Class: B.Sc. (Non Medical/Computer Science/Economics)/B.A
Course: Calculus and Trigonometry Semester: I

Course Objectives:

This course provides an introduction to topics involving calculus and trigonometry. Both Calculus and trigonometry equations have applications in all areas of applied Sciences and engineering. Upon completion, students will be able to understand the applications of differential and integral calculus and also demonstrate understanding of the theoretical concepts and select and use appropriate techniques for finding solutions.

Course Outcomes:

A. Knowledge and Understanding:

-Learn the general concept of function and its applications to real-world situations.
-Define the integral of the inverse trigonometric and hyperbolic functions.
-State the Fundamental theorem of calculus
-Find general solutions to first order, second order and higher order homogeneous and non-homogenous differential equations with constant and variable coefficients.
-find the series solution of differential equation.
-learn to use concept of integration to evaluate geometric area and solve other applied problems.

B. Intellectual(cognitive/Analytical) skills:

-Learn to calculate derivative for various type of function using definition.
-Sketch the graph of curves (Cartesian and parametric co-ordinates)
-Calculate areas of plane regions and arc length.
- Select and apply appropriate methods to solve differential equations.
-Apply power series method to find solution of Differential equations involving Bessel and Legendre equations.
- Use fundamental theorem of calculus to evaluate integral involving algebraic and transcendental functions.

C. Practical skills:

-Present mathematics to others, both in oral and written form clearly and in a well organized manner.
- Have the ability to carry out complex calculations orally and mentally.

Learn to work with exponential, logaritnmic and trigonometric functions and their applications in applied problems.

Class: B.Sc(Non Medical/Computer Science/Economics)/B.A
Course: Algebra Semester: I

Course Objectives:
The course on Algebra deals with advance topics on matrices viz. rank, eigen values, eigen vectors and homogeneous and non homogeneous systems, solution of cubic and bi-quadratic equations.

Course Outcomes:

D. Knowledge and Understanding:

- Understand all basic fundamentals of Matrices and vectors
- Learn to find rank of a matrix.
- Learn to solve linear system of equations (homogeneous and non homogeneous)
- Increasing Knowledge of the basic concepts of equations.
- Aware of a variety learning aids that can be used in the teaching of solving equations.
- Know how to transform the equation.
- Understand to solve cubic and bi-quadratic equations using cardon , Descarte and Ferrari's method.

E. Intellectual(cognitive/Analytical) skills:

- Use the basic concepts of matrix algebra and vector, including linear dependence/independence, rank and nullity, for analysis of matrices and systems of linear equations.
- Use the characteristic polynomial to compute the eigen values and eigen vectors of a square matrix and use them to diagonalise matrices when this is possible; discriminate between diagonalizable and non- diagonalizable matrices.
- Orthogonally diagonalise symmetric matrices and quadratic forms.

F. General skills:

- Use questioning and explanation strategies to help students learn new concepts and to support students in their problem solving activities.

- Apply mathematical methods involving arithmetic, algebra to solve problems.
- Represent mathematical information and communicate mathematical reasoning symbolically and verbally.

Class: M.A (Economics)
Course: Quantitive Method for Economics-1 Semester: II

Course Objectives:

The course offers essential quantitative skills useful for current and future undergraduate core courses. It covers basic mathematical and statistical concepts. The first component includes topics as: basic algebra, polynomial, logarithmic and exponential functional forms, differentiation and unconstrained and constrained optimisation. The statistics component focuses on descriptive statistics, probability theory.

Learning outcomes:

G. Knowledge and Understanding:

Student will be able to

-Matrix and its types, Determinant and its properties.
-Define the derivative and integral of the trigonometric, logarithmic and inverse trigonometric and rational functions
-Recognize the different techniques of integration (by parts, trigonometric integrals, partial fractions).

H. Intellectual(cognitive/Analytical) skills:.

-Students will learn how markets organize core economic activities, such as production, distribution, and consumption, and the growth of productive resources
-Understand partial derivatives and total differentials for multivariate functions
-Demonstrate understanding of and ability to explain the economic applications of differentiation, and use it to formulate economic problems, including elasticities, marginal cost/ benefit, marginal product of labour/capital, marginal utilities.

I. Practical skills:

- Have the ability to carry out complex calculations orally and mentally.

- Present mathematics to others in oral and written form clearly and in a well organized manner.
- Organize results in appropriate visual displays or tables.
- Have fun by crunching number and master a highly useful skill for the career.
- Use results of applied statistics to make informed decisions.
- Understand and use these techniques to solve problems in economics, such as profit maximisation, cost minimisation or utility optimisation
- Apply descriptive statistics to summarise data and explain basic concepts of probability theory

Class: B.Sc(Non Medical/Computer Science/Economics)/B.A
Course: Calculus II Semester: II

Course Objectives:

This course introduces the student to integral calculus with the techniques of integration and application of integration to physical problem.

