IV Semester

Solid State Physics			
Course Code	21BSP42	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:2:0:0)	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	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 **08 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. Polymarphism and Allotropy Crystal structures of NaCl, and diamond, Pervoskites. Principle and working of Liquid Crystal display, Numericals.

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: Self-study Component: Principle and working of Liquid Crystal display

Module-2

Electrical Conductivity in Metals: **08 Hours**

Free-electron concept. Classical free-electron theory (Drude-Lorentz model) – Assumptions. .Effect of impurity and temperature on electrical resistivity of metals. Failures of classical free-electron theory. Quantum free-electron theory - Assumptions. Fermi - Dirac Statistics. Fermi-energy, Fermi factor & its temperature dependence, Expression for Fermi energy and Kinetic energy at absolute zero(derivation),

Density of states (No derivation). Expression for electrical conductivity (derivation). Temperature dependence of resistivity of metals. Merits of Quantum free electron theory, Numericals.

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

Module-3

Magnetic Properties of Matter **08 Hours**

Dia, Para, Ferri and Ferromagnetic Materials.Classical Langevin Theory of dia – and Paramagnetic Domains. 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: Hysteresis and Energy Loss.

Module-4

Dielectric Properties of Materials: **08 Hours**

Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons, Numericals.

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

Module-5

Liquid crystals **08 Hours**

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

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

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. Analyze the success and failure of free electron theory
3. Distinguish between different types of magnetic materials
4. Understand the mechanism of polarisation with different theories
5. Recognise various liquid crystalline phases required for display applications

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.

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. Elementary Solid State Physics, Md. Ali Omar, 1999, Pearson India
8. Solid-state Physics, H. Ibach and H Luth, 2009, Springer
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://nptel.ac.in/courses/115104109
- https://nptel.ac.in/courses/115106127
- https://archive.nptel.ac.in/courses/115/105/115105099
- https://onlinecourses.nptel.ac.in/noc21_ph21/preview
- https://www.youtube.com/watch?v=qIZUAe7ntjI

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

https://nptel.ac.in

https://swayam.gov.in

https://vlab.amrita.edu

SAMPLE TEMPLATE

IV Semester

Electricity & Magnetism			
Course Code	**21BSP42**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03 Hours

Course objectives:

- Comprehend the knowledge of electric and magnetic force and fields
- Understand the concept of electromagnetic induction through various laws

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

Vector Analysis & Electrostatics **08 Hours**

Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Basics of scalar and vector product

Module-2

Electric Field and Electric Potential **08 Hours**

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Electric field and Electric flux

Module-3

Dielectric Properties of Matter **08 Hours**

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics. Expression for mechanical stress on surface of charged conductor. Application to electrified soap bubble. Expression for electrostatic energy in a medium surrounding charged conductor. Derivation of Clausius – Mossotti equation and its limitations.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Polarisation concept

Module-4

Magnetism **08 Hours**

Magnetic force between current elements and (Magnetic effect of the current) definition of Magnetic Field B. Lorentz force, Force on a current carrying wire. Magnetic flux density. Magnetic field on a moving Charge. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its

Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to Solenoid and Toroid. Properties of B: curl and divergence. Vector Potential. Magnetic Force on point charge current carrying wire between current elements. Torque on a current loop in a uniform Magnetic Field.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** . Magnetic field, Magnetic flux & Magnetic flux density.

Module-5

Electromagnetic Induction **08 Hours**

Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current. Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series and parallel LCR Circuit: Resonance, Power Dissipation, Quality Factor, and Band Width. Measurement of high resistance. Discharge of condenser through inductance and resistance.

Pedagogy	Chalk and talk, Power point presentation, Videos **Practical Topics:** **Self study Component:** Faraday's Law and Lenz's Law

Course outcome (Course Skill Set)

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

1. Understand Gauss law and its applications.
2. Calculate Electric field and Electric potential due to charge.
3. Explain the concept of polarisation mechanisms and Clauisus-Mossotti equation.
4. Discuss magnetism phenomenon though Biot – Savrt law, Amperes law.
5. Understand Faraday's laws of electromagnetic induction and its importance.

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.

