B. Sc. (Honors) Mathematics

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

SEMESTER - VI

GROUP THEORY			
Course Code	**21BSM61**	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	03

Course objectives: This course will enable the students to:

- Understand the fundamentals of Groups and its theories.
- Relate abstract algebraic constructs to more familiar sets and operators.
- Know about the Subgroups and Group Homomorphisms.
- Familiar with the theories on Rings, Integral Domains and Fields.

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 for Mathematics Science Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, 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: Groups and its Elementary Properties

Binary operations, algebraic structure, problems on finding identity and inverse. Definitions of semigroup, abelian group, problems on finite and infinite groups. Properties of the group with proof. Standard problems on groups. A finite semigroup with both the cancellation laws is a group, Problems. **(8 hours)**

Self-study: Any group of order less than five is abelian.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-2: Subgroups and Cyclic Groups

Order of an element of a group, properties related to the order of an element, subgroup generated by an element of a group. Equivalence class and partition of a set, coset decomposition of a group, cyclic groups, properties, modulo relation, index of a group, Lagrange's theorem, consequences. **(8 hours)**

Self-study: Problems on Equivalence class and partition set.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3: Normal Subgroups and Permutation Groups

Normal subgroups, examples and problems, quotient group, Homomorphism and Isomorphism of groups, Kernel and image of a homomorphism, Normality of the Kernel, Fundamental theorem of homomorphism, properties related to isomorphism, Permutation group, Properties of permutations, Even and odd permutations, Cayley's theorem and its applications. **(8 hours)**

Self-Study: Alternating groups.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4: Rings

Rings, Types of Rings, properties of rings. Rings of integers modulo n, subrings, Ideals, Principal, Prime and Maximal ideals in a commutative ring, examples and standard properties following the definition. Homomorphism, Isomorphism, properties. **(8 hours)**

Self-Study: Quotient rings.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5: Group Homomorphisms, Rings and Fields

Integral domains, Fields, properties follow the definition. Fundamental theorem of Homomorphism of rings, Every field is an integral domain, Every finite integral domain is a field, problems. **(8 hours)**

Self-Study: Examples of fields: Z, Q, R, and C. Field of rational functions.

(RBT Levels: L1, L2 and L3)

Course outcomes: After successfully completion of the course, the students will be able to:

- Recognize the mathematical objects called groups.
- Link the fundamental concepts of groups and symmetries of geometrical objects.
- Explain the significance of the notions of cosets, normal subgroups, and factor groups.
- Analyze consequences of Lagrange's theorem.
- Learn about structure preserving maps between groups and their consequences.

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 hour**)

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

Reference Books

1. I. N. Herstein (2006). Topics in Algebra (2nd edition). Wiley India.
2. Michael Artin (2014). Algebra (2nd edition). Pearson.
3. John B. Fraleigh (2007). A First Course in Abstract Algebra (7th edition). Pearson.
4. Joseph A. Gallian (2017). Contemporary Abstract Algebra (9th edition). Cengage.
5. Nathan Jacobson (2009). Basic Algebra I (2nd edition). Dover Publications.
6. Ramji Lal (2017). Algebra 1: Groups, Rings, Fields and Arithmetic. Springer.
7. I.S. Luthar & I.B.S. Passi (2013). Algebra: Volume 1: Groups. Narosa.

Web links and Video Lectures (e-Resources):

- **http://www.themathpage.com/**
- **http://www.abstractmath.org/**
- **http://www.ocw.mit.edu/courses/mathematics/**

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 - VI

PROBABILITY & STATISTICS			
Course Code	**21BSM62**	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	03

Course objectives: This course will enable the students to:

1. Providing the knowledge of basics of Probability and the distribution related.
2. Providing the understanding of various sampling techniques related various applications in Science.
3. Introducing the concepts of Hypothesis testing & Regression analysis.

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 for Mathematical Science Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, 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: Probability Functions and Moment Generating Function

Basic notions of probability, Sample spaces and Conditional probability and independence, Baye's theorem; Random variables - Discrete and continuous, Cumulative distribution function, Probability mass/density functions; Transformations, Mathematical expectation, Moments, Moment generating function. **(8 hours)**

Self-study: Characteristic function.

