B. Sc. (Honors) Mathematics

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

Numerical Analysis			
Course Code	21BSM41	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3 hours

Course Learning Objectives: This course will enable the students to:

- Obtain numerical solutions of algebraic and transcendental equations.
- Find numerical solutions of system of linear equations and check the accuracy of the solutions.
- Learn about various interpolating and extrapolating methods.
- Solve initial and boundary value problems in differential equations using numerical methods.
- Apply various numerical methods in real life problems.

Pedagogy (General Instructions): These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lesson shall develop students theoretical and applied mathematical skills.
- State the need of Mathematics in Science with real-life examples.
- Support and guide the students for self-study.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
- Encourage the students for group learning to improve their creative and analytical skills.
- Show short related video lectures in following ways:
  - As an introduction to new topics (pre-lecture activity).
  - As a revision of topics (post-lecture activity).
  - As additional examples (post-lecture activity).
  - As an additional material of challenging topics (pre and post lecture activity).
  - As a model solution of some exercises (post-lecture activity).

Module-1: Numerical Methods for Solving Algebraic and Transcendental Equations

Round-off error and computer arithmetic, Local and global truncation errors, Algorithms and convergence; Bisection method, False position method, Fixed point iteration method, Newton's method and Secant method for solving equations. **(8 Hours)**

Self-study: Error analysis for the above methods.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Module-2: Numerical Methods for Solving Linear System of equations

Partial and scaled partial pivoting, Lower and upper triangular (LU) decomposition of a matrix and its applications, Cholesky's method and Crout's methods. Gauss-Jacobi, Gauss-Seidel and successive over-relaxation (SOR) methods. **(8 Hours)**

Self-study: Thomas method for tridiagonal systems.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Module 3: Interpolation	
Interpolation with equal intervals: Finite difference operators, Newton-Gregory forward and backward difference interpolations. **Interpolation with unequal intervals:** Newton divided difference interpolation, Lagrange interpolation. **Piecewise linear interpolation:** Cubic spline interpolation. **(8 Hours)** **Self-study:** Lagrange Inverse interpolation.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Module-4: Numerical Differentiation and Integration	
Numerical differentiation: First order and higher order approximation for first derivative, Approximation for second derivative. **Numerical integration:** Generalised quadrature formula, Trapezoidal rule, Simpson's rules and error analysis. **(8 Hours)** **Self-study:** Weddle's rule and Problems.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Module-5: Initial and Boundary Value Problems of Differential Equations	
Numerical solutions of 1^{st} order 1^{st} degree Differential Equations: Taylors method, Euler 's method, modified Euler's method. Runge-Kutta method of 4^{th} order. Higher order one step method, Multi-step methods; Finite difference method, Shooting method. **(8 Hours)** **Self-study:** Solving simultaneous differential equations of 1^{st} order.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes: This course will enable the students to:

- Obtain numerical solutions of algebraic and transcendental equations.
- Find numerical solutions of system of linear equations and check the accuracy of the solutions.
- Learn about various interpolating and extrapolating methods.
- Solve initial and boundary value problems in differential equations using numerical methods.
- Apply various numerical methods in real life problems

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Brian Bradie (2006), A Friendly Introduction to Numerical Analysis. Pearson.
2. C. F. Gerald & P. O. Wheatley (2008). Applied Numerical Analysis (7th edition), Pearson Education, India.
3. F. B. Hildebrand (2013). Introduction to Numerical Analysis: (2nd edition). Dover Publications.
4. M. K. Jain, S. R. K. Iyengar & R. K. Jain (2012). Numerical Methods for Scientific and Engineering Computation (6th edition). New Age International Publishers.
5. Robert J. Schilling & Sandra L. Harris (1999). Applied Numerical Methods for Engineers Using MATLAB and C. Thomson-Brooks/Cole.

Web links and Video Lectures (e-Resources):

http://www.class-central.com/subject/math(MOOCs)
http://academicearth.org/
http://www.bookstreet.in.
VTU EDUSAT PROGRAMME – 20
VTU e-Shikshana Program

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quiz
- Group assignment and
- Seminars

B. Sc. (Honors) Mathematics

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

Operation Research			
Course Code	21BSM42	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3 hours

Course Learning Objectives: This course will enable the students to:

- Analyse and solve linear programming models of real-life situations.
- Provide graphical solution of linear programming problems with two variables, and illustrate the concept of convex set and extreme points.
- Solve linear programming problems using simplex method.
- Learn techniques to solve transportation and assignment problems.
- Solve two-person zero sum game problems.