Suggested Learning Resources:

Text books:

1. Fundamentals of Electricity and Magnetism – Basudev Ghosh –Books & Allied New Central Book Agency, Calcutta, 2009.
2. Electricity and magnetism- D.N. Vasudev- S.Chand Publication,New Dehli.
3. Electricity and Magnetism- B.S.Agarwal- S.Chand Publication,New Dehli.
4. **Electricity and Magnetism**: *Arora V. P., Saxena M. C., Prakash S*, 18th Ed. (2007) Pragati Prakashan, Meerut
5. Electricity and magnetism- Brijlal &Subramanyam.
6. Electricity and magnetism and Atomic physics vol-I – John Yarwood.
7. Electricity and magnetism – A.N.Matveer-Mir publisher,Moscow 1986.
8. Introduction to electrodynamics- D.J.Griffith(3rd ed)Prentice Hall of India, New Dehli.
9. Electricity and Magnetism- D.Chattopadhya& Rakshit.
10. Electricity and magnetism- K.K.Tiwari
11. Electricity and Magnetism- Segal and Chopra
12. Text book of Electrical Technology, Vol. 1 – B.L. Theraja and A.K Theraja.

Reference books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ.Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole. TEXT

Web links and Video Lectures (e-Resources):

https://onlinecourses.nptel.ac.in/noc21_ph05/preview
https://nptel.ac.in/courses/115104088
https://www.youtube.com/watch?v=Xr1E46TFBfc
https://nptel.ac.in/courses/108106073

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

https://nptel.ac.in
https://swayam.gov.in
https://vlab.amrita.edu

For Syllabus

21BSS432-Soil and Water Chemistry

Please see page no. 34

B. Sc. (Honors) Mathematics

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

Numerical Analysis and Analytical Geometry			
Course Code	21BSS433	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	3 hours

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

- Learn the numerical solutions of algebraic and transcendental equations.
- Analyse the numerical solutions of system of linear equations and check the accuracy of the solutions.
- Learn about various interpolating and extrapolating methods.
- Familiarize the solution of differential equations using numerical methods.
- Understand the basic concept of analytical geometry.

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 of Solving Algebraic and Transcendental Equations	
Round-off error, Bisection method, False position method, Newton Raphson method and Secant method for solving equations. **(5 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	
Gauss elimination method, Lower and upper triangular (LU) decomposition of a matrix, Cholesky's method and Gauss-Seidel methods. **(5 Hours)** **Self-study:** Elementary row operation.	
(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.
Self-study: Lagrange Inverse interpolation. **(5 Hours)**

(RBT Levels: L1, L2 and L3)

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

Module-4: Solution of ODE by Numerical Methods and Numerical Integration

Numerical solutions of 1^{st} order 1^{st} degree Differential Equations: Modified Euler's method. Runge-Kutta method of 4^{th} order.
Numerical integration: Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.
Self-study: Trapezoidal rule. **(5 Hours)**

(RBT Levels: L1, L2 and L3)

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

Module-5: Analytical Solid Geometry

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

(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 the differential equations using numerical methods and Numerical integration.
- Learn basic 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.

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.
6. Shanti Narayan and Dr. P K Mittal Analytical Solid Geometry, S.Chand 17th Edition

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

Electricity & Magnetism Lab			
Course Code	21BSPL44	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:2:0	/SEE Marks	50
Credits	01	Exam Hours	3 Hours

Course objectives:

1. To learn the basics of electricity and magnetism through various experiments.
2.

List of Experiments:

Any Eight Experiments to be performed

Sl.NO	Experiments
1	Tangent Galvanometer
2	To find dielectric constant by charging and discharging the capacitor
3	LCR series & parallel combination
4	To determine the Charge Sensitivity and Current Sensitivity of a Ballistic Galvanometer
5	Maxwell's bridge to determine L.
6	Anderson's bridge to determine L.
7	Magnetic field along the axis / centre of a circular coil
8	To determine high Resistance by leakage method
9	To compare capacitances using DeSautys bridge.
10	Measurement of field strength B and its variation in a solenoid (determine dB/dx)
11	Deflection magnetometer
12	Magnetic Material Characterisation via Hysteresis

Course outcomes (Course Skill Set):

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

1. Acquire the knowledge of L , C, R using series and parallel combination.
2. Measure dielectric constant of a material
3. Understand Maxwell's and Andersonsbridge to determine inctance value.