(RBT Levels: L1, L2 and L3)

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

Module-2: Univariate Discrete and Continuous Distributions

Discrete distributions: Bernoulli, Binomial, Geometric and Poisson; Continuous distributions: Uniform, Gamma, Exponential, Chi-square, Normal; Normal approximation to the binomial distribution. **(8 hours)**

Self-study: Negative binomial distribution. Beta distributions.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3: Bivariate Distribution

Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, Expectation of function of two random variables, Joint moment generating function. **(8 hours)**

Self-Study: Conditional distributions and expectations.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4: Correlation, Regression and Central Limit Theorem

The Covariance, Correlation coefficient, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables, The method of least squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem. **(8 hours)**

Self-Study: Weak law of large numbers.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5: Test of Hypothesis

Testing of hypothesis, Null and Alternate hypothesis, type I and II errors, level of significance, one-sided and two-sided tests of hypothesis concerning one mean. Discussion on Hypothesis Concerning one mean. Estimation of proportions, testing of hypothesis on proportions, goodness of fit.

Self-Study: Modelling Uncertainty, Uncertainty, Information and Entropy. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Course outcomes: After successfully completion of the course, the students will be able:

- To understand the scenarios to apply suitable probability distribution models.
- Students have gained sufficient knowledge related to sampling and hypothesis testing.
- Students are equipped with knowledge on regression analysis which is an important concept in the concept of data mining.

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 hour**)

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

Books Recommended:

1. Irwin Miller & Marylees Miller (2014). John E. Freund's "Mathematical Statistics with Applications" (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
2. S C Gupta and V K Kapoor, "Fundamentals of Mathematical Statistics", S Chand and Company, Latest edition.
3. Robert V. Hogg, Joseph W. McKean & Allen T. Craig (2013). Introduction to Mathematical Statistics (7th edition), Pearson Education.
4. Jim Pitman (1993). Probability, Springer-Verlag.
5. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.
6. A. M. Yaglom and I. M. Yaglom (1983). Probability and Information. D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi.
7. B. S. Grewal(2021) "Higher Engineering Mathematics", 44th Ed., Khanna publishers.

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 - VI

Group Theory, Probability & Statistics Lab			
Course Code	21BMATL63	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:2:0	SEE Marks	50
Credits	02	Exam Hours	3 Hours

Course Description: This course will enable the students to gain hands-on experience in the Mathematical tools to executive the practical problems (Maxima/ Scilab/ MatLab/ Mathematica/ Python).

Course Learning Objectives: This course will help the learner to

- Determine the various operations and verification of the theorem on group theory
- Understand and verify the addition & multiplication laws of probability
- Compute the expectations, standard deviation and variance of random variables.
- Analyse the discrete and Continuous probability distributions
- Apply the least square method to fit a curve and regression analysis

List of Experiments:

Any Ten Experiments to be performed

Sl.NO	Experiments
1	Programs to determine the operation * gives a group on the set
2	Program to verify Lagranges theorem for given finite group
3	Programs to find all possible cosets of the given finite group
4	Programs to test the homomorphism of a given function
5	Programs for solving the problems using addition law on probability
6	Programs for verifying the Bayes theorem
7	Programs for finding the expectation of the random variable
8	Programs for finding Variance and Standard deviation of a random variable
9	Programs on Discrete probability distributions
10	Programs on Continuous probability distributions
11	Programs for fitting a curve by using the least square method
12	Programs for correlation and regression analysis

Course outcomes (Course Skill Set):

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

1. Verify various operations and theorems pertaining to group theory.
2. Apply the addition & multiplication laws of probability to real-world problems.
3. Compute the expectations, standard deviation and variance of random variables.

4. Develop the skill to apply the probability distributions to industry-related problems
5. Apply the least square method to fit a curve and regression analysis to practical 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. I. N. Herstein (2006). Topics in Algebra (2nd edition). Wiley India.
2. Michael Artin (2014). Algebra (2nd edition). Pearson.
3. John B. Fraleigh (2007). A First Course in Abstract Algebra (7th edition). Pearson.
4. Irwin Miller & Marylees Miller (2014). John E. Freund's "Mathematical Statistics with Applications" (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
5. S C Gupta and V K Kapoor, "Fundamentals of Mathematical Statistics", S Chand and Company, Latest edition.
6. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.

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 - VI

Number Theory			
Course Code	**21BSM641**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:1:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	03

Course objectives: This course will enable the students to:

1. Learn the basic concepts of Number theory
2. Analyze the modular arithmetic and find primitive roots of prime and composite numbers.
3. Understand the open problems in number theory, the Goldbach conjecture and twin-prime conjecture.