Pedagogy (General Instructions): These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lesson shall develop students theoretical and applied mathematical skills.
- State the need of Mathematics in Science with real-life examples.
- Support and guide the students for self-study.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
- Encourage the students for group learning to improve their creative and analytical skills.
- Show short related video lectures in following ways:
  - **a.** As an introduction to new topics (pre-lecture activity).
  - **b.** As a revision of topics (post-lecture activity).
  - **c.** As additional examples (post-lecture activity).
  - **d.** As an additional material of challenging topics (pre and post lecture activity).
  - **e.** As a model solution of some exercises (post-lecture activity).

Module-1: Introduction to OR and Linear Programming Problem
Evolution of OR, definition of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, Linear Programming Problem, Convexity and Basic Feasible Solutions. Formulation and examples, Graphical Solution, Convex and polyhedral sets, Extreme points, Basic solutions, Basic feasible solutions, Correspondence between basic feasible solutions and extreme points. **(8 Hours)** **Self-study:** Scope of OR, application areas of OR.

(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Module-2: Simplex method	
Simplex method, Canonical and Standard form of LP problem, Optimality criterion, slack and surplus variables, Solutions to LPP by Simplex method, Artificial Variable, Big-M Method and Two-Phase Simplex Method. **(8 Hours)** **Self-study:** Degeneracy in LPP.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Module 3: Duality	
Formulation of the dual problem, Duality theorems, Unbounded and infeasible solutions in the primal, Solving the primal problem using duality theory. **(8 Hours)** **Self-study:** Solving LPP by Generalized simplex method	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Module-4: Transportation and Assignment Problem	
Formulation of transportation problems, Methods of finding initial basic feasible solutions: North-west corner rule, Least-cost method, Vogel approximation method, Algorithm for obtaining optimal solution using MODI method. Formulation of assignment problems, Hungarian method. **(8 Hours)** **Self-study:** Travelling sales man problem.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit-5: Game Theory	
Formulation of two-person zero-sum games, Games with mixed strategies, Graphical method for solving matrix game, Dominance principle, Solution of game problem, Linear programming method of solving game. Network Scheduling by CPM-PERT: Rules of Network construction, Numbering of events(Fulkerson's rule), Construction of network, Time analysis: Forward Pass computation, Backward Pass computation, Determination of Floats and Slack times, Critical Path Method(CPM), Programme Evaluation Technique(PERT). **(8 Hours)** **Self-study:** Linear programming method to solve with out saddle point.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Course outcomes: On completion of this subject, students will be able to: 1. Understand the meaning, definitions, scope, need, phases and techniques of operations research. 2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method. 3. Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems. 4. Solve problems on game theory for pure and mixed strategy under competitive environment.	

5. Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.
2. Operations Research, S D Sharma Kedarnath Ramnath & Company.
3. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt. Ltd. 2016.
4. Introduction to Operations Research, Hillier and Lieberman,8thEd., McGraw Hill.
5. Mokhtar S. Bazaraa, John J Jarvis & Hanif D. Sherali (2010). Linear Programming and Network Flows (4th Edition). John Wiley & Sons.
6. G Hadley (2002). Linear Programming. Narosa Publishing House.
7. Frederick S Hillier & Gerald J Lieberman (2015) Introduction to Operations Research (10th Edition). McGraw-Hill Education.
8. Hamdy A. Taha (2017). Operations Research: An Introduction to Linear Programming and Game Theory (3rd edition).
9. Paul R. Thie & Gerard E. Keough (2014). An Introduction to Linear Programming and Game Theory (3rd Edition) Wiley India Pvt. Ltd.

Web links and Video Lectures (e-Resources):

http://www.class-central.com/subject/math(MOOCs)
http://academicearth.org/

http://www.bookstreet.in. VTU EDUSAT PROGRAMME – 20 VTU e-Shikshana Program
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning • Quiz • Group assignment and • Seminars

IV Semester

Condensed Matter Physics			
Course Code	21BSS431	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(2L+0T+0P+1S)	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	03

Course objectives:

After going through the course, the student will be able

1. To study the crystal systems and Bragg's law
2. To gain knowledge on electrical, magnetic and dielectric properties of materials

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills in physics.
2. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
3. Encourage the students for group learning to improve their creativity and analytical skills.
4. While teaching show how every concept can be applied to the real world. This helps the students to expand understanding level.
5. Support and guide the students for self-study.
6. Ask some higher order thinking questions in the class, which promotes critical thinking.

Inspire the students towards the studies by giving new ideas and examples.

Module-1

Crystal Structure **05 Hours**

Space lattice, Bravais lattice - unit cell, primitive cell. Lattice parameters. Crystal systems. Direction and planes in a crystal. Miller indices. Expression for inter-planar spacing. Co-ordination number. Atomic packing factor for SC, FCC, BCC. Bragg's Law. Determination of crystal structure by Bragg's x-ray spectrometer Crystal structures of NaCl, Numericals

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: Self-study Component: Crystal structures of NaCl

Module-2

Liquid crystals **05 Hours**

Introduction, classification of liquid crystals, Liquid crystalline phases, polymorphism in thermotropic liquid crystals, polymer liquid crystals, orders parameter, measurement of order parameters by X-ray diffraction. Mier-Saupe theory for nematic-isotropic and nematic-smectic A transitions, , the blue phases, applications of liquid crystals.

