuity, and Partial Differentiation | PLO\_1  (Academic Education) | C2  (Understanding) |
| 2 | **Applying** the concept of Vector algebra and the equations of Line and Surface | PLO\_1  (Academic Education) | C3  (Applying) |
| 3 | **Applying** the concept of Fourier Transform; Laplace Transform, Z-transform. | PLO\_2  (Knowledge for solving computing problems) | C3  (Applying) |

**RELATIONSHIP BETWEEN ASSESSMENT TOOLS AND CLOs:**

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| **Assessment Tools** | **CLO-1**  **(34)** | **CLO-2**  **(38)** | **CLO-3**  **(28)** |
| **Quizzes** | 3 (8.83%) | 3 (7.9%) | 4 (14.29%) |
| **Assignments** | 3 (8.83%) | 3 (7.9%) | 4 (14.29%) |
| **Midterm Exam** | 20 (58.82%) | 10 (26.31%) | -- |
| **Final Exam** | 08 (23.52%) | 22 (57.89%) | 20 (71.42%) |
| **Total** | 36 (36%) | 38 (38%) | 26 (26%) |

**GRADING POLICY:**

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| --- | --- |
| **Assessment Tools** | **Percentage** |
| Quizzes | 10% |
| Assignments | 10% |
| Midterm Exam | 30% |
| Final Exam | 50% |
| **TOTAL** | **100%** |

**Benchmark:**

**RECOMMENDED BOOK:**

* Maurice D. Weir, Joel Hass, Frank R. Giordano, ***Thomas’ Calculus****,* 14th edition, Pearson Prentice Hall., (2017). ISBN 13: 978-0-13-443898-6, ISBN 10: 0-13-443898-1

<https://www.engbookspdf.net/thomas-calculus-14th-edition-pdf/>

* Erwin Kreyszig, ***Advanced Engineering Mathematics***, (10th edition), John Wiley & Sons, Inc. (2011) ISBN 978-0-470-45836-5

<http://www.wiley.com/college/kreyszig>

**REFERENCE BOOKS:**

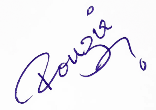
* Anton, Bivens, Davis, Calculus, 11th edition, John Willey & Sons, Inc., (2016). ISBN-13: 978-8126556403, ISBN-10: 9788126556403
* Earl William Swokoski,***Calculus****,* 5th edition, PWS-KENT Pub. Co., (1991). ISBN 13:  978-0534926489, ISBN 10 0534435386
* Hughes-Hallett, Gleason, McCallum, et al, *Calculus Single and Multivariable*, 3rd Edition. John Wiley & Sons, Inc. 2002.
* H. K. Dass, *Advanced Engineering Mathematics,* S. Chand & Company Ltd

**LESSON PLAN**

**Course Title: Multivariate Calculus**

**Course Code: MS-208**

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| **Week No.** | **Week Dates** | **Topics** | **Required Reading** | **Key Date** |
| **1** |  | Function. Function of several variable. Domain and range.  Boundary and interior points. Bounded and unbounded region. level curves and surfaces. | TC-Chap#14  Exe. 14.1  1- 15  Page # 798 |  |
| **2** |  | Limit and continuity  Properties of limit of function  Continuous function | TC-Chap#14  Exe. 14.2  1-5,13-16,27-34  Page # 806-807 |  |
| **3** |  | Partial derivative, continuity, Second order partial derivative, The derivative theorem Chain rule, Implicit differentiation theorem | TC-Exe. 14.3  23-32, 41-50  Page # 818  TC-Exe. 14.4  1-6, 25-30  Page # 828 | Assignment # 1 |
| **4** |  | Directional derivative, Gradient vector | TC-Exe. 14.5  1-6, 11-13  Page # 838 |  |
| **5** |  | Tangent and normal lines, Linearization, Total differentiation | TC-Exe. 14.6  1-6, 27-30  Page # 846 | Quiz # 1 |
| **6** |  | Extreme values, Saddle point, Constrained maxima and minima Lagrange multipliers | TC-Exe. 14.7  1-5  Page # 856  TC-Exe. 14.8  1-5  Page # 865 |  |
| **7** |  | Taylor formula,  Double integral over rectangle.  Surface area as a double integral  Triple integral | TC-Exe. 14.9  1-5  Page # 872  TC-Exe. 15.1  17-21  Page # 887  TC-Exe. 15.5  7-8  Page # 887 | Assignment # 2 |
| **8** |  | Vector algebra  Analytics equation for line and plane  Cylindrical and spherical coordinates | TC-Exe. 12.5  1-8, 21-25  Page # 735  TC-Article 15.7  Page # 934 |  |
| **9** | **Midterm Examination**  **()** | | | |
| **10** |  | Parametric equations for 3D geometry.  Gradient, Divergence and curl. | TC-Exe. 16.4  1-4  Page # 996  TC-Exe. 16.8  1-4  Page # 1042  TC-Exe. 16.7  1-4  Page # 1029 |  |
| **11**  Eid |  | Vector fields, Line integrals  Green's theorem. | TC-Exe. 16.2  1-4, 7-10, 19  Page # 735  TC-Exe. 16.4  7-10  Page # 996 | Quiz # 2 |
| **12** |  | Surface integral  Stokes theorem  Divergence theorem | TC-Exe. 16.6  1-6  Page # 1016  TC-Exe. 16.7  7-8  Page # 1029  TC-Exe. 16.8  9-10  Page # 1042 |  |
| **13** |  | Fourier Integrals, Fourier Sine and Cosine Integrals  Fourier transforms | AE-Exe. 11.7  2-4, 7-10, 16-17  Page # 517  AE-Exe. 11.9  1-5, 7, 10  Page # 533 | Assignment #3 |
| **14** |  | Laplace transforms of elementary functions, inverse transform | AE-Exe. 6.1  1-8, 25-30  Page # 210-211 | Quiz # 3 |
| **15** |  | Laplace transform, s-shifting, unit step functions, t-shifting | AE-Exe. 6.1  33-38  Page # 211  AE-Exe. 6.3  2-14  Page # 223 |  |
| **16** |  | *Z*-transformation and its properties | Notes will be provided |  |
| **Final Examination**  **()** | | | | |

Name & Signature (Course Instructor): Fozia Iqbal\_ Date: 3rd March’2025

Name: & Signature (Head of Department): Date: