| COURSE NO. | COURSE NAME | CREDITS | YEAR OF INTRODUCTION |
|---|---|---|---|
| **MA 101** | **CALCULUS** | **4** | **2016** |

**Course Objectives**

In this course the students are introduced to some basic tools in Mathematics which are useful in modelling and analysing physical phenomena involving continuous changes of variables or parameters. The differential and integral calculus of functions of one or more variables and of vector functions taught in this course have applications across all branches of engineering. This course will also provide basic training in plotting and visualising graphs of functions and intuitively understanding their properties using appropriate software packages.

**Syllabus**

Single Variable Calculus and Infinite series, Functions of more than one variable, Partial derivatives and its applications, Calculus of vector valued functions, Multiple Integrals.

**Expected outcome**

At the end of the course the student will be able to (i) check convergence of infinite series (ii) find maxima and minima of functions two variables (iii) find area and volume using multiple integrals (iv) apply calculus of vector valued functions in physical applications and (v) visualize graphs and surfaces using software or otherwise.

**Text Books**

(1)Anton, Bivens, Davis: Calculus, John Wiley and Sons, 10th ed

(2)Thomas Jr., G. B., Weir, M. D. and Hass, J. R., Thomas' Calculus, Pearson

**References:**


1. Sengar and Singh, Advanced Calculus, Cengage Learning, Ist Edition
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India edition, 10th ed.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.
4. N. P. Bali, Manish Goyal, Engineering Mathematics, Lakshmy Publications
5. D. W. Jordan, P Smith. Mathematical Techniques, Oxford University Press, 4th

Edition.

6. A C Srivastava, P K Srivasthava, Engineering Mathematics Vol 1. PHI Learning Private Limited, New Delhi.



| | COURSE NO: MA101 | L-T-P:3-1-0 | |
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| | COURSE NAME: CALCULUS | CREDITS:4 | |
| MODULE | CONTENT | HRS | END SEM. MARK % |
| I | **Single Variable Calculus and Infinite series**<br>**(Book I –sec 9.3,9.5,9.6,9.8)**<br>Basic ideas of infinite series and convergence - .Geometric series- Harmonic series-Convergence tests-comparison, ratio, root tests (without proof). Alternating series- Leibnitz Test- Absolute convergence, Maclaurins series-Taylor series - radius of convergence.<br>(For practice and submission as assignment only:<br>Sketching, plotting and interpretation of hyperbolic functions using suitable software. Demonstration of convergence of series bysoftware packages) | 9 | 15% |
| II | **Partial derivatives and its applications(Book I –sec. 13.3 to 13.5 and 13.8)**<br>Partial derivatives–Partial derivatives of functions of more than two variables - higher order partial derivatives - differentiability, differentials and local linearity -<br>The chain rule – Maxima and Minima of functions of two variables - extreme value theorem (without proof)-relative extrema . | 5<br>4 | 15% |

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| **FIRST INTERNAL EXAM** | | | |
| III | **Calculus of vector valued functions(Book I-12.1,12.2,12.4&12.6,13.6 &13.7)**<br>Introduction to vector valued functions- parametric curves in 3-space<br>Limits and continuity – derivatives - tangent lines – derivative of dot and cross product- definite integrals of vector valued functions-<br>unit tangent-normal- velocity-acceleration and speed–Normal and tangential components of acceleration.<br>Directional derivatives and gradients-tangent planes and normal vectors<br>(For practice and submission as assignment only: Graphing parametric curves and surfaces using software packages ) | 3<br>3<br>3 | 15% |
| IV | **Multiple integrals**<br>**(Book I-sec. 14.1, 14.2, 14.3, 14.5)**<br>Double integrals- Evaluation of double integrals – Double integrals in non-rectangular coordinates- reversing the order of integration-<br>Area calculated as a double integral-<br>Triple integrals(Cartesian co ordinates only)-<br>volume calculated as a triple integral-<br>(applications of results only) | 4<br>2<br>2<br>2 | 15% |
| **SECOND INTERNAL EXAM** | | | |
| | **Topics in vector calculus**<br>**(Book I-15.1, 15.2, 15.3)**<br>Vector and scalar fields- Gradient fields – | 2 | |

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| V | conservative fields and potential functions –<br>divergence and curl - the $\nabla$ operator - the Laplacian $\nabla^2$ ,<br>Line integrals - work as a line integral-<br>independence of path-conservative vector field –<br>(For practice and submission as assignment only: graphical representation of vector fields using software packages) | 2<br>2<br>2<br>2 | 20% |
| VI | **Topics in vector calculus (continued)**<br>**(Book I sec., 15.4, 15.5, 15.7, 15.8)**<br>Green's Theorem (without proof- only for simply connected region in plane),<br>surface integrals –<br>Divergence Theorem (without proof for evaluating surface integrals) ,<br>Stokes' Theorem (without proof for evaluating line integrals)<br>(All the above theorems are to be taught in regions in the rectangular co ordinate system only) | 2<br>2<br>3<br>3 | 20% |
| **END SEMESTER EXAM** | | | |

Open source software packages such as gnuplot, maxima, scilab ,geogebra or R may be used as appropriate for practice and assignment problems.

TUTORIALS: Tutorials can be ideally conducted by dividing each class in to three groups. Prepare necessary materials from each module that are to be taught using computer. Use it uniformly to every class.