COURSE OUTCOME for Mathematics Hons SEC (Semester-III)

Name of the course: **C Programming Language**

At the end of this course, the incumbent will be able to:

Remembering: To recall the basic structure of a mathematical modelling computer language, including developing programming code for various mathematical problems, including operations on matrices, sorting of numbers, finding the root of a quadratic equation, etc.

Understanding: To describe the concept of constants and variables, operators and expressions, control statements, loop, arrays, user-defined functions, built-in functions, library functions, etc.

Applying: To use in various allied engineering, physical problems, and mathematical problems, including finding numerical solutions to a transcendental equation, numerical integration, searching and sorting of numbers and characters, etc.

Analyzing: To analyze various real-world problems and categorize them using the coding of C Language.

Evaluating: To justify and understand the hidden beauty of the coding corresponding to various mathematical and real-world problems.

Creating: To design and build coding beyond mathematical problems including the development of software.

Future Perspective of the course:

First of all, this course would be helpful for the practical course of CC14. Moreover, C Programming Language is the base of various advanced software including MATLAB, Python, etc. Hence, the foundation of a good research scholar would be handling 'C Programming Language' with ease.

COURSE OUTCOME for Mathematics Hons SEC (Semester-IV)

Name of the course: **Mathematical Logic**

At the end of this course, the incumbent will be able to:

Remembering: To recall the fundamental concept of logical arguments, the idea of set and Boolean algebra, the validity of a statement, etc.

Understanding: To describe the concept of propositions, categorical propositions, syllogisms, conversion, obversion, truth table, propositional calculus, formal logic, first-order language etc.

Applying: To use in various mathematical and real-world problems including finding switching circuits, use of truth table, the validity of a proposition, use of inductive and deductive logic etc.

Analyzing: To analyze different types of proofs (viz. direct proof, indirect proof, and proof by contradiction), the difference between the affirmative and negative statement, the difference between general and particular statements (i.e. use of ∀, ∃) etc.

Evaluating: To justify and understand the hidden beauty of the statements and propositions to distinguish an illogical statement from a logical one.

Creating: To design and create various arguments and syllogisms in investigating which one is logical and why……..

Future Perspective of the course:

Beyond the course of the subject, a student would be able to know the illogical or invalid arguments and not to use them in real life.

COURSE OUTCOME for Mathematics Hons DSE-A (Semester-V)

Name of the course: **Bio Mathematics**

At the end of this course, the incumbent will be able to:

Remembering: To recall the fundamental concept of mathematical modelling to formulate and analyze the various type of ecological and epidemiological models using ordinary differential equation, partial differential equations, difference equations etc.

Understanding: To describe the concept of logistic growth, exponential growth, extinction criteria of a population, strong and weak Allee effects, different types of Holling type functional forms, predator-prey system, effect of harvesting, basic epidemic models and their dynamics, stability and bifurcation criteria, basic reproduction number etc.

Applying: To use in various biological and real-world problems including determining prey-predator interactions, existence and extinction criteria of a species, effect of harvesting, impact of diffusion, insect outbreak scenarios, criteria for endemic and the pandemic of infectious disease and procedure of its eradication, control measures of infectious disease, graphically representations of a biological system etc.

Analyzing: To analyze how to linearise a complex mathematical model, describing the steady state solutions and their stability criteria, one and two-dimensional bifurcation in biological systems, compute basic reproduction number and its impact on the eradication of infectious disease, use of control theory in different biological problems, interpret theoretical results etc.

Evaluating: To justify and understand how to express a biological system using various mathematical tools, solving different real-world problems that include optimal harvesting policy of open sea-shore, determining biodiversity and co-existence criteria of different interacting species, proposing eradication criteria of an infectious disease etc.

Creating: To formulate valid mathematical models to describe various biological interactions using differential equations or difference equations and analyze them to fit with existing real-world data.

Future Perspective of the course:

Of late Bio-mathematics or Mathematical biology has begun as an emerging research field for students from both Mathematics backgrounds and allied fields. During and post-COVID era, theoretical analysis of infectious disease systems has drawn attention to all communities. Thus a student opting for this course has the freedom to not only enrich himself/herself with the subject matter but also can extend the scope of the subject by doing some research work on this emerging topic.

COURSE OUTCOME for Mathematics Hons DSE-B (Semester-V)

Name of the course: **Linear Programming & Game Theory**

At the end of this course, the incumbent will be able to:

Remembering: To recall the fundamental concept of basic mathematics, including matrices and vectors and their operations, to construct different financial problems using linear inequalities and solving them by different methods viz. graphical method, simplex method, two-phase method, dual simplex method etc, to recall the concept of Game theory and its usage in the practical field etc.