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 for Mathematics Science Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, 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 Number Theory

Divisibility, Prime and composite numbers, Euclidean algorithm, fundamental theorem of Athematic, the greatest common divisor and least common multiple, congruences, Linear congruences, Wilson's, Euler's and Fermat's Theorems and their applications. **(5 Hours)**

Self-study: Simultaneous congruences.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-2: Number Theoretic Functions

Number theoretic functions for sum and number of divisors, Multiplicative function, Greatest integer function, Euler's phi-function and properties, Euler's theorem. **(5 Hours)**

Self-study: The Möbius inversion formula.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3: Primitive Roots

Order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots; Definition of quadratic residue of an odd prime, Euler's criterion. **(5 Hours)**

Self-Study: Problems.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4: Quadratic Reciprocity Law

The Legendre symbol and its properties, Quadratic reciprocity, Quadratic congruencies with composite moduli. **(5 Hours)**

Self-Study: Problems.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5: Applications

Public key encryption, RSA encryption and decryption with applications in security systems. **(5 Hours)**

Self-Study: Applications**.**

(RBT Levels: L1, L2 and L3)

Course outcomes: After successfully completion of the course, the students will be able:

- Learn about some important results in the theory of numbers including the prime number theorem, Chinese remainder theorem, Wilson's theorem and their consequences.
- Learn about number theoretic functions, modular arithmetic and their applications.
- Familiarize with modular arithmetic and find primitive roots of prime and composite numbers.
- Know about open problems in number theory, namely, the Goldbach conjecture and twin-prime conjecture.
- Apply public crypto systems, in particular, RSA.

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.

Books Recommended:

1. David M. Burton (2007). Elementary Number Theory (7th edition). McGraw-Hill.
2. Gareth A. Jones & J. Mary Jones (2005). Elementary Number Theory. Springer.
3. Neville Robbins (2007). Beginning Number Theory (2nd edition). Narosa.
4. I. Niven (2012). An Introduction to the Theory of Numbers (5th edition). John Wiley & Sons.
5. Neal Koblitz (1994). A Course in Number Theory and Cryptography (2nd edition). Springer-Verlag.

Web links and Video Lectures (e-Resources):

1. http://www.numbertheory.org/
2. www.freebookcentre.net
3. mathworld.wolfram.com
4. https://www.math.brown.edu/NTgroup.html

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 - VI

Infinite series, Special functions and Analytical Geometry			
Course Code	21BSD642	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:1:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	3 hours

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

- Learn the convergence and divergence of infinite series.
- Analyse the concept of series solution technique of differential equations.
- Understand the basic concept of solid geometry.

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 lesson shall develop students theoretical and applied mathematical skills.
2. State the need of Mathematics in Science with real-life examples.
3. Support and guide the students for self-study.
4. You will also be responsible for assigning homework, 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 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: Infinite Series	
Basic definition of convergence and divergence, Power series in x, exponential series, Logarithmic series, Binomial series, Uniform convergence. **(5 Hours)** **Self-Study:** Abel's Test.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Module-2: Bessel Differential Equation	
Power Series solution of Differential Equations, Series Solution of Bessel Deferential equations, properties, recurrence relation, orthogonality of Bessel functions, generating functions. **(5 Hours)** **Self-Study:** Bessel integrals.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module 3: Legendre Differential Equations	
Series solutions of Legendre differential equations, Legendre's Polynomial $p_n(x)$, Recurrence relation, Orthogonality of Legendre's polynomial, Rodrigues's formula and problems. **(5 Hours)** **Self-Study:** Generating function of Legendre's Polynomial.	
(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4: Three-Dimensional Analytical Geometry

Direction Cosine of line, angle between two lines, plane, intercept form and normal form, Angle between two planes, straight line, Symmetric form and angle between line and plane. **(5 Hours)**
Self-Study: Basic concepts of three-dimensional Geometry.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5: Analytical Solid Geometry

Equation of Sphere in different forms, Intersection of two Spheres, Equations of cone and right circular cone in different forms and Equations of Cylinder and right circular in different forms. **(5 Hours)**

Self-Study: Great circle.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcomes: This course will enable the students to:

- Analyse the Convergence and divergence of the infinite series.
- Obtain the series solution of ordinary differential equations.
- Learn basic concepts of three-dimensional geometry.

