International Winter School
Manipal University Jaipur

Name of Course: Applied Calculus

Name of instructor: Dr Kalpna Sharma, Dr Ruchika Mehta, Dr Alok Bhargava
Session: January 2023
Language of instruction: English
Number of contact hours: 36
Credit awarded: 03

Objective of Course

The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analysing and describing the behaviour of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.

Syllabus

Functions: Functions and their graphs, combining functions: Shifting and scaling graphs, Trigonometric functions. **Limit and Continuity:** Limit of a function and Limit laws, Numerical and graphical viewpoints, Algebraic viewpoint. **Introduction to the derivative:** Average rate of change, Numerical and graphical viewpoints of derivative, algebraic viewpoint of derivative. **Techniques of differentiation:** Derivatives of powers, sums, and constant multiples, A first application: Marginal analysis, The product and quotient rules, The chain rule, Derivatives of logarithmic and exponential functions, Implicit differentiation. **Further applications of the derivative:** Maxima and minima, Applications of maxima and minima, Higher order derivatives: Acceleration, concavity, Analyzing graphs, Related rates. **The integral:** The indefinite integral, definite integral, Area and Estimating with Finite sum, Numerical and graphical viewpoints, Algebraic viewpoint and the fundamental theorem of calculus, Substitution. **Further integration techniques and applications of the integral:** Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fractions Area between two curves and applications, Averages and moving averages, Applications to business and economics: Consumers' and producers' surplus and continuous income streams, Improper integrals and applications

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Organization of course

Total contact hrs 36		
1st week:	10 hrs (classes)	2 hrs (self-study/project)
2nd week:	10 hrs (classes)	2 hrs (Mid term exam/assessment/discussion)
3rd week:	10 hrs (classes)	2 hrs (End term exam)

Mode of lectures: online lecture/online videos/case study/ discussion/ workshop/ hands-on

Course Plan

Lecture no.	Topic	Lecture mode	Instructor
L: 1-6	Functions, Limits and Continuity	Online Lecture and Online videos	Dr. Ruchika Mehta
L: 7-12	Concept of derivative, Fundamental theorem of differential calculus, Techniques of differentiation.	Online Lecture and online video	Dr. Alok Bhargava
L: 13-18	Applications of the derivatives.	Online Lecture and Discussion	Prof. Kalpna Sharma
L: 19-24	Fundamental theorem of integral calculus, Indefinite Integral, various evaluation techniques of integrals	Online Lecture and online video	Prof. Kalpna Sharma and Dr. Alok Bhargava
L: 25-30	Concept of definite Integrals, properties of definite integrals and applications of integrals	Online Lecture and Discussion	Prof. Kalpna Sharma and Dr. Ruchika Mehta
L: 31-36	Functions, Limits and Continuity	Online Lecture and Online videos	Dr. Ruchika Mehta

Brief profile of the instructor

Prof Kalpna Sharm

She earned her Ph.D. degree from Department of Mathematics, University of Rajasthan (India). She has more than 20 years of teaching, and research experience along with more than 16 years of administrative experience. Currently, she is Professor and HoD, Department of Mathematics & Statistics. Her specialization includes fluid Dynamics, Heat Transfer, mass transfer and Optimization.

Dr Ruchika Mehta

She earned her Ph.D. degree from Department of Mathematics, University of Rajasthan (India). She has 19 years of teaching and research experience. Presently She is working as Associate Professor in Department of Mathematics & Statistics, Manipal University Jaipur, Jaipur. Her research interest includes Fluid Dynamics, Computational Fluid Dynamics, Heat and Mass Transfer and Numerical Methods.

Dr Alok Bhargava

He earned his Ph.D. degree from Poornima University, Jaipur (India). He has more than 21 years of teaching, research, and administrative experience. Presently he is associated with Manipal University Jaipur, India as an Assistant Professor in Mathematics and Statistics department. His specialization includes Special Functions, Fractional Calculus and Integral Transforms and their applications.