Course Outcomes:

J. Knowledge and Understanding:

- Extend the concept of integrals to a variety of applications, establishing several integration
- Use a variety of mathematical techniques to evaluate integrals
- Develop problem solving skills through diverse applications of the integral
- Analyze the parameterization of curves and the polar coordinate system

K. Intellectual(cognitive/Analytical) skills:

- Examine various techniques of integration and apply them to definite and improper integrals,
- Approximate definite integrals using numerical integration techniques and solve related problems,
- Model physical phenomena using partial differential equations,-
- Compute limits of, differentiate, integrate and solve related problems involving functions represented parametrically or in polar coordinates,

- Differentiate, and integrate functions represented using power series expansions, including Taylor series, and solve related problems.

L. Practical skills:

Students will be able to:

- Evaluate iterated integrals and switch the order of integration.
- Find volumes of solids by calculating appropriate double integrals in rectangular and polar coordinates.
- Find surface area using a double integral.
- Evaluate triple integrals and use them to find volumes in rectangular, cylindrical and spherical coordinates.
- Use a Jacobian to make a change of variables in a double integral.

Department: Mathematics
Class: B.Sc(Bio-Technology)
Course: Biostatistics Semester: II

Course Objectives:

Biostatistics provides rigorous training in statistical theory and methodologies that are suitable for applications in research, collaboration and consulting on a broad spectrum of health and life science problems. The main purpose of the course is to enable the students to describe and explain the data in with best descriptive statistics measurements and how calculate probability of different events in addition to some important measurements related to clinical studies and industry.

Course Outcomes:

M. Knowledge and Understanding:

Student will be able to

-Learn statistical methods to analyze summarize and present data.
-Demonstrate an understanding of the central concepts of modern statistical theory and their probabilistic foundation.
-Communicate the results of statistical analysis accurately.
-Read and learn new statistical procedures independently.
-Understand basics of probability, probability rules and conditional probability rules.

-Recognize the basic concepts of simple linear regression and correlation.
-Understand basic statistical theory to design the experiments.
-Aware the assumptions of various statistical methods before experimental design and data analysis.
-Understand the fundamental and principles of Biostatistics.

N. Intellectual(cognitive/Analytical) skills:

-Apply basic concepts of probability, probability laws in solving biological problems in the field of life sciences.
-Apply concepts and methods from biostatistics and epidemiology disciplines jointly.
- Apply and examine the goodness-of-fit test, test for independence and homogeneity.
-Differentiate between methods of data presentation.
-Differentiate between alternative and null hypothesis.
-calculate measures of central tendency and measures of dispersion.

O. Practical skills:

-Communicate effectively with biostatistician and non- biostatisticians collaborators
-Organize results in appropriate visual displays or tables.
-Have fun by crunching number and master a highly useful skill for the career.
-Use results of applied statistics to make informed decisions.
-Give examples of different types of data arising in clinical studies.

Department: Mathematics
Class: B.Sc (Non Medical/Computer Science/Economics)/B.A
Course: Calculus and Differential equations II Semester: II

Course Objectives:

This course provides an introduction to topics involving calculus and ordinary differential equations. Both Calculus and Differential equations have applications in all areas of applied Sciences and engineering. Upon completion, students will be able to understand the applications of differential and integral calculus and also demonstrate understanding of the theoretical concepts and select and use appropriate techniques for finding solutions to differential equations.

Course Outcomes:

P. Knowledge and Understanding:

-Write the definition of indefinite and definite integrals.
-Define the integral of the inverse trigonometric and hyperbolic functions.
-State the Fundamental theorem of calculus
-Find general solutions to first order, second order and higher order homogeneous and non-homogenous differential equations with constant and variable coefficients.
-find the series solution of differential equation

Q. Intellectual(cognitive/Analytical) skills:

-Evaluate Indefinite integral involving hyperbolic functions and Definite integral of all the functions.
-Sketch the graph of curves (Cartesian and parametric co-ordinates)
-Calculate areas of plane regions and arc length.
- Select and apply appropriate methods to solve differential equations.
-Apply power series method to find solution of Differential equations involving Bessel and Legendre equations.
- Use fundamental theorem of calculus to evaluate integral involving algebraic and transcendental functions.

R. Practical skills:

-Present mathematics to others, both in oral and written form clearly and in a well organized manner.
- Have the ability to carry out complex calculations orally and mentally.