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 (SEEtudents): 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. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I.Prakash and Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub
5. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.
6. Nelson and Jon Ogborn, Practical Physics

Suggested Learning Resources:

https://vlab.amrita.edu/index.php?sub=1&brch=192
https://vlab.amrita.edu/index.php?sub=1&brch=195
https://virtuallabs.merlot.org/vl_physics.html
https://www.myphysicslab.com
https://nptel.ac.in/courses/115105110
https://nptel.ac.in/courses/115105121

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

IV Semester

Bio Physics			
Course Code	21BSP47	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:1	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	03 Hours

Course objectives:
Course Objectives:

1. To understand the essentials of cells and Biomolecular structures.
2. To understand the importance of sun light to sustain the life.
3. To recognize the role of Biophysics in human life cycle.

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 physics in engineering studies and offer real life examples.**
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. **8. Inspire the students towards the studies by giving new ideas and examples.**

Module-1 .

Biomolecular Structures: **08 hours**

Brief Introduction about cell, Characteristics of cell, Structural organization of proteins, Dynamics of protein folding, Protein Engineering,

Nucleic Acids; DNA, RNA, Principle of base pairing/base stacking, Watson-Crick model for DNA, Replication of DNA and RNA.

Lipids and Membranes; Structure of Simple Lipids, Compound Lipids and Steroids. Membranes and membrane structures.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self-study Component:** The size of the cell, basic unit of cell and characteristics of Cell.

Module-2

Thermodynamics and Bioenergetics; **08 hours**

Laws of thermodynamics, Differential Scanning Calorimetry, Free energy, Irreversible Thermodynamics, Chemical potential, The Isolated state, Fick's law of diffusion, Open System, and Biological Oscillations. Photo -Bioenergetics, The Chloroplast, Photo synthesis, Photosynthetic reactions, Photo system1, and 2, Chemo Bioenergetics, Mitochondrial Structure, Electron transport process, Electron transport Chain (Respiratory Chain) Complex1,2,3,4-Oxidative Phosphorylation- Mechanism of Oxidative Phosphorylation.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Laws of Thermodynamics. Differential Scanning Calorimetry.**

Module-3

Biomechanics: **08 hours**

Introduction, Striated Muscles, Contractile proteins, Mechanical properties of muscles, contraction mechanism, role of Ca^{2+} ions, Biomechanics of the cardiovascular system, Blood pressure, Electrical activity during the heartbeat, Electrocardiography.

PedagogyDirectly	Chalk and talk, Power point presentation, Videos **Self study Component: Introduction and Striated muscles**

Module-4

Radiation Biophysics: **08 hours**

Types of radiations. Interaction between radiation and matter, Directly ionizing radiation, dose and Dose rate, dosimetry. Description and interpretation of radiation action, Dose effects graphs and target theory, direct and indirect radiation action, radioactive isotopes, biological effects of radiation, radiation protection and therapy.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Types of radiations.**

Module-5

Neurobiophysics: **08 hours**

Introduction, The Nervous System, Physics of membrane Potentials

. Membrane potential due to diffusion, Voltage Clamp, Sensory mechanisms- The visual receptor, Electrical activity and visual generator potentials, Optical defects of eye, Neural aspects of vision, visual communications, bioluminescence, Physical aspect of hearing, The ear, Elementary acoustics, theories of hearing, Signal transduction in the Cell.

Pedagogy	Chalk and talk, Power point presentation, Videos **Practical Topics:** **Self-study Component:** Nervous system, and Physics of membranes

Course Outcomes

After the completion of the course student should be able to :

1. Elucidate the Bio molecular structures.
2. Describe the Photo Bioenergetics.
3. Apprehend on properties of muscles and Cardiovascular systems.
4. Analyse various biological effects of radiations.
5. Describe the Nervous system, Neural aspects of vision and Physical aspect of hearing.