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.

Books Recommended:

1. Shanti Narayan and Dr. P K Mittal, "Analytical Solid Geometry", S. Chand 17th Edition
2. H. K Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand
3. Bali and Iyengar "Engineering Mathematics" Laxmi Publications.

4. B S Grewal (2021). Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
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

VI-Semester

Semiconductors & Electronics			
Course Code	**21BSS651**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:1:0:1	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	03 Hours

Course Objectives:

- The course enables student to learn the fundamental physics of semiconductor materials,
- The course covers the working and applications of various logic gates

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

Band Theory of Solids: **05 Hours**

Introduction, Classification of solids based on electrical properties and energy band gap, band structure of semiconductors, Types of semiconductors- Intrinsic & extrinsic semiconductor, Majority and minority charge carriers. Concentration of electrons and holes in intrinsic semiconductors(derivation), law of mass action, Relation between Fermi level and Energy gap in an Intrinsic semiconductor (derivation). Electrical Conductivity in an intrinsic semiconductor. Hall effect (qualitative) & its applications.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** band structure of semiconductors.

Module-2

Transistors: **05 Hours**

Junction Transistor, types and their working, Transistor Current components, Common Base (CB), Common Collector (CC), Common Emitter (CE) configuration characteristics and its graphical analysis, Current gains α and β, Relations between α and β. Load line(ac & dc), Operating Point, Transistor amplifier in CE mode.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Junction transistors.

Module-3

Field Effect Transistor(FET): **05 Hours**

Construction of JFEET, idea of channel formation, pinch- off voltage, Transfer and output characteristics. MOSFET: MOS Diode, Basic construction of MOSFET and working, I-V characteristics, enhancement and depletion modes, Complimentary MOS (CMOS)

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Complimentary MOS (CMOS)

Module-4

Oscillators: **05 Hours**

Concept of, Feedback Positive negative feedback Sinusoidal oscillators: Tuned oscillators-Barkhausen criterion for oscillations, Hartley and Colpitt's oscillators. RC oscillators – Phase shift oscillator and Wien Bridge oscillator.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Wien Bridge oscillator

Logic Gates: **05 Hours**

Boolean Algebra & Logic gates: Basic Postulates and Fundamental Theorems of Boolean Algebra, De Morgan's theorems, Switching Equivalent Circuits of Basic Gates, Truth Tables and Symbolic Representation of OR, AND, NOT, NAND, NOR, XOR, XNOR Gates (realization using Transistor), NAND and NOR Gates as Universal Gates. Half adder and Full adder circuits.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self-study Component:** Boolean Algebra

Course outcome (Course Skill Set):

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

1. Capable to distinguish materials based on their band structure
2. Explain different types of transistors.
3. Understand the fundamentals of FET's.
4. Gain knowledge of the various types of oscillators.
5. Apply the knowledge of Boolean algebra in various logic circuits.

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. Modern Physics, R.Murugeshan & Er.K.Shivaprasath, S.Chand (2015).
2. Semiconductor Device Fundamentals, Robert F. Pierret, Pearson education
3. Solid state Physics,S. O. Pillai, New age International Publishers
4. Hand Book of Electronics, Gupta and Kumar, Pragati Prakasan, Meerut
5. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, Tata McGraw Hill
6. Fundamentals ofE ectrical & Electronic Engineering, B L Theraja, S.Chand Publishing.

Reference books:

1. Physics for degree students, C L Arora and P. S. Hemme, S Chand Publications

2. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
3. Introduction to Solid State Physics, Charles Kittel, Wiley India Pvt. Ltd.
4. Basic Electronics Solid state, B.L. Theraja, S.Chand Publishing.
5. Principles of Electronics – V.K.Mehta and Rohit Mehta S.Chand Publishing.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/k6ZxP9Yr02E
2. https://youtu.be/JA3sCmrv11M
3. https://youtu.be/mHAyQhz0ILE
4. https://youtu.be/N01BYteinzE
5. https://www.classcentral.com/course/swayam-fundamentals-of-electronic-device-fabrication-14080

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

https://youtu.be/c0fs-sNWmMM
https://nptel.ac.in
https://swayam.gov.in
https://vlab.amrita.edu

Course Code	21BSS652	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:1:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	2	Exam Hours	3

Course Learning objectives:

CLO 1	The course will cover the basic principles of Industrial chemistry.
CLO 2	The class will cover the fundamentals principles of the various purification techniques used in industries like distillation, absorption, adsorption and solvent extraction.
CLO 3	It provides a selective understanding on the production, storage and handling of important gases like-oxygen, argon, helium, hydrogen and acetylene
CLO 4	This course provides information on the surface coatings, Pharmaceuticals and agrochemicals.