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: Self-study Component: Applications of liquid crystals.

Module-3

Electrical Conductivity in Metals: **05 Hours**

Free-electron concept. Classical free-electron theory (Drude-Lorentz model) – Assumptions. . Failures of classical free-electron theory. Quantum free-electron theory - Assumptions. Fermi - Dirac Statistics. Fermi-energy, Fermi factor & its temperature dependence, Expression for electrical conductivity (derivation). Merits of Quantum free electron theory, Numericals.

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: Self study: Drift velocity. Mean collision time and mean free path. Relaxation time.

Module-4

Magnetic Properties of Matter **05 Hours**

Dia, Para, Ferri and Ferromagnetic Materials. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss, Numericals.

.

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: Self-study Component: Hysteresis and Energy Loss,

Module-5

Dielectric Properties of Materials: **05 Hours**

Polarization. Depolarization Field. Electric Susceptibility. Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation (Qualitative). Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons, Numericals.

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: Self-study Component: Plasmons

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain crystal systems and to calculate the APF for cubic crystal systems
2. Recognise various liquid crystalline phases required for display applications
3. Analyze the success and failure of free electron theory
4. Distinguish between different types of magnetic materials
5. Understand the mechanism of polarisation with different theories

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE).

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

Suggested Learning Resources:

Books

1. Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
2. Solid State Physics, S,O Pillai, 9 th Edition , New Age International Publishers, 2021
3. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
4. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
5. Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
6. Solid State Physics, Rita John, 2014, McGraw Hill
7. Solid-state Physics, H. Ibach and H Luth, 2009, Springer
8. Elementary Solid State Physics, Md. Ali Omar, 1999, Pearson India
9. Solid State Physics, Structure and Properties of Materials ,Third Edition M.A. Wahab, 2020, Narosa Publications.
10. Liquid Crystals by S. Chandrasekhar.

11. Thermotropic Liquid Crystals by Vertogen and Jeu.
12. The Physics of Liquid Crystals by de Geenes and Prost.

Reference Books

1. Elliot R. J. & Gibson A. F. – An Introduction to Solid state Physics and its Application, ELBS, Macmilan (1974)
2. Harrison W. A. – Solid State Theory, Tata McGraw Hill, India (1977)
3. Dekker A. J. – Solid State Physics, Macmillan, Students Edition (1991)
4. Luth H. and Ibach H. – Solid State Physics, Narosa Publishing House, New Delhi (1991)

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc19_ph14/preview
- https://www.classcentral.com/course/swayam-introduction-to-solid-state-physics-13045
- https://ocw.mit.edu/courses/8-02-physics-ii-electricity-and-magnetism-spring-2007/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

https://nptel.ac.in

https://swayam.gov.in

https://vlab.amrita.edu

B. Sc. Honors (Mathematics)

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - IV

Numerical Methods Lab			
Course Code	21BSML44	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	02	Exam Hours	3 Hours

Course description: This course aims at providing hands on experience in using Python functions to solve the equations, system of equations, and differential equations.

Course Learning objectives: This course will help the learner to

- To solve the algebraic and transcendental equations
- To solve the system of equations
- To find the value of the function which approximate the given set of values
- To find the value of definite integrals from the tabulated values
- To solve the initial and boundary value problems.

List of Experiments:

Any Ten Experiments to be performed

Sl.NO	Experiments
1	Programs for finding the root of the equation using Fixed-point iterative method
2	Programs for finding the root of the equation using false position method
3	Programs for finding the root of the equation using Newton-Raphson method
4	Programs for the solution of system of equations using LU Decomposition method.
5	Programs for the solution of system of equations using Gauss-Jacobi iterative method
6	Programs for the solution of system of equations using Gauss-Seidel iterative method
7	Programs on interpolation using Newton's forward and backward interpolation formula
8	Programs on interpolation using Lagrange's interpolation formula.
9	Programs on interpolation using Newton's general interpolation formula.
10	Programs on finding the definite integrals by using Simpson's 1/3rd and 3 /8^{th} rule.
11	Programs for finding the solution of the ordinary differential equations by Euler's modified Method.
12	Programs for finding the solution of the ordinary differential equations by R-K 4^{th} order Method.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Solve the algebraic and transcendental equations.
2. Solve the system of equations
3. Interpolate from the given set of values
4. Understand the method of Numerical Integration
5. Solving the Initial and boundary value problems.

Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE): The CIE marks awarded in case of Practical shall be based on the weekly evaluation of laboratory journals/ reports after the conduction of every experiment and one practical test.