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:

Reference books:

1. Bio Physics, W, Hoppe, W. Lohmann, Markl, Springer, Verling, Berlin.
2. Essentials of Bio Physics P. Narayanan New Age International (P) Ltd New Delhi (2000)
3. Bio Physics V.Pattabhin and N. Gautham, Narosa Publishing House ,New Delhi..
4. Bio physical Chemistry, Upadhyay and Upadhyanath, Himalaya Publishing House (2008)

Web links and Video Lectures (e-Resources):

1. https://youtu.be/SSNC2nFxnuA.
2. https://youtu.be/0GNNW553IVY.
3. https://youtu.be/NX0VQ8Uj4PY
4. https://youtu.be/L_az3Zvb_tc

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

http://nptel.ac.in

https://swayam.gov.in

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

ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕವಿಶ್ವವಿದ್ಯಾಲಯ

ವಿಟಿಯುಅಧಿನಿಯಮ೧೯೯೪ ರಅಡಿಯಲ್ಲಿಕರ್ನಾಟಕಸರ್ಕಾರದಿಂದಸ್ಥಾಪಿತವಾದರಾಜ್ಯವಿಶ್ವವಿದ್ಯಾಲಯ

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

State University of Government of Karnataka Established as per the VTU Act, 1994 "JnanaSangama" Belagavi-590018, Karnataka, India

Prof. B. E. Rangaswamy, Ph.D
REGISTRAR

Phone: (0831) 2498100
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REF: VTU/BGM/Aca/BoS/2023/ 464

DATE: 18 APR 2023

CIRCULAR

Subject: 21BSS432 Soil and Water Chemistry regarding...
Reference: Chairperson BoS in Basic Science and Humanities approval dated: 18.04.2023

In IV semester syllabus of B.Sc(Hons) program the course "**21BSS432- Soil and Water Chemistry**" is missing, the chairperson Board of Studies have submitted the syllabus for the same subject.

All the Principals of the colleges where B.Sc(Hons) program being offered are hereby informed to bring the content of this circular to the notice of all concerned.

Encl: Syllabus of 21BSS432 Soil and Water Chemistry

Sd/-
REGISTRAR

To,

The Principals of Engineering Colleges where B.Sc(Hons) degree program being offered.

Copt to,

1. The Hon'ble Vice-Chancellor through secretary to VC for kind information
2. The Registrar(Evaluation) Examination Section VTU, Belagavi
3. The Director(I/c), ITI SMU, VTU Belagavi for information and make arrangement to upload the syllabus along with circular on VTU web portal.
4. The Special Officer, QPDS Examination section VTU Belagavi
5. Office Copy

18/04/23

REGISTRAR

SOIL AND WATER CHEMISTRY			
Course Code	21BSS432	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	2	Exam Hours	3

Course Learning objectives:

- The course will cover the basic principles of soil and water chemistry.
- The class will cover the fundamentals principles of the properties of soil components and soil reactions that affect environmental quality.
- It provides as elective understanding on the water quality parameters.
- This course provides information on the chemical analysis of soil and water.

Pedagogy (General Instructions)

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

- Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to convince abstract concepts.
- Encourage collaborative (Group Learning) Learning in the class
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
- 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.
- Topics will be introduced in a multiple representation.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Soil Chemistry

Introduction to soil chemistry: Definition, soil formation, weathering, Soil Solution, soil colloids, inorganic and organic colloids, Phyllosilicates, Isomorphous Substitution, Phyllosilicate Minerals: Kaolinite, Montmorillonite and beidellite, Vermicullite, illite, Chlorite. Non-Phyllosilicates-Amorphous aluminosilicates, Oxy-hydroxide Minerals, Organic Colloids (Humus), Specific Surface of Soil Minerals, Surface Charge of Soil Minerals

Teaching-LearningProcess	Chalk and talk method / Power Point Presentation

Module-2

Sorption Phenomena on Soils: Introduction and Terminology, Surface Functional Groups, Surface Complexes Adsorption Isotherms, Equilibrium-based Adsorption Models-Freundlich Equation, Langmuir Equation

Ion Exchange Processes – Introduction, Characteristics of Ion Exchange, Cation exchange capacity (CEC).

