B. Sc Honors (Common to all specializations)

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

SEMESTER - III

PARTIAL DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS			
Course Code	**21BS31**	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: The goal of the course Partial differential equations and vector calculus **21BS31** is

- To demonstrate understanding of the theory of partial differential equations and the techniques required to solve them.
- To gain a clear intuitive understanding of the concept of partial differential equation and its relevance to describing physical phenomena such as heat conduction, diffusion and wave propagation.
- To gain practical knowledge of the numerical techniques for solving partial differential equations using the finite differences.
- Compute directional derivatives and gradients of scalar functions, divergence and curl of vector point functions and explain their geometrical meaning.
- Recognize and apply Fundamental theorem of line integrals, Green's theorem, Divergence Theorem, and Stokes' theorem

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 home work, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises(post-lecture activity).

Module-1: Partial Differential Equations

Order and degree of partial differential equations(PDE). Formation of partial differential equations by eliminating the arbitrary constants and by eliminating arbitrary functions. Solution of linear and non-linear partial differential equations of the first order: Lagrange's solution, Charpit's general method. **(8 hours)**

Self-study: Solution of first order P.D.E by Separation of variables method.

(RBT Levels: L1, L2 and L3)

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

Module-2: Solution of second and higher order Partial Differential Equations

Classification of the general linear partial differential equations of second order, Homogeneous and non-homogeneous linear equations with constant coefficients and its solution. Monge's method to solve non-linear equations of the second order. Application of partial differential equations: One dimensional Heat equation and Wave equation. Solution by variable separable method. **(8 hours)**
Self-study: Solution of higher order partial differential equations by direct integration methods.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3: Numerical Solutions of Partial Differential Equations

Finite difference approximations to partial derivatives. Solution of Laplace's equation using standard five –point formula. Solution of heat equation by Schmidt explicit formula and Crank- Nicholson method, Solution of Wave equation. Problems. **(8 hours)**
Self-Study: Solution of Poisson equation's using standard five–point formula.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4: Vector differentiation

Vector differentiation, Velocity and acceleration of a moving particle. Scalar field: gradient of a scalar field and its geometrical interpretation, Directional Derivative-Maximum directional derivative, angle between two surfaces. Vector field: Divergence and curl of a vector point function and their physical interpretations. Solenoidal and irrotational vectors. Problems. **(8 hours)**
Self-Study: Vector identities and standard properties, Orthogonal curvilinear co-ordinates.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5: Vector integration

Line integral: Work done during small displacement. Surface integrals: Flux across a surface. Volume integrals: Green's Theorem, Stoke's theorem and Gauss divergence theorem. Problems. **(8 hours)**
Self-Study: Conservative field.

(RBT Levels: L1, L2 and L3)

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

- To form partial differential equations by eliminating arbitrary constants/arbitrary functions from the given relation and to solve linear and non-linear first order partial differential equations.
- To model physical phenomena using partial differential equations and solve homogeneous and non-homogeneous second order partial differential equations.
- To solve mathematical models represented by initial or boundary value problems involving partial differential equations
- To determine gradient, divergence and curl of a function.
- To evaluate the given integrals by using the relations between line integral and surface integrals, surface and volume integrals.

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. I. N. Snedon, Elements of *Partial Differential Equations*, Dover Publications, Mineola, New York, 2006
2. Narayanan and Manicavachagom Pillay, *Differential equations*, Vishwanathan (Printers and Publisher) Pvt.Lts 1991.
3. K. Shankara Rao, *Introduction to Partial differential equations*, 3rd edition, PHI,2010
4. B.S. Grewal, *Numerical methods in Engineering and Science*, Khanna Publishers Tenth Edition
5. Shanthi Narayana and P.K Mithal, *A text book of Vector calculus*, S Chand and company PVT .ltd,
6. Murray R Spigel and Seymour Lipschnutz, *Vector Analysis*, Latest Ed, Schaum McGrew Hill Publishers.
7. Paul C. Mathews, *Vector Calculus*, Springer – Verlag, Publishers
8. George B. Thomas Jr, Joel Hass, Chistopher Heil and Maurice D, Weir (2018), *Thomas Calculus* (14 th edition) Pearson education.
9. MD Raisinghania, Ordinary and Partial differential equations, S. Chand and Co. Pvt. Ltd, 2014
10. Erwin Kreyszig (2011) Advanced Engineering mathematics (10th edition) Wiley)
11. TynMyint-u & Lokenath Debnath (2013),Linear Partial Differential Equations for Scientists and Engneers
12. (4th edition) , Springer India
13. S.B Rao & H.R. Anuradha (1996), Differential Equations with Applications, University Press.