Class: B.Sc. (Non Medical/Computer Science/Economics)/B.A
Course: Analysis Semester: III

Course Objectives:

The aims of this course are to develop an understanding of convergence in its simplest setting to explain the difference between the sequence and series in the mathematical context to lay foundations for further investigation of infinite processes, in particular differential and integral calculus.

Learning outcomes:

S. Knowledge and Understanding:

Students will have

- An ability to work within an axiomatic framework.
- Knowledge of some simple technique for testing the convergence of sequences and series and confidence in applying them.
- An understanding of how the elementary functions can be defined by power series with an ability to deduce some of their easier properties.

T. Intellectual(cognitive/Analytical) skills:

- Express correctly the definitions of basic concepts from the course unit, for example the definition of the limit of a sequence.
- Decide on the correctness or otherwise of statements involving the basic concepts from the course unit, providing justifications or counter examples as appropriate.

U. Practical skills:

- Decide on convergence or divergence a wide class of series of real numbers or power series with real coefficient.
- A detailed understanding of how Cauchy's criterion for the convergence of real sequences and series follows from the completeness for R and the ability to explain the steps in standard mathematical notation.

Class: B.Sc (Non Medical/Computer Science/Economics)/B.A
Course: Analytical Geometry Semester: III

Course Objectives:

The aim of this course is to introduce the geometry of lines and conics in the Euclidean plane. Students can develop geometry with a degree of confidence and will gain fluency in the basics of Euclidean geometry. In this course, foundational mathematical training is also pursued. Curves studied include straight lines, ellipse, parabolas, hyperbolas and sphere. The course assumes a sound background in algebra, geometry and trigonometry.

Course Outcomes:

V. Knowledge and Understanding:

Students will be able to:

- Parameterize curves.
- Evaluate the distance and angle.

- Sketch conic sections.
- Identify conic sections.
- Classify quadratic equations.

W. Intellectual(cognitive/Analytical) skills:

On completion of this module, students should be able to:

- Establish rectangular coordinate system in the plane and in the space, express concept of vector both geometrically and analytically, understand operations on vectors and the properties of these operations.
- Estimate polar equations of conics and their graphs.
- Study of conics like ellipse, parabola and hyperbola.
- Express condition of parallel or perpendicular of the two lines.

Practical skills:

- Define conics and draw the graphs of conics such as ellipse, hyperbola, parabola and ellipse.
- Use the polar coordinate system, relate it to the rectangular coordinate system and graph equations using polar coordinates.
- Model real world situations with equations of conics.
- Determine equation of curves when given information that determines the curve.

Course: Research Methodology and Biostatistics
Class: Bachelor of Physiotherapy (III year)

Course Objectives:

Biostatistics provides rigorous training in statistical theory and methodologies that are suitable for applications in research, collaboration and consulting on a broad spectrum of health and life science problems. This course aims to develop working knowledge of how knowledge is collected, presented and disseminated. It develops the ability to formulate a question, find the data relevant to your question, analyze the data and present your finding skills that benefit professional and personal life.

Course Outcomes:

X. Knowledge and Understanding:

- Help to learn ethical, political and pragmatic issues involved in the research process.
- Learn to collect, analyze and interpret research data.
- Help to know the types of descriptive statistics typically reported in educational research.
- Understand the fundamental and principles of Biostatistics.
- Recognize the basic concepts of simple linear regression and correlation.
- Understand the fundamental and principles of biostatistics.

Y. Intellectual(cognitive/Analytical) skills:

- Enable the students to describe the ethical issues in educational research, including those issues that arise in using qualitative and quantitative research.
- Able to distinguish between a population and a sample

- Able to identify the overall process of designing a research study from its inception to its report.
- Calculate measures of central tendency and measures of dispersion.
- Differentiate between the methods of data presentation.
- Differentiate between alternative and null hypothesis.

Z. Practical skills:

- Gain a practical understanding of the various methodological tools used for social scientific research.
- Communicate effectively with biostatistician and non- biostatisticians collaborators.
- Organize results in appropriate visual displays or tables.