Redox Chemistry of Soils - Oxidation–Reduction Reactions and Potentials, Eh vs pH and pevs pH Diagrams, Measurement and Use of Redox Potentials

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

Module-3

The Chemistry of Soil Acidity : Definition of Soil Acidity, Forms of soil acidity, Solution Chemistry of Aluminum, Monomeric Al Species, Polymeric Al Species, Exchangeable and Nonexchangeable Aluminum. **The Chemistry of Saline and Sodic Soils:**Causes of Soil Salinity, Sources of Soluble Salts, important Salinity and Sodicity Parameters-Total dissolved Solids (TDS), Electrical Conductivity, Parameters for Measuring the Sodic Hazard, Classification and Reclamation of Saline and Sodic Soils	
Teaching-LearningProcess	Chalk and talk method / Power Point Presentation
Module-4	
Introduction to water chemistry: Introduction, Water Sources, water quality parameters: Hardness, alkalinity, TDS, pH, Chlorides, Sulfates, nitrites, nitrates, fluorides, Basic Drinking Water Treatment: Primary Settling, Aeration, Coagulation, Disinfection, Disinfection Procedures, Disinfection By-Products and Disinfection Residuals, Strategies for Controlling Disinfection By-Products, Chlorine Disinfection Treatment, Drawbacks to Use of Chlorine: Disinfection By-Products Trihalomethanes, Chlorinated Phenols, Chloramines, Chlorine Dioxide Disinfection Treatment, Ozone Disinfection Treatment, Ozone DBPs, Ultraviolet Disinfection Treatment, Membrane Filtration Water Treatment-Micro, ultra, nano filtrations, Reverse osmosis.	
Module-5	
Chemical analysis Soil and water: Water and soil sampling procedures, Measurement of soil pH (colorimetric and redox indicators), Determination of cation exchange capacity of soils, Determination of nitrogen (Total Kjeldhal Nitrogen) in water and soil, Determination of Hardness of water by complexometric method and Determination of alkalinity of water, Determination of dissolved oxygen by Winkler's method, Determination of Na and K by flame photometry	
Teaching-LearningProcess	Chalk and talk method / Power Point Presentation
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 15thweek of the semester **Two assignments each of 10 Marks** 4.First assignment at the end of 4thweek of the semester 5. Second assignment at the end of 9thweek 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 fullquestions, selecting one full question from each module.

Suggested Learning Resources:

Books:

1. Soil and Water Chemistry; An Integrative Approach: Michael E. Essington, CRC Press, Washington D.C., 2005
2. Hand Book of Water, Air and Soil Analysis (A Lab Manual) : SadhanaChaurasia&AnandDev Gupta, International E – Publication, India, 2014
3. Environmental Soil Chemistry: Donald L. Sparks, Second Edition, Academic Press, Amsterdam, 2003.
4. Applications of Environmental Aquatic Chemistry- A Practical Guide: Eugene R. Weiner, Second Edition, CRC Press, New York, 2008
5. Introduction to Soil Chemistry Analysis and Instrumentation: Alfred R. Conklin, Jr, Second Edition, Wiley, New Jersey, 2014
6. Soil Chemical Analysis: M. L. Jackson, Prentice Hall Inc, USA, 1958

WeblinksandVideoLectures(e-Resources):

1. Soil Chemistry Part 1 https://youtu.be/bhNWSpm4ygw
2. Soil Sampling for Chemical Analysis https://youtu.be/LuSNfuE4Xmc
3. Soil Mineralogy and Chemistry https://youtu.be/JmrhN3Ygsm0
4. Soil Organic Matter: https://youtu.be/5qR5d1uQnd8
5. Chemical Properties of Soil: https://youtu.be/CijD5qmeD_Y
6. Determination of Potassium : https://youtu.be/r-ThlPu96q4
7. Soil Mineralogy: https://youtu.be/Qh6wSfVN45s
8. Cation Exchange Capacity: https://youtu.be/8fJojcqF978
9. CEC Analysis: https://youtu.be/CyF_IyWT66U

Skill Development Activities Suggested

- Assignments
- Quizes
- Seminars

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

Sl. No.	Description	Blooms Level
CO1	Explain the classification of minerals present in the soil	Understand
CO2	Illustrate the chemical processes like Sorption, Ion-Exchange, oxidation and reduction involved in soil and water environment	Apply
CO3	Identify the water quality parameters and apply treatment procedures	Apply
CO4	Analyze the chemicals present in soil and water	Apply