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

III Semester

Concepts of Modern Physics			
Course Code	21BS32	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2L+2T+0P)	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

Course Objective

1. To study the basic concepts of modern physics and their applications in physics.
2. Will be able to apply the Schrodinger equation in quantum mechanics.
3. Demonstrate the basic understanding of quantum mechanics and relativity required to pursue more advanced topics of Physics.

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

Introduction to Modern Physics **08 Hours**,

Blackbody radiation spectrum:- Wien's law, Rayleigh-Jean's law,Stefan –Boltzman's law, Plank's radiation law; assumptions and derivation of planks radiation law, Deduction of Wien's law and Rayleigh- Jeans law from Planck's law. Compton effect (derivation).

Wave particle Dualism. de Broglie hypothesis– de Broglie wavelength, extension to electron particle accelerated, Matter waves and their Characteristic properties. Phase velocity, group velocity and Particle velocity. Relation between phase velocity and group velocity (Qualitative) . Relation between group velocity and particle velocity (Qualitative). Relation between group velocity, phase velocity and velocity of light (Qualitative) Expression for de Broglie wavelength using group velocity (derivation), Numericals.

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: 1. To verify Stefan's law 2. To find the value of Stefan's constant 3. Determination of Planck's constant using Photodiode/ LED Self-study Component: Failure of classical Physics

Module-2

Wave Mechanics **08 Hours**

Heisenberg's uncertainty principle and its physical significance, canonical conjugate variables, Application of uncertainty principle: Non-existence of electron inside the nucleus (relativistic case derivation) and Radius of Bohr's first orbit.

Wave function: Properties and Physical significance of a wave function. Probability density and Normalisation of wave function, operators, Setting up of a one dimensional time dependent Schrödinger wave equation for free particle, Eigen values and Eigen functions. Setting up of time independent Schrodinger's equation from time dependent equation and mention the equation for three dimension. Eigen values and Eigen functions. Particle in one dimensional potential well of infinite height, Eigen values and Eigen functions, Free particle (qualitative),Numericals.

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

Module-3

Lasers and Optical fibers: **08 Hours**

Laser

Introduction, interaction between radiation and matter, Einstein's coefficients for two level system, conditions and Requisites for laser action, Types of lasers, Principle , construction and working of NdYAG laser,CO_2 laser and semiconductor laser. Industrial applications of laser (welding and drilling). LIDAR, Laser as a range finder.

Optical fiber

Basic of optical fibers, Total internal reflection, angle of acceptance, fractional index change, Numerical aperture, types of optical fibers based on refractive index profile and mode concept, Attenuation,. Applications, Numericals.

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: 1. To find the wavelength of laser using diffraction grating 2. Study of divergence of laser beam 3. Determination of particle size of lycopodium powder using semiconductor laser. 4. Determination of angle of divergence of a laser beam using He-Ne laser 5. Determination of Acceptance angle and Numerical Aperture using fiber optic cable 6. To study bending losses occur in optical fibre Self study: Laser properties

Module-4

Superconductivity **08 Hours**

Temperature dependence of resistivity in metals and superconducting materials. Effect of magnetic field (Meissner effect). Type-I and Type-II superconductors–Temperature dependence of critical field. BCS theory (qualitative). High temperature superconductors. AC & DC Josephson Effects, super current interference, London Penetration depth (qualitative), Applications of superconductors –. Maglev vehicles. SQUIDs, super conducting magnets. Numericals.

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

Module-5

Theory of Relativity **08 Hours**

Frames of reference systems, frames of reference, Galilean transformations equation, Michelson -Morley experiment, Search for ether, Lorentz transformation equation (derivation),Length contraction (derivation),Time dilation , Velocity addition theorem, Variation of mass with velocity (derivation), mass energy equivalence(derivation), Applications, Numericals.

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

Course outcome (Course Skill Set)

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

1. Understand the laws of blackbody radiation and deBroglie hypothesis.
2. Apply Schrodinger's wave equation to solve particle in box of infinite height.
3. Explain the working principle, structure and applications of laser and optical fibers.
4. Explain superconductivity on the basis of BCS theory and its applications.
5. Understand the basic principles of the special theory of relativity.

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. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw – Hill
2. Solid State Physics, S.O Pillai, New Age International Publishers (7 th Edition)
3. Modern Physics, R. Murugeshan & Er K.Sivaprasath, S.Chand & company , 17 th Edition, 2015.
4. Concepts of Modern Physics, *Beiser A., Mahajan S. and Choudhury S. R*., Tata McGraw Hill Education, New Delhi (2011)
5. Quantum Physics: S. Gasiorowicz.
6. Quantum Mechanics: B. H. Bransden and C. J. Joachain.
7. Quantum Mechanics: V. Devanathan.
8. Quantum Mechanics: C. S. Chaddha.