Course: Solid Geometry Semester: IV
Class: B.Sc.(Non Medical/Computer Science/Economics)/B.A
Course Objectives:
This course provides an introduction of solid geometry that studies the size, shape, and position of 2-dimensional shapes and 3-dimensional figures.
Students will be able to identify geometric shapes in objects they use in their daily lives. Studying solid geometry provides many foundational skills and helps to build the thinking skills of logic, deductive reasoning, analytical reasoning, and problem-solving.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills, transferable skills)
Learning outcomes:

AA. Knowledge and Understanding:

- The method of using virtual reality in desktop application that is intended to be used for solid geometry
- Geometry covers a whole range of concepts which will be encountered in everyday life
- Show them examples of 2-D and 3-D shapes, such as a circle and a sphere
- Geometry has many practical applications like architects and interior designers need to use their geometry knowledge to guide their designs

BB. Intellectual(cognitive/Analytical) skills:

- Allowing the systematic use of linear equations and matrix algebra, which are important for higher dimensions
-

CC. Practical skills:

- 3-D Computer graphics revolutionized animation, Video games, graphics etc.
- Architectural designing is another area in which applications of solid geometry play a major role

Class: B.Sc. (Non Medical/Computer Science/Economics)/B.A
Course: Statics and Vector Calculus Semester: IV

Course Objectives:
This Course introduces the student to review vector arithmetic, distinguish point and vectors, relate geometric concepts to their algebraic representation, describe point, line, and planes, use the dot product and cross product and their applications in Graphics. In Statics, we deal with equilibrium of bodies under action of forces (bodies may be either at rest or move with a constant velocity)

Course Outcomes:

A. **Knowledge and Understanding:**

Students will be able to:

- Identify conservative vector fields.
- Find the divergence and curl of a vector field.
- Evaluate line integrals of curves and vector fields.
- Use Green's theorem to evaluate line integrals.
- Gradient vector fields and constructing potentials

B. **Intellectual(cognitive/Analytical) skills:**

On completion of this module, students should be able to:

a) calculate vector and scalar derivatives of vector and scalar fields using the grad, div and curl operators in Cartesian and in cylindrical and spherical polar coordinates;
b) use suffix notation to manipulate Cartesian vectors and their derivatives;
c) calculate multiple integrals in two and three dimensions including changing variables using Jacobians;
d) calculate line and surface integrals and use the various integral theorems.
Undertake the analysis of symmetric beams under vertical loads and torsion of cylindrical shafts
2. Evaluate plane stresses

C. **Practical skills:**

- The integral ideas of the functions defined including line, surface and volume integrals - both derivation and calculation in rectangular, cylindrical and spherical coordinate systems and understand the proofs of each instance of the fundamental theorem of calculus.
- Examples of the fundamental theorem of calculus and see their relation to the fundamental theorems of calculus in calculus leading to the more generalised version of Stokes' theorem in the setting of differential forms.

- The differential ideas of divergence, curl, and the Laplacian along with their physical interpretations, using differential forms or tensors to represent derivative operations.

Class: B.Sc(Non Medical/Computer Science/Economics)/B.A
Course: Dynamics Semester: V
Course Objectives:

This course aims to equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems and vibrations. The overall objective of this course is to learn how to analyze the motions of mechanisms, design mechanisms to have given motions and analyze forces in machines.

Learning outcomes:

A. Knowledge and Understanding:

Students will be able to

- Understand the set of physical laws, describing the motion of bodies, under the influence of system of forces.
- Understand and use basic terms for the description of the motion of particles, vector functions and the fundamental laws of Newtonian mechanics.
- Solve mechanics problems in one dimension that involve one or more of the forces of gravity, friction and air resistance.
- understand the concept of terminal speed, and use it in solving mechanics problems in one dimension

B. Intellectual(cognitive/Analytical) skills:

- Analyze the applications of mathematics to the problems in physics & develop suitable mathematical method for such application.
- Solve problems relating to the motion of a projectile in the absence of air resistance

C. Practical skills:

- Understood the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.

- Solve mechanics problems in one dimension that involve one or more of the forces of gravity, friction and air resistance.

Class: B.Sc (Non Medical/Computer Science/Economics)/B.A
Course: Number theory Semester: V

Course Objectives:

The objective of this course is the study of basic structure and properties of integers. Learning number theory helps improving one's ability of mathematical thinking. The objectives for this course are to expose students to this beautiful theory, to understand what inspired this quote from Gauss and to allow students to experience mathematics as a creative, empirical science.

Learning Outcomes:

A. Knowledge and Understanding:

Students will be able to

- Explore the use of arithmetical functions, the Mobius function and the Euler totient function.
- Solve systems of linear congruences with different moduli using the Chinese Remainder Theorem.
- Prove results involving divisibility and greatest common divisors.
-

B. Intellectual(cognitive/Analytical) skills:

- Enchance and reinforce the student's understanding of concepts through the use of technology when appropriate.
- Apply Euler-Fermat's Theorem to prove relations involving prime numbers.

C. General skills:

- Analyze the structure of real-world problems and plan solution strategies.
- Communicate quantitative data verbally, graphically, symbolically and numerically.
- Use mathematical concepts in problem-solving through integration of new material and modeling.