Semester End Evaluation (SEE): The practical examinations to be conducted as per the time table of University in a batch wise with strength of students not more than 10-15 per batch.

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Books:

1. M. K. Jain, S. R. K. Iyengar & R. K. Jain (2012). Numerical Methods for Scientific and Engineering Computation (6th edition). New Age International Publishers.
2. H P Langtangen, *A Primer on Scientific Programming with Python*, 2nd ed., *Springer*, 2016.
3. C Hill, Learning Scientific Programming with Python, Cambridge University Press, 2016.
4. H. Fangohr, Introduction to Python for Computational Science and Engineering (A beginner's guide), University of Southampton, 2015.

Suggested Learning Resources:

http://vlabs.iitb.ac.in
http://math.fulletron.edu/mathews/numerical.html
http://www.my-mooc.com/en/categorie/mathematics
www.python.org

B. Sc Honors (Mathematics)

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER -IV

Mathematical Modelling			
Course Code	**21BSMO451**	CIE	50
Teaching Hours/Week (L:T:P: S)	2:1:0:0	SEE	50
Total Hours of Pedagogy	25	Total	100
Credits	2	Exam Hours	3hrs

Course Learning objectives:

The course will enable students to:

1. Interpret the real-world problems in the form of first and second order differential equations
2. Familiar with some classical linear and nonlinear models
3. Analyzing the solutions of the system of differential equations by phase portrait method

Pedagogy (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need of Mathematics in Science Study and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning home work, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).

As a model solution of some exercises(post-lecture activity

Model-1:Mathematical Modelling through First Order Equations-1	
Population Dynamics, Carbon dating, Newton's law of cooling, Epidemics, Economics, Medicine, mixture problem.	
(RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	Chalk and talk method/PowerPoint Presentation.

Module-2:Mathematical Modelling through First Order Differential Equations-2	
Electric circuit problem, Chemical reactions, Terminal velocity, Continuously compounding of interest.	
RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	Chalk and talk method/PowerPoint Presentation.

Module-3: Mathematical Modelling through Second Order Differential equation-1	
The vibrations of a mass on a spring, free damped motion, forced motion.	
RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	Chalk and talk method/PowerPoint Presentation.

Module-4: Mathematical Modelling through Second Order Differential equation-2	
Resonance phenomena, electric circuit problem, Nonlinear Pendulum	
RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	Chalk and talk method/PowerPoint Presentation.
Module-5: Mathematical Modeling through system of linear Differential Equations	
Phase plane analysis, Predator prey model, Combat model, Epidemics, Economics- SIR model, mixture Problems	
RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	Chalk and talk method/PowerPoint Presentation.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Demonstrate a working knowledge of differential equations in other branches of sciences, commerce, medicine, etc.,
2. Become familiar with some of the classical mathematical models .
3. Validate the results of the calculations
4. Demonstrate competence with a wide variety of mathematical tools and techniques
5. Take an analytical approach to problems in their future endeavours

Assessment Details (both CIE and SEE)

(Methods of CIE need to define topic wise i.e.- MCQ, Quizzes, Open book test or Seminar) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and then it is reduced to 50. Based on this grading will be awarded.

Continuous Internal Evaluation:

1. Methods suggested: Test, Open Book test, Written Quiz, Seminar, Assignment, Report writing etc.
2. The class teacher has to decide the topic for the closed book test, open-book test, Written Quiz and Seminar. In the beginning, only the teacher has to announce the methods of CIE for the subject.
3. 10 marks weightage has to be given for Self-Study component (Via assignment / seminar / test).

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Text Books And Reference Books:

1. D. G. Zill, W. S. Wright, *Advanced Engineering Mathematics*, 4th ed., Jones and Bartlett Publishers, 2010.
2. J. R. Brannan and W. E. Boyce, Differential equations with boundary value problems: modern methods and applications. Wiley, 2011.
3. C. H. Edwards, D. E. Penney, and D. Calvis, *Differential equations and boundary value problems: computing and modeling*. 3rd ed., Pearson Education Limited, 2010.
4. D. G. Zill, *Differential Equations with Boundary-Value Problems, I 7th ed.*, Cengage Learning, 2008.

Web links and Video Lectures (e-Resources):

https://people.maths.bris.ac
https://link.springer.com
https://www.mmmp-jounal.org
https://www.lshtm.ac.uk

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quiz
- Group assignment
- Seminars

Semester

SOLAR ENERGY UTILIZATION			
Course Code	21BSO452	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:10:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	03 Hours

Course objectives:

- To introduce the concept of Solar Energy, its radiation, Collection, Storage and Application..
- To explore Society's Present needs and future energy demand
- To get exposed to energy Conservation methods.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills in physics.
2. State the necessity of Solar energy.
3. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
4. Encourage the students for group learning to improve their creativity and analytical skills.
5. While teaching show how every concept can be applied to the real world. This helps the students to expand understanding level.
6. Support and guide the students for self-study.
7. Ask some higher order thinking questions in the class, which promotes critical thinking.
8. Inspire the students towards the studies by giving new ideas and examples.