Understanding: To describe the concept of object function, constraints, feasible solution and basic feasible solution, extreme points, degenerate solutions, slack, surplus and artificial variables, primal and dual, rectangular game, pure and mixed strategies etc.

Applying: To use in various financial and real world problems including maximizing profit, minimizing the application cost, solution of Assignment and Transportation problems, solution in travelling salesman problem, construction of rectangular game problems and their solutions etc.

Analyzing: To analyze how to construct a linear programming problem (LPP), the nature of the solution of an LPP (i.e. whether it is bounded or unbounded, feasible or infeasible etc), rectangular game, and its solution procedure.

Evaluating: To justify and understand how to express a financial system into its equivalent LPP form, to evaluate profit and loss, evaluation of travelling salesman problems etc.

Creating: To formulate valid linear mathematical systems to describe various real-world optimization problems and their solution using suitable methods, construction of a rectangular game and its solution etc.

Future Perspective of the course:

Operations research is an emerging field of study for students from Mathematics as well as allied courses. Hence students opting this course able to enrich themselves by enjoying the hidden beauty of the subject and may engage in research work in this field.

COURSE OUTCOME for Mathematics Hons DSE-A (Semester-VI)

Name of the course: **Mathematical Modelling**

At the end of this course, the incumbent will be able to:

Remembering: To recall the fundamental concept of mathematical modelling that includes series solution of a differential equation, the origin of some special functions and their properties, Laplace transformation and its application field, simulation technique, random numbers etc.

Understanding: To describe the concept of ordinary point and singular point of an ordinary differential equation, solution of the ordinary differential equation about both ordinary and regular singular point, derivation of Legendre and Bessel's functions, Laplace transformation of different types functions and corresponding inverse Laplace theorem, Convolution theorem and its application during inverse Laplace transform, solution of ODE using Laplace transform, Generation of random numbers etc.

Applying: To use in various physical problems where the solution can be done using the concept of Laplace transformation, Generation of random numbers and its usage in various practical problems, solving problems on queuing theory etc.

Analyzing: To analyze how to solve problems with an infinite or finite number of customers receiving service from either one or more than one service channel, Generation of random numbers are truly random or not, simulation of various real-world problems etc.

Evaluating: To find the solution of ordinary differential equations other than integration techniques, generating function and recurrence relation for both Bessel's and Legendre functions, solution of various geometrical problems using simulation techniques etc.

Creating: To formulate some valid mathematical models corresponding to various real-world problems and find their solution by using special functions or Laplace transform or simulation technique, development of coding for simulating problems on mathematical modelling etc.

Future Perspective of the course:

Recently models are used quite frequently in both research problems and in problems of daily life. Thus students opting 'Mathematical Modelling' course should able to know what are good and effective models, and how physical, biological or other real-world problems can be designed using mathematical modelling.

COURSE OUTCOME for Mathematics Hons DSE-B (Semester-VI)

Name of the course: **Point Set Topology**

At the end of this course, the incumbent will be able to:

Remembering: To recall the fundamental concept of various topological terms, which include neighbourhoods of a point, interior points, limit points, derived set, boundary of a set, closed sets, closure and interior of a set, dense subsets, subspace topology, finite Product topology, Continuous functions, open maps, closed maps, etc.

Understanding: To describe the concept of topological space, compact space and compactness, metric spaces, T1 and T2 separation axioms etc.

Applying: To grow the concept of topology and apply it in diverse fields of study.

Analyzing: To analyze how to analyze higher dimensional problems, how to find the relations between compact sets and compact spaces and the relation with metric spaces, different properties of topology etc.

Evaluating: To evaluate the solution of many fundamental problems using the concept of topology.

Creating: To enrich the concept of abstract mathematics using the definition and properties of point set topology and topological space.

Future Perspective of the course:

Topology is the backbone of pure mathematics. Thus a student good in topology should understand the subject Mathematics in a better sense and can use the knowledge in further study as well as research.

COURSE OUTCOME for Mathematics General SEC (Semester-III)

Name of the course: **C Programming Language**

At the end of this course, the incumbent will be able to:

Remembering: To recall the basic structure of a mathematical modelling computer language including the development of programming code of various mathematical problems including operations on matrices, sorting of numbers, finding root of a quadratic equation, etc.