Class: B.Sc. (Non Medical/Computer Science/Economics)/B.A

Course: Numerical Analysis Semester: VIth
Course Objectives:

This course aims to provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics. The focus of the course will be the study of certain structures called groups, rings, fields and some related structures. Abstract algebra gives to student a good mathematical maturity and enables to build mathematical thinking and skill.

Course Outcomes:

D. Knowledge and Understanding:

Students will know how

- Solve an algebraic or transcendental equation using an appropriate numerical method.
- Approximate a function using an appropriate numerical method.
- solve a differential equation using an appropriate numerical method
- evaluate a derivative at a value using an appropriate numerical method
- code a numerical method in a modern computer language

E. Intellectual(cognitive/Analytical) skills:

- Derive numerical methods for approximating the solution of problems of continuous mathematics,
- Analyze the error incumbent in any such numerical approximation,
- Implement a variety of numerical algorithms using appropriate technology.
- Compare the viability of different approaches to the numerical solution of problems arising in roots of solution of non-linear equations, interpolation.
- And approximation, numerical differentiation and integration, solution of linear systems.

F. Transferable skills:

- solve a linear system of equations using an appropriate numerical method
- Problem solving and Analytical skills
- Be able to develop numerical literacy
- Social responsibility and global citizenship skills

Class: B.Sc. (Non Medical/Computer Science/Economics)/B.A
Course: Linear Algebra Semester: VI

Course Objectives:

Algebraic structures -- such as groups, rings, and fields -- are pervasive in mathematics. This course focuses on (commutative) rings, which are sets equipped with two (commutative) operations (called addition and multiplication), and that contain an additive identity and an additive inverse for each element of the set. A fundamental example of a ring is **Z**, the set of integers; other important examples include **Q**, **Z** modulo n, and **Q**[X], which is the set of polynomials in X with rational Coefficients.

Course Outcomes:

G. Knowledge and Understanding:

Students will be able to

- Develop an understanding of linear algebra in mathematics, natural and social sciences.
- Use matrix algebra to analyze and solve equations arising in many applications that require a background in linear algebra.
- Utilize vector space terminology and describe how closely other vector spaces resemble R^n.

H. Intellectual(cognitive/Analytical) skills:

- Demonstrate factual knowledge of the fundamental concepts of spanning, linear independence, and linear transformations.
- Acquire communication and organizational skills, including effective written communication in their weekly assignments.
- Use visualization, spatial reasoning as well as geometric properties and strategies to mode, solve problems and view solutions especially in R^2 and R^3.

I. General skills:

- Apply mathematical methods involving arithmetic, algebra, geometry and graphs to solve problems.
- Represent mathematical information and communicate mathematical reasoning symbolically and verbally.
- Interpret and analyze numerical data, mathematical concepts and identify patterns to formulate and validate reasoning.

Class: Msc. (Bio-Statistics)
Course: BioStatistics Semester: I

Course Objectives:

Biostatistics provides rigorous training in statistical theory and methodologies that are suitable for applications in research, collaboration and consulting on a broad spectrum of health and life science problems. The main purpose of the course is to enable the students to describe and explain the data in with best descriptive statistics measurements and how calculate probability of different events in addition to some important measurements related to clinical studies and industry.

Learning outcomes:

A. Knowledge and Understanding:

Students will be able to know

- Learn statistical methods to analyze summarize and present data.
-Demonstrate an understanding of the central concepts of modern statistical theory and their probabilistic foundation.
-Communicate the results of statistical analysis accurately.
-Read and learn new statistical procedures independently.
-Understand basics of probability, probability rules and conditional probability rules.
-Recognize the basic concepts of simple linear regression and correlation.
-Understand basic statistical theory to design the experiments.
-Aware the assumptions of various statistical methods before experimental design and data analysis.
-Understand the fundamental and principles of Biostatistics.

B. Intellectual(cognitive/Analytical) skills:

- Apply basic concepts of probability, probability laws in solving biological problems in the field of life sciences.
-Apply concepts and methods from biostatistics and epidemiology disciplines jointly.
- Apply and examine the goodness-of-fit test, test for independence and homogeneity.
-Differentiate between methods of data presentation.

-Differentiate between alternative and null hypothesis.
-calculate measures of central tendency and measures of dispersion.

C. <u>Practical skills:</u>

-Communicate effectively with biostatistician and non- biostatisticians collaborators
-Organize results in appropriate visual displays or tables.
-Have fun by crunching number and master a highly useful skill for the career.
-Use results of applied statistics to make informed decisions.
-Give examples of different types of data arising in clinical studies.