Module-1

Solar Energy Basic Concepts: **05 Hours**

Introduction, The Sun as Source of Energy, The Earth, Sun. Earth radiation spectrum, Extraterrestrial and Terrestrial radiations, Solar Constant, Solar Radiation at the earth's Surface, Spectral power Distribution of solar radiation, Depletion of Solar radiation. Solar radiation data.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Introduction to energy sources need of nonconventional energy Sources.

Module-2

Solar Radiation Geometry; **05 Hours**

Flux on a plane surface, Latitude, Declination angle, Surface Azimuth angle, Hour angle, Zenith angle, Solar altitude angle, Expression for the angle between the incident beam and normal to a plane surface, Local apparent time, Apparent motion of sun, day length,
Radiation Flux on a tilted Surface; beam, diffuse and reflected radiation, Expression for flux on a tilted surface, Numerical examples.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Flux on plane surfaces, Latitude, Declination angle,

Module-3

Measurement of Solar radiation; **05 hours**

Solar radiation Data, Solar time, Solar radiation geometry, Solar day length, Extra-terrestrial radiation on horizontal surface, Empirical Equations for Estimating Terrestrial Solar radiation on horizontal Surface, Solar radiation on inclined plane surface
Temperature of the sun by radiation Pyrometer, Shading ring Pyrheliometer, Sun shine recorder, Schematic diagrams and Principle of working,

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Solar radiation data.**

Module-4	
Solar Thermal systems: **05 hours** Thermal Collection devices, Liquid flat plate Collectors, Solar air heaters (Cylindrical, parabolic, paraboloid) sensible heat storage latent heat storage, application of Solar energy , Solar water heaters Solar Passive space heating and cooling Systems, Solar industrial heating systems, Solar refrigeration and air conditioning systems, Solar cookers	
Pedagogy	Chalk and talk, Power point presentation, Video. **Self study Component: Thermal collection devices,**
Module-5	
Solar Photovoltaic Systems: **05 Hours.** . Introduction**, Solar cells Fundamentals, Solar cell Characteristics, Solar cell Classification** solar cell Technologies, Solar cell module and array construction, Maximizing the solar PV Out put and load matching, Maximum power point tracker, Balance of system components, Solar PV Systems and solar PV applications	
Pedagogy	Chalk and talk, Power point presentation, Videos **Practical Topics:** **Self study Component:** Solar cell fundamentals and Characteristics..

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1) Discuss the importance of the role of renewable energy the concept of energy storage, principles of energy storage devices,
2) Discuss the concept of solar radiation data and solar PV system fabrication operation of solar cell sizing and design of PV System
3) Describe the process of harnessing solar energy and its applications in heating and cooling.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE).

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Text books:

1. Non-Conventional Energy Resources by B.H.Khan. McGraw Hill , 2nd Edition2017
2. Non-Conventional Sources of Energy by G.D.Rai, Khanna Publishers, 4th Edition,2009.
3. Solar Energy by Subhas P Sukhatme, Tata Mc,Graw Hill, 2nd Edition1996;
4. Solar Energy-Principles of Thermal Collections and Storage by S.P.Sukhatme, J.K.Nayak, Mc.Graw Hill,2008.

Reference books:

1. Non-Conventional Energy Resources by ShobhNath Singh, Pearson 1st Edition2015.
2. Renewable Energy Sources and Conversion Technology by Bansal, Manfred Kleeman & Mechael Meliss Tata McGraw Hill 2004

Web links and Video Lectures (e-Resources):

1. https://youtu.be/8nJXN6kwyqA
2. https://youtu.be/XkpKsBIW7tI
3. https://youtu.be/iZyzvDj6Y3c
4. https://youtu.be/iZyzvDj6Y3c

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. https://youtu.be/DZ30tWPOO1I

Semester

PRINT TECHNOLOGY			
Course Code	21BSO453	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:10:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	03 Hours

Course objectives:

- To know the necessity of printing technology in Today's life.

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- Understand the different printing processes and contribution of various elements in designing and type setting.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills in physics.
2. State the necessity of printing in modern era.
3. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
4. Encourage the students for group learning to improve their creativity and analytical skills.
5. While teaching show how every concept can be applied to the real world. This helps the students to expand understanding level.
6. Support and guide the students for self-study.
7. Ask some higher order thinking questions in the class, which promotes critical thinking.
8. Inspire the students towards the studies by giving new ideas and examples.

Module-1

Introduction to Printing Process: **05 Hours.**

Definition of Printing. Brief history, Origin of Printing processes, Intaglio, Lithography, Screen Printing, Offset printing, Flexography, Photo copiers, Printers, Frescography,3D printing.