Pedagogy (General Instructions)

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

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

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to convince abstract concepts.
4. Encourage collaborative (Group Learning) Learning in the class
5. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Topics will be introduced in a multiple representation.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1 Chemical Technology

Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry.

Pedagogy	**Chalk and talk/power point presentation:** Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. **Videos/Learning material:** An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. **Self-study:** Scaling up operations in chemical industry.

Module-2 Industrial Gases & Inorganic Chemicals

Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, acetylene, carbon monoxide, chlorine, sulphur dioxide and phosgene.

Inorganic Chemicals: Industrial preparation with the help of flowchart, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, borax, bleaching powder, hydrogen peroxide, potash alum, potassium dichromate and potassium permanganate.

Pedagogy	**Chalk and talk/power point presentation:** Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, acetylene, carbon

	monoxide, chlorine, sulphur dioxide and phosgene. **Videos/Learning material: Inorganic Chemicals:** Industrial preparation with the help of flowchart, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, borax, bleaching powder, hydrogen peroxide, potash alum, potassium dichromate and potassium permanganate. **Self-study:** Hazards in handling of the following gases: oxygen, nitrogen.
Module-3 Surface Coatings	
Objectives of surface coatings, preliminary treatment of surface and classification of surface coatings.Paints and pigments - formulation, composition and related properties. Oil paint, Pigments, toners and lakes pigments, fillers, thinners, enamels, emulsifying agents. Special paints (heat retardant, fire retardant, eco- friendly and plastic paint), wax polish, water paints, additives. Metallic coatings (electrolytic and electroless), metal spraying and anodizing.	
Pedagogy	**Chalk and talk/power point presentation:** Objectives of surface coatings, preliminary treatment of surface and classification of surface coatings. Paints and pigments - formulation, composition and related properties. Oil paint, Pigments, toners and lakes pigments, fillers, thinners, enamels, emulsifying agents. **Videos/Learning material:** Special paints (heat retardant, fire retardant, eco- friendly and plastic paint), wax polish, water paints, additives. **Self-study:** Metallic coatings (electrolytic and electroless), metal spraying and anodizing.
Module-4 Fertilizers & Pesticides	
Fertilizers: Different types of fertilizers (N, P and K). Importance of fertilizers, chemistry involved in the manufacture of the following fertilizers: urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime, potassium chloride and potassium nitrate. **Pesticides**: Introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides. Synthesis and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammaxene), Organophosphates (Malathion, Parathion), Carbamates (Carbofuran and carbaryl), Quinones (Chloranil), Anilides (Alachlor and Butachlor).	
Pedagogy	**Chalk and talk/power point presentation: Fertilizers**: Different types of fertilizers (N, P and K). Importance of fertilizers, chemistry involved in the manufacture of the following fertilizers: urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime, potassium chloride and potassium nitrate. **Videos/Learning material: Pesticides**: Introduction to pesticides (natural and synthetic), Synthesis and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammaxene), Organophosphates (Malathion, Parathion), Carbamates (Carbofuran and carbaryl), Quinones (Chloranil), Anilides (Alachlor and Butachlor). **Self-study:** Benefits and adverse effects, changing concepts of pesticides.
Module-5 Drugs and Pharmaceuticals	
Drug discovery, design and development; Retrosynthetic approach (with any two examples). Synthesis of the representative drugs of the following classes: analgesics, antipyretics, anti-inflammatory agents (Aspirin), antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides); Cardiovascular drugs (Glyceryltrinitrate).	

Pedagogy	**Chalk and talk/power point presentation:** Drug discovery, design and development; Retrosynthetic approach (with any two examples). Synthesis of the representative drugs of the following classes: analgesics, antipyretics, anti-inflammatory agents (Aspirin), antibiotics (Chloramphenicol); **Videos/Learning material:** Antibacterial and antifungal agents (Sulphonamides); **Self-study:** Cardiovascular drugs (Glyceryltrinitrate).

Course outcome (Course Skill Set)

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

CO1	Explain the various procedures used in separation of chemicals
CO2	Illustrate the industrial production of a number of important gases and inorganic chemicals.
CO3	Identify the coating techniques for various applications
CO4	Differentiate the chemicals used in Fertilizers, Pesticides and Pharmaceuticals

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 5thweek of the semester
2. Second test at the end of the 10thweek 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 13thweek 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:

Books:

1. Vermani, O. P.; Narula, A. K. (2004), Industrial Chemistry, Galgotia Publications Pvt. Ltd., New Delhi.
2. Gupta, P.K.; Gupta, S.K.(2011),Pharmaceutics and Cosmetics, PragatiPrakashan

3. Bhatia, S. C. (2004), Chemical Process Industries, Vol. I & II, CBS Publishers, New Delhi.
4. Jain, P. C.; Jain, M. (2013), Engineering Chemistry, DhanpatRai& Sons, Delhi.
5. Kent, J. A. (ed) (1997), Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
6. Stocchi, E.(1990), Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK
7. Benvenuto, M. A. (2017) Industrial Organic Chemistry,DE GRUYTER, Germany.
8. Benvenuto, M. A. (2015) Industrial Inorganic Chemistry, DE GRUYTER, Germany.

Web links and Video Lectures(e-Resources):

1. NPK Fertilizershttps://youtu.be/rKzt9BvvEeQ
2. Pesticide chemistry, Classification of Pesticides based on Origin & Source. Part-02 https://youtu.be/QN_B2P6bxzs
3. Pesticide Chemistry https://youtu.be/D6t_Ikfn4GI
4. Pharmaceutical chemistry https://youtu.be/L9Ms2hiGJyU
5. Liquid liquid extraction: https://youtu.be/1tmqUVSVPo4
6. Surface Coatings: https://youtu.be/Aoo4iMUPee8

Skill Development Activities Suggested

- Assignments
- Quizes
- Seminars

B.Sc. Honors (Physics/Chemistry/Mathematics)

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

SEMESTER - VI

Subject Name: FINANCE & BANKING			
Course Code	**21BSO662**	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:

CO1. To explain fundamental banking concepts.
CO2. To explain and use the banking system.
CO3. To develop and implement new ideas and innovations in banking service operations and procedures.
CO4. To improve organisational effectiveness.
CO5. To proper utilization of financial resources.

Pedagogy (General Instructions)

Teaching-Learning Process (General Instructions) These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not be only the traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video to explain various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.
5. Introduce Topics in manifold representations.
6. Show the different ways to analyze the research problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps Improve the students' understanding.

Module-1

Banking System in India

Meaning, Definitions, Features of a bank – Meaning, definition and features of banking – Features of Indian Banking System – Reserve Bank Of India – Role and Functions, Commercial Banks – Role and Functions.

Teaching- Learning Process: Chalk and talk method / PowerPoint Presentation.

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

Module-2

Banking Products

Bank Accounts – Saving Bank Accounts, Current Accounts, Recurring deposit accounts, fixed deposit accounts, NRI accounts, pigmy accounts, and other special accounts. – Procedures and docs involved in opening bank accounts (offline and online).

Teaching-Learning Process: Chalk and talk method / PowerPoint Presentation

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

Module-3

Recent Innovations in Banking

E-Banking, Telebanking, Internet banking, Mobile banking, NEFT, RTGS, EFT, UPI, IMPS, ATM, Debit card, credit card, MICR Cheques, Crypto Currency, Central bank digital currency.

Teaching-Learning Process: Chalk and talk method / PowerPoint Presentation

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

Module-4

Financial Management

Meaning of finance – Business finance, Importance of business finance - Financial requirements-working Capital requirements and fixed capital requirements

Teaching-Learning Process: Chalk and talk method / PowerPoint Presentation

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

Module-5:

Sources of finance

Methods of rising finance- Equity and preference shares, Debentures, and bonds, retained earnings, public deposits, loan from commercial banks, financial institutions, trade credits.

Teaching-Learning Process: Chalk and talk method / PowerPoint Presentation

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

Course outcome:

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

CO 1. Understand the fundamental function of banking
CO 2. Analyze the banking products and decision making.
CO 3. Comprehend emerging trends in banking.
CO 4. Understand the basic financial concepts
CO 5. Estimate the working capital & fixed capital requirements

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 hour**)

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

Books Recommended:

1. Dr. Guruprasad B G & Udaykumar C. (2022) **"Banking Innovations",** Sapna Book House
2. Verma J C (1997) **"Venture Capital Financing"** , SAGE Publications
3. H R Machiraju (2019) **"Indian Financial System",** Vikas Publishing House
4. B S Raman (Recent Edition) **"Business Studies"** , United Publishers

Web links and Video Lectures (e-Resources):

https://irjhis.com/paper/IRJHIS2111015.pdf
https://www.capitalone.com/bank/money-management/banking-basics/banking-products-and-services

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

- Quiz
- Group assignment
- Seminars

B.Sc. Honors (Physics/Chemistry/Mathematics)

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

SEMESTER - VI

Subject Name: Sociology			
Course Code	**21……**	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. To understand the nature of sociology
2. To know about culture and socialization
3. To know the Social change and its research in the society
4. To understand Indian society and its unity and diversity
5. To know about social movements and its impact on the society in general

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 for Mathematical Science Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, 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: Nature of sociology

Introdution, Meaning and definition of sociology, Basic Concepts of Sociology, Social Process - Meaning, definition and types. Culture and Socialization.

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

Pedagogy	Chalk and talk method/PowerPoint Presentation.

Module-2: Culture and Socialization

Culture : Meaning, definition and Characteristics. Types of Culture : Material and Non-material Culture. : culture lag. Socialization : Meaning and Definition. Stages of : Oral, anal, oedipal, adolescence and adulthood. Agencies of Socialization : (Family, peer groups, schools, mass media and state) The Role of culture in socialization.

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

Pedagogy	Chalk and talk method/PowerPoint Presentation.

Module-3: Social Change & Social Research

Social change : Meaning, definition and characteristics of social Change - Forms of Social change. Factors for social change. Social Research : Meaning, definition, Sources of Data. Society and Environment : Meaning, Definition and Types.	
(RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	Chalk and talk method/PowerPoint Presentation.
Module-4: Indian society	
Unity in diversity: Nature of diversity, regional, linguistics, cultural & ethnic, Nature of Unity in India. National integration: meaning and definitions, Challenges to national integration. Social inequality: meaning and definitions, Exclusion and inclusion concept.	
(RBT Levels: L1, L2 and L3)	**5 hours**
Pedagogy	Chalk and talk method/PowerPoint Presentation.
Module-5: Social movements and social changes in India	
Social movements in India: Meaning, definitions of social movements, components of social movements, types of social movements. Westernization and its effects, modernisation and its impact, Globalization, Concept of Global Outlook.	
(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 analyse and understand about:

- The nature of sociology and its area
- Indian culture and socialization in different perspectives
- Social change and its research in the society
- Indian society and its unity and diversity
- social movements and its impact on the society in general

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 hour**)

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

Books Recommended:

Text Books:

1. **Introduction to Sociology**, Prescribed textbook for first PUC, 2021-2022, Published by Department of Pre University education, Government of Karnataka
2. **Sociology of Indian society,** Prescribed textbook for Second PUC, 2021-2022, Published by Department of Pre University education, Government of Karnataka
3. Handbook on Sociology, VTU study material

Reference Books:

1. **NATURE AND SCOPE OF SOCIOLOGY** by **MSC. Asutosh** (Author), Publisher : Asutosh (10 March 2022).
2. **Essential Sociology** Second Edition by Nitin Sangwan (Author), Seema (Author), Shruti Jakhar (Author), Publisher : EduGali; Second Edition (1 January 2022).

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

- Quiz
- Group assignment
- Seminars

B.Sc. Honors (Physics/Chemistry/Mathematics)

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

SEMESTER - VI

Subject Name: INTELLECTUAL PROPERTY RIGHTS			
Course Code	**21IPR67**	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:

CO1. To understand the basic concepts of IPR.
CO2. To know the types of IPRs and drafting procedure.
CO3. To know the emerging Issues and Challenges.
CO4. To analyze the future aspects of Intellectual Property Rights

Pedagogy (General Instructions)

Teaching-Learning Process (General Instructions) These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not be only the traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video to explain various concepts on IPR.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.
5. Introduce Topics in manifold representations.
6. Show the different ways to analyze the research problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps Improve the students' understanding.

Module-1:

Introduction: Introduction to Intellectual Property Rights Concept and Theories Kinds of Intellectual Property Rights Economic analysis of Intellectual Property Rights Need for Private Rights versus Public Interests Advantages and Disadvantages of IPR.

Criticisms of Intellectual Property Rights, Politics of Intellectual Property Rights, Third World Criticisms and Marxist Criticisms.

Teaching- Learning Process: Chalk and talk method / PowerPoint Presentation.

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

Module-2:

Introduction to Patents: An Overview Historical development Concepts, Novelty, Utility Inventiveness/Non-obviousness. Patent Act 1970 – amendments of 1999, 2000, 2002 and 2005 Patentable subject matter, Patentability criteria, non-patentable inventions Pharmaceutical products and process and patent protection Software Patents Patenting of Micro-organism. Rights of patentee Procedure for granting a patent and obtaining patents Grounds for opposition Working of Patents, Compulsory License Acquisition, Surrender, Revocation, restoration Transfer of patent rights. Infringement and its effects and management.

Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent, Case study of Apple Inc. v. Samsung Electronics Co., Ltd.

Teaching-Learning Process Chalk and talk method / PowerPoint Presentation

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

Module-3:

Copyright and Neighbouring Rights Concept and Principles: Historical background and Development of Copyright Law Leading International Instruments, Berne Convention, Universal Copyright Convention, International Copyright under Copyright Act WIPO Phonograms and Performances treaty. Copyright Act, 1957 Terms of Copyright conditions for grant of copyright, extent of rights exception to copyright protection, fair use provision, assignment and licensing, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers. Copy rights registrations and infringements.

Teaching-Learning Process :Chalk and talk method / PowerPoint Presentation

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

Module-4:

Basic Principles of Design Rights - Justification for Protecting Designs - Historical Perspective - Features of Shape, configuration, Pattern or Ornament - or Composition of lines or colour - New or Original - Applied to an Article, Excluded Subject - Matter - Method or Principle of Construction - Features Dictated Solely by Function - Mechanical Device - Trademark, or Property Mark, or Artistic Work - immoral Designs and Designs Contrary to Public order–Rights of the Owner of Designs and Tests for Infringement. Assignment of Design Rights, Infringement of Designs.

Teaching-Learning Process :Chalk and talk method / PowerPoint Presentation

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

Module-5:

Historical development of the concept of trademarks, trade secrets, Geographical integrated products, machine designs, lay out and topographical designs, and other IPRs.

Emerging issues and challenges in IPR; Public health and Intellectual Property Rights Case study—Novartis Pharmaceuticals and Bayer Pharmaceuticals. TRIPS Flexibilities and access to medicine IPR and Climate change Patents and Biotechnology. Traditional knowledge and IPR Bio piracy Domain Name, Disputes and Cyber squatting

Teaching-Learning Process :Chalk and talk method / PowerPoint Presentation

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

Course outcome:

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

CO 1. To know the basic concepts of IPR.
CO 2. To know the fundamentals of Patent laws and drafting procedure.
CO 3. To know the fundamentals of Copy Rights.
CO 4. To understand basic principles of design rights
CO 5. To understand emerging issues and challenges in IPR.

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 hour**)

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

Books Recommended:

Fundamentals of Intellectual Property Rights by Ramakrishna B , Anil Kumar H.S **ISBN 13** 9781946556318, Notion Press: Edition 2016.

D.P. Mittal (Taxman Publication), Indian Patents Law and Procedure

•B.L. Wadera, Patents, trademarks, copyright, Designs and Geographical Judications.

• P. Narayanan (Eastern Law House), Intellectual Property Law

• N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow

References:

Laws relating to Intellectual Property Rights by V K Ahuja Publisher Code: 9788131251652, Lexis Nexis: Edition 2017

Web links and Video Lectures (e-Resources):

https://www.google.com/search?rlz=1C1ASVC_enIN953IN954&q=%22weblinks%22+for+Research+methodology+and+IPR&sa=X&ved=2ahUKEwirt8XRhZiAAxVQb2wGHW9SB6QQ5t4CegQIOhAB

https://www.dolphininstitute.in/workshops-seminars-conducted-on-research-methodology-ipr-and-entrepreneurship/

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

- Quiz
- Group assignment
- Seminars