Reference Books:

1. Modern Physics, *Blatt F. J*. McGraw Hill International (1992)
2. Quantum Mechanics, Gupta, Kumar, Sharma Jai Prakash Nath Pub. 31st Ed. 2012.
3. Essentials of Quantum Mechanics, B.N.Srivastava, Pragathi Prakasan, 2014

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/122101002
- https://nptel.ac.in/courses/115104096
- https://nptel.ac.in/courses/115102023
- https://www.youtube.com/watch?v=TcmGYe39XG0
- https://www.youtube.com/watch?v=AiQ8JhNuVrk
- https://www.youtube.com/watch?v=toGH5BdgRZ4
- https://nptel.ac.in/courses/115101011
- https://ocw.mit.edu/courses/8-04-quantum-physics-i-spring-2016/

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

https://nptel.ac.in

https://swayam.gov.in

https://vlab.amrita.edu

SAMPLE TEMPLATE

III Semester

THERMODYNAMICS & THERMOCHEMISTRY			
Course Code	21BS33	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

CLO 1	Understand and apply Laws of thermodynamics and concepts.
CLO 2	Explain Partial molar quantities and its attributes, dilute solution and its properties.
CLO 3	Understanding the concept of entropy; reversible, irreversible processes. Calculation of entropy using 3nd law of thermodynamics and the application of thermodynamics: Joule Thompson effects, partial molar quantities
CLO 4	Evaluate thermochemical equations for calculation of energy and related terms.
CLO 5	Use of thermodynamics in explaining chemical behavior of solute/solvent and reactions study of calorimeter principle and its use.

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 Introduction to thermodynamics

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. First law: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

Pedagogy	**Chalk and talk/power point presentation:** Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. **Videos/Learning material:** Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities. **Self-study:** Use of thermodynamics in explaining chemical behavior of solute/solvent and reactions.

Module-2 Heats of reactions

Standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations), pressure on enthalpy of reactions. Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.	
Pedagogy	**Chalk and talk/power point presentation**: Standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications. **Videos/Learning material**: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy.
Module-3 Third law of thermodynamics & Free Energy Functions	
Third Law of thermodynamics, residual entropy, calculation of absolute entropy of molecules. Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.	
Pedagogy	**Chalk and talk/power point presentation**: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. **Videos/Learning material**: Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature;
Module-4	
Partial molar quantities: Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.	
Pedagogy	**Chalk and talk/power point presentation**: Partial molar quantities: Partial molar quantities, dependence of thermodynamic parameters on composition; **Videos/Learning material**: Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.
Module-5 Dilute solutions	
Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties: [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.	
Pedagogy	**Chalk and talk/power point presentation**: lowering of vapour pressure, Raoult's and Henry's Laws and their applications. **Videos/Learning material**: Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

Course outcome (Course Skill Set)

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

CO 1	Discuss Laws of thermodynamics and concepts.
CO 2	Explain the concept of system, variables, heat, work, and laws of thermodynamics.
CO 3	Interpret the knowledge of concept of entropy; reversible, irreversible processes. Calculation of entropy using 3rd law of thermodynamics.
CO 4	Enumerate the importance of application of thermodynamics: Joule Thompson effects, partial molar quantities.
CO 5	Illustrate the fundamental principles and theories/thermodynamics of dilute solutions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of the maximum marks (400 marks out of 100). A student shall be deemed to have satisfied the academic requirements if the student secures not less than 40% (40 Marks out of 100)in the CIE.

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

Course Seminar suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. Conducting at least 05 labs sessions within the Academic Duration.

The sum of three tests, two assignments, and a seminar/Lab sessions will be out of 100 marks

Suggested Learning Resources:

Books

Atkins P. and De Paula, J. Physical Chemistry Tenth Ed., OUP, 2014.