Digital Printing Processes: Concept of impact and Non-Impact, Working of electrophotography and Ink jet.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Brief history of Printing.

Module-2

Basic Operations in Printing: **05 Hours**

(a) Pre-Press; Typography, digital font and movable type, type terminology, typeface structure and parts, type family- definition, typesetting and measurements-measure and gauge, pics. em. en Readability and legibility.

(b) Press; Letter press printing technology, Flat bed, Platen press, Rotary press and its applications. Offset-Sheet fed& Web & fed machines line, Stack CIC and Perfecting mechanism and its applications.

(c) Post- Press; Cutting, Slitting, Trimming, Binding-folding, types of folding (parallel and perpendicular folds), gathering, collating, insetting, Binding style-saddle setting, section binding, perfect binding, finishing.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Typography, Post-press Cutting, Slitting,Trimming.

Module-3

Printing Processes; **05 Hours**.

Introduction to printing processes, basic principles, Characteristics, Identification and application of letterpress, Flexography, Lithography, Offset and Screen printing .General Principles of printing surface preparation for these processes, Modes of taking Impressions, Suitability and Limitations of various processes.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Basic principles of printing process.**

Module-4	
Screen Printing: **05 Hours.** Introduction**,** Stencils, their kinds and methods of preparations, **Screen** materials, Screen fabric mono filaments, multifilament, Stretching screen fabric to frame, screen preparation, screen reclamation,. Trouble shooting clogged screens, Care and storage of screens, Image transfer, Squeegee Considerations, squeegee preparations, hardness categories of squeegee blades, Screen ink-its kinds and uses for different substrates and drying methods.	
Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Introduction to Screen Printing.**
Module-5	
Screen Printing Machines: **05 Hours.** Kinds of Screen printing machines, principles, Method of halftone preparation for Screen printing, Drying equipment; Drying racks, Wicket dryers, jet dryers, infrared and UV Dryers ,Flocking process.	
Pedagogy	Chalk and talk, Power point presentation, Videos **Practical Topics:** **Self study Component:** Various types of Screen-printing Machines.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :
1)Distinguish the various printing techniques like Planography. intaglio etc.
2)Explain the basic principles of printing process
3) Familiarize with different process of printing Industry.
4)Recognize various Materials used in printing operations and distinguish printing finishing..
4) Choose an appropriate printing process for any given printing job.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE).

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)
1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**
4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)
6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**
(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**
1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Text books:

1. Letterpress Printing part 1&2 by Chandra Shekar Mishra.
2. Printing Technology 5th Edition by Michale Adams.
3. Printing Material Science& Technology.Vol.24 by Anthony Bristow.
4. Hand book of Print and Production by Michale Bernard John Peacock..
5. Screen Printing by John Stephens.

Reference books:

1. Hand book of Topography by Kailas Tahle.
2. The Print and Production Manual by PIRA.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/7L42aRs68WI
2. https://youtu.be/UKtue--8- s
3. https://youtu.be/t7yv4gSnNkE
4. https://youtu.be/rxN8Iuo28oQ

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

https://youtu.be/UhV_XrHZj3c

IV Semester

Scientific Foundations of Health

Course Code	**21SFH46**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**2:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**02 Hours/Week**	**Total Marks**	**100**
Credits	**02**	**Exam Hours**	**60 Minutes / 01 Hour**

Course objectives:

The course 21**SFH46** will enable the students:

- To know about Health and wellness (and its Beliefs)
- To acquire Good Health & It's balance for positive mind-set
- To Build the healthy lifestyles for good health for their better future
- To Create of Healthy and caring relationships to meet the requirements of MNC and LPG world
- To learn about Avoiding risks and harmful habits in their campus and outside the campus for their brightfuture
- To Prevent and fight against harmful diseases for good health through positive mindset

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools and software'sto meet the present requirements of the Global employment market.

(i) Direct instructional method (Low /Old Technology),
(ii) Flipped classrooms (High/advanced Technological tools),
(iii) Blended learning (combination of both),
(iv) Enquiry and evaluation based learning,
(v) Personalized learning,
(vi) Problems based learning through discussion,
(vii) Following the method of expeditionary learning Tools and techniques,

Apart from conventional lecture methods, various types of innovative teaching techniques through videos,animation films may be adapted so that the delivered lesson can progress the students In theoretical applied and practical skills in teaching of the concepts of Health and Wellness in general.

Module-1

Good Health and It's balance for positive mindset:

What is Health, Why Health is very important Now? – What influences your Health?, Health and Behaviour,Health beliefs and advertisements, Advantages of good health (Short term and long term benefits), Health and Society, Health and family, Health and Personality - Profession. Health and behaviour, Disparities of health in different vulnerable groups. Health and psychology, Methods to improve good psychological health. Psychological disorders (Stress and Health - Stress management), how to maintain good health, Mindfulness for Spiritual and Intellectual health, Changing health habits for good health. Health and personality.

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. creating real time stations in classroom discussions. Giving activities &assignments.

Module-2

Building of healthy lifestyles for better future:

Developing a healthy diet for good health, Food and health, Nutritional guidelines for good health and well beingness, Obesity and overweight disorders and its management, Eating disorders - proper exercises for its maintenance (Physical activities for health), Fitness components for health, Wellness and physical function,

Teaching-Learning Process	Chalk and talk method, PowerPoint presentation and YouTube videos, Animation videos methods. creating real time stations in classroom discussions. Giving activities&assignments.

Module-3

Creation of Healthy and caring relationships :

Building communication skills (Listening and speaking), Friends and friendship - education, the value of relationships and communication, Relationships for Better or worsening of life, understanding of basic instincts of life (more than a biology), Changing health behaviors through social engineering,

Teaching-Learning Process	Chalk and talk method, PowerPoint presentation and Animation videos methods. Creating real time stations in classroom discussions. Giving activities and assignments.

Module-4

Avoiding risks and harmful habits :

Characteristics of health compromising behaviors, Recognizing and avoiding of addictions, How addiction develops and addictive behaviors, Types of addictions, influencing factors for addictions, Differences between addictive people and non addictive people and their behavior with society, Effects and health hazards from addictions Such as..., how to recovery from addictions.

Teaching-Learning Process	Chalk and talk method, PowerPoint presentation and Animation videos methods. Creating real time stations in classroom discussions. Giving activities and assignments.

Module-5

Preventing and fighting against diseases for good health :

Process of infections and reasons for it, How to protect from different types of transmitted infections suchas….,

Current trends of socio economic impact of reducing your risk of disease, How to reduce risks for goodhealth,

Reducing risks and coping with chronic conditions, Management of chronic illness for Quality of life,

Health and Wellness of youth : a challenge for the upcoming future Measuring of health and wealth status.

Teaching-Learning Process	Chalk and talk method, PowerPoint presentation and YouTube videos, Animation videos methods. creating real time stations in classroom discussions. Giving activities & assignments.

Course outcome (Course Skill Set)

At the end of the course the student will be able :

CO 1: To understand Health and wellness (and its Beliefs)

CO 2: To acquire Good Health & It's balance for positive mindset

CO 3: To inculcate and develop the healthy lifestyle habits for good health.

CO 4: To Create of Healthy and caring relationships to meet the requirements of MNC and LPG world

CO 5: To adopt the innovative & positive methods to avoid risks from harmful habits in their campus & outside thecampus.

CO 6: To positively fight against harmful diseases for good health through positive mindset.

Assessment Details (both CIE and SEE)

methods of CIE need to be defined topic wise i.e.- Tests, MCQ, Quizzes, Seminar or micro project/CourseProject, Term Paper)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 35% of maximum marks in SEE and a minimum of 40% of maximum marks in CIE. Semester End Exam (SEE) is conducted for 50 marks (hours' duration). Based on this grading will be awarded.

The student has to score a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

(All testsare similar to the SEE pattern i.e question paper pattern is MCQ)

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Report writing /Group discussion/Seminar any one of three suitably planned to attain the COsand POs for **20 Marks**(**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy asper the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common questionpapers for subject

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper isMCQ. The time allotted for SEE is **01 hours**

Suggested Learning Resources:

1. **Health Psychology** (Second edition) by Charles Abraham, Mark Conner, Fiona Jones and Daryl O'Connor –Published by Routledge 711 Third Avenue, New York, NY 10017.
2. **Health Psychology - A Textbook,** FOURTH EDITION by Jane Ogden McGraw Hill Education (India) Private Limited - Open University Press
3. **HEALTH PSYCHOLOGY (Ninth Edition)** by SHELLEY E. TAYLOR - University of California, Los Angeles,McGraw Hill Education (India) Private Limited - Open University Press
4. **Scientific Foundations of Health (Health & Welness) - General Books** published for university andcolleges references by popular authors and published by the reputed publisher.

1) **SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos** and other materials / notes

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- ✓ Contents related activities (Activity-based discussions)
- ✓ For active participation of students, instruct the students to prepare Flowcharts and Handouts
- ✓ Organizing Group wise discussions and Health issues based activities
- ✓ Quizzes and Discussions
- ✓ Seminars and assignments

B. Sc Honors (Mathematics)

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - IV

Concepts of Biomathematics			
Course Code	**21BCS47**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE	50
Total Hours of Pedagogy	25	Total	100
Credits	2	Exam Hours	3 hrs

Course Learning Objectives: The course will enable students to

1. Study the classification of biological data
2. Familiar with correlation of bi-Variate data
3. Understand the basic concepts of probability theory

Pedagogy (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need of Mathematics in Science Study and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning home work, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises(post-lecture activity

Module-1: Introduction to statistics

Classification of biological data, frequency distribution, cumulative frequency distribution, graphical representation of data, Histogram, bar chart, pie chart, Measures of central tendency, Mean, median and mode for grouped data

(RBT Levels: L1, L2 and L3) **5 hours**

Pedagogy	**Chalk and talk method/PowerPoint Presentation.**

Module-2: Measures of dispersion

Concept of dispersion, Measures of dispersion: Variance, Standard deviation (SD) for grouped and ungrouped data, Quartile deviation, Moments.

(RBT Levels: L1, L2 and L3) **5 hours**

Pedagogy	**Chalk and talk method/PowerPoint Presentation.**

Module-3: Correlation and Regression

Curve fitting: $y = ax + b$, $y = ax^2 + bx + c$, $y = ax^b$

Karl-Pearson's Correlation coefficient, Rank correlation, Lines of Regressions.

(RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	**Chalk and talk method/PowerPoint Presentation.**

Module-4: Probability

Introduction, Sample space, Events, Mutually exclusive events, Exhaustive events, Independent events, Definition of probability, Axioms of Probability, Conditional probability, Baye's Theorem.

(RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	**Chalk and talk method/PowerPoint Presentation.**

Module-5: Random variable

Random Variable, Discrete and Continuous random variables, Probability distribution and density functions, Mean , Variance and standard deviation.

(RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	**Chalk and talk method/PowerPoint Presentation.**

Course outcome :

At the end of the course the student will be able to:

1. Analyse and design various statistical problems.
2. Foundation to tackle live problems in various spheres of bioscience and bioengineering.
3. Demonstrate strong basics in statistics which is applicable to Biological Sciences.

Assessment Details (Both CIE and SEE)

(Methods of CIE need to define topic wise i.e.- MCQ, Quizzes, Open book test or Seminar) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and then it is reduced to 50. Based on this grading will be awarded.

Continuous Internal Evaluation:

1. Methods suggested: Test, Open Book test, Written Quiz, Seminar, Assignment, Report writing etc.
2. The class teacher has to decide the topic for the closed book test, open-book test, Written Quiz and Seminar. In the beginning, only the teacher has to announce the methods of CIE for the subject.
3. 10 marks weightage has to be given for Self-Study component (Via assignment / seminar / test).

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Books Recommended

- Irwin Miller & Marylees Miller (2014). John E. Freund's Mathematical Statistics with Applications (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
- S C Gupta and V K Kapoor, "Fundamentals of Mathematical Statistics", S Chand and Company, Latest edition.

Web links and Video Lectures (e-Resources):

- http://www.themathpage.com/
- http://www.abstractmath.org/
- http://www.ocw.mit.edu/courses/mathematics/
- http://www.mathcs.org/analysis/reals/ndex.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quiz
- Group assignment
- Seminars

IV Semester

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)			
Course Code	21CIP48	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	03 Hours

Course Learning Objectives: To

- know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
- Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
- Know about the cybercrimes and cyber laws for cyber safety measures.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills in physics
2. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
3. Encourage the students for group learning to improve their creativity and analytical skills.
4. While teaching show how every concept can be applied to the real world. This helps the students to expand understanding level.
5. Support and guide the students for self-study.
6. Ask some higher order thinking questions in the class, which promotes critical thinking.
7. Inspire the students towards the studies by giving new ideas and examples.

Module-1

Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

Pedagogy	Chalk and talk, Power point presentation, Videos

Module-2

Union Executive and State Executive: Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and

Pedagogy	Chalk and talk, Power point presentation, Videos

Module-3

Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences. Constitutional special provisions: Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

Pedagogy	Chalk and talk, Power point presentation, Videos

Module-4

Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative

Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering

Pedagogy	Chalk and talk, Power point presentation, Videos

Module-5

Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.

Pedagogy	Chalk and talk, Power point presentation, Videos

Course outcome (Course Skill Set)

Course outcomes:

1. Have constitutional knowledge and legal literacy.
2. Understand Engineering and Professional ethics and responsibilities of Engineers.
3. Understand the the cybercrimes and cyber laws for cyber safety measures.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE).

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is **01 hours.**

Suggested Learning Resources:

Text books:

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Reference books:

1. Constitution of India, Professional Ethics and Human Rights Shubham Singles, Charles E. Haries, and et al Cengage Learning India 2018
2. Cyber Security and Cyber Laws Alfred Basta and et al Cengage Learning India 2018 Reference Books
3. Introduction to the Constitution of India Durga Das Basu Prentice –Hall, 2008.
4. Engineering Ethics M. Govindarajan, S. Natarajan, V. S. Senthilkumar Prentice –Hal