Understanding: To describe the concept of constants and variables, operators and expressions, control statements, loops, arrays, user-defined functions, built-in functions, library functions, etc.

Applying: To use in various allied engineering, physical problems and mathematical problems including finding numerical solutions of a transcendental equation, numerical integration, searching and sorting of numbers and characters, etc.

Analyzing: To analyze various real-world problems and categorize them using the coding of C Language.

Evaluating: To justify and understand the hidden beauty of the coding corresponding to various mathematical and real-world problems.

Creating: To design and create coding beyond mathematical problems including the development of software.

Future Perspective of the course:

C Programming Language is the base of various advanced software including MATLAB, Python, etc. Hence, the foundation of a good research scholar would be handling 'C Programming Language' with ease.

COURSE OUTCOME for Mathematics General SEC (Semester-VI)

Name of the course: **Boolean Algebra**

At the end of this course, the incumbent will be able to:

Remembering: To recall the basic structure of Boolean algebra including ordered set, Boolean function and Boolean polynomials, lattices, switching circuits, etc.

Understanding: To describe the concept Boolean function, truth tables, switching circuits, lattice, poset, minimization of circuits, etc.

Applying: To use in various allied engineering, physical and mathematical problems including finding minimization of switching circuits, minimal forms of Boolean polynomials, lattices and its application, etc.

Analyzing: To analyze various scientific problems using Boolean algebra and lattices.

Evaluating: To justify and evaluate basics and various properties of duality principle, homomorphism, modular lattices, and minimization of Boolean function using Karnaugh diagrams.

Creating: To design and create switching circuits, distributive lattices, minimizing Boolean function, etc.

Future Perspective of the course:

Boolean algebra is the base of discrete mathematics including mathematical logic. Students taking this course would be able to grow their concepts in discrete mathematics.

COURSE OUTCOME for Mathematics General DSE-A (Semester-V)

Name of the course: **Particle Dynamics**

At the end of this course, the incumbent will be able to:

Remembering: To recall the fundamental concept of dynamics including velocity and acceleration of a particle, motion of a particle, central force, simple harmonic motion, etc.

Understanding: To describe the concept of force, the difference between motion in a straight line and in two dimensions, motion of a particle in Cartesian and polar co-ordinate systems, planetary motion, oscillations, etc.

Applying: To find the path of artificial satellites, oscillations of a particle, motion of a particle moving under inverse square law, the component of velocity and oscillations of a particle under a straight line and plane curve, etc.

Analyzing: To analyze the nature of the path of a particle moving under different laws of forces, to describe the path of a planet, and to understand the motion of projectiles in a vacuum and in a medium with resistance.

Evaluating: To evaluate the path of a particle, to determine the conservation of energy, etc.

Creating: To formulate and solve various physical and mathematical problems including the path of a planet and satellite, path and force of a particle moving under polar and Cartesian co-ordinates, etc.

Future Perspective of the course:

In various physical and mathematical problems, the concept of dynamics is used quite frequently. Hence students opting 'Particle dynamics' would be able to solve various problems related to dynamics in their future life.

COURSE OUTCOME for Mathematics General DSE-B (Semester-VI)

Name of the course: **Advanced Calculus**

At the end of this course, the incumbent will be able to:

Remembering: To recall the fundamental concept of calculus that includes power series, Fourier series, uniform convergence, Laplace transformation, and its application field, etc.

Understanding: To describe the concept of the Weierstrass M-Test for Uniform convergence of the sequence of functions and of series of functions, boundedness, continuity, differentiability, and integrability of the limit function of uniformly convergent sequence of functions, radius of convergence of power series, Laplace transformation of different types functions and corresponding inverse Laplace theorem, Convolution theorem and its application during inverse Laplace transform, solution of ODE using Laplace transform, etc.

Applying: To use in various physical problems where the solution can be done using the concept of Laplace transformation, Fourier series, etc.

Analyzing: To analyze how to find the radius of convergence, periodic functions, sine and cosine series convolution of two functions and its application in Laplace transform, etc.

Evaluating: To use Dirichlet's conditions in using Fourier series, the concept of the term by term differentiation and integration in evaluating power series, evaluation of ODE using Laplace transform, evaluation of Fourier terms, etc.

Creating: To formulate some mathematical problems corresponding to various real-world problems and find their solution by using the concept of power series, Fourier series or Laplace transform.

Future Perspective of the course:

Calculus is the basics of Mathematics. Thus the students opting this course would not only be able to grow their concepts on the subject, but also they can utilize their earned knowledge in diverse practical fields.