2 Castellan, G. W. Physical Chemistry 4th Ed., Narosa, 2004.

3 Engel, T. and Reid, P. Physical Chemistry 3rd Ed., Prentice Hall, 2012.

4 McQuarrie, D. A. and Simon, J. D. Molecular Thermodynamics Viva Books, 2004.

5 Roy, B. N. Fundamentals of Classical and Statistical Thermodynamics Wiley, 2001

6 Commonly Asked Questions in Thermodynamics. CRC Press, 2011.

7 Levine, I .N. Physical Chemistry 6th Ed., Tata Mc Graw Hill, 2010.

8 Metz, C.R. 2000 solved problems in chemistry, Schaum Series, 2006.8. Peter Atkins, Peter William Atkins, Julio de Paul: Atkins' Physical Chemistry, OUP Oxford.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=pMmHdWvN_FI&list=PLyqSpQzTE6M_QOKxVxZ5nQ48gOkzg7zWP&index=1

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

- https://www.vlab.co.in/broad-area-chemical-sciences
- https://demonstrations.wolfram.com/topics.php
- https://interestingengineering.com/science

B. Sc. Honors (Mathematics)

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

SEMESTER - III

Mathematics Laboratory Using C++			
Course Code	21BSL34	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	02	Exam Hours	3 Hours

Course description: This course aims at providing hands-on experience in using C++ to solve the Partial differential equations and Vector Calculus

Course Learning objectives: This course will help the learner to

- To solve the Partial differential equations of first and second order.
- To familiarize students in using C++ for finding the tangent vector and the gradient vector field.
- Evaluation of Line integral.
- Applications of Line and double integrals.

List of Experiments:

Any Ten Experiments to be performed

Sl.NO	**Experiments**
1	Fundamentals of C++ program. Logic flow, Structure of C++ program, Common compilers and IDE's and Basic data types, Variables and literals in C++
2	Operators, Expressions, Evaluation precedence and type compatibility, outline of program development in C++, Debugging and testing, Applications.
3	Solutions to the problems on different types of partial differential equations
4	Solving second-order linear partial differential equations in two variables with constant coefficient.
5	Solving one-dimensional heat & wave equation.
6	Solution of Laplace's equation using standard five-point formula.
7	Solution of heat equation by Schmidt explicit formula and Crank- Nicholson method.
8	To demonstrate the physical interpretation of gradient, divergence, curl, and Laplacian.
9	Evaluation of the line integral with constant limits & Variable limits.
10	Evaluation of the double & triple integral with constant limits.
11	Evaluation of the double & triple integral with variable limits.
12	Green's theorem and Gauss divergence theorem
13	Stokes theorem.

Course outcomes (Course Skill Set):

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

1. Solve the Partial differential equations of first and second order.
2. Find the tangent vector and the gradient vector field
3. Evaluation of Line integral.
4. Applications of Line and double integrals.

Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE): The CIE marks awarded in the 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 are to be conducted as per the timetable of the University in a batch wise with the 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 the answer script to be strictly adhered to by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Books:

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

Suggested Learning Resources:

http://vlabs.iitb.ac.in

http://math.fulletron.edu/mathews/numerical.html

http://www.my-mooc.com/en/categorie/mathematics

http://ocw.mit.edu/courses/mathematics/

I/II Semester

Modern Physics Lab			
Course Code	21BSL35	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	/SEE Marks	50
Credits	01	Exam Hours	3 Hours

Course objectives:

1. To gain in-depth knowledge by correlating theory with the experiments.
2. To impart the knowledge through various experiments related to Lasers and optical fibers.
3. Work effectively as part of a group or team of students with diverse cultural, intellectual, and educational backgrounds

List of Experiments:

Any Eight Experiments to be performed

Sl.NO	Experiments
1	To verify Stefan's law
2	To find the value of Stefan's constant
3	Determination of Planck's constant using Photodiode/ LED
4	To find the wavelength of laser using diffraction grating
5	Study of divergence of laser beam
6	Determination of particle size of lycopodium powder using semiconductor laser.
7	Determination of angle of divergence of a laser beam using laser
8	Determination of Acceptance angle and Numerical Aperture using fiber optic cable
9	To study bending losses in optical fibres
10	Determination of Plank's constant by using Einstein's equation.
11	Verification of Einstein's photo electric equation.
12	Determination of Avogadro number using electrolysis technique

Course outcomes (Course Skill Set):

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

1. Gain the knowledge of various laws of blackbody radiation.
2. Utilise the Laser source to calculate the wavelength, spot size and angle of divergence
3. Acquire the knowledge of optical fiber to measure the Numerical aperture and loss mechanism

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. 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:

http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/vlabs_recbanda/labs/exp1/bootSimulation/boot_simulator.html
https://vlab.amrita.edu/?sub=1&brch=189&sim=343&cnt=2
https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=342&cnt=1
https://vlab.amrita.edu/index.php?sub=1&brch=195&sim=547&cnt=1
https://virtuallabs.merlot.org/vl_physics.html
https://www.myphysicslab.com

Sample Template

Physical Chemistry Laboratory			
Course Code	**21BCHEL36**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:2	SEE Marks	50
Credits	02	Exam Hours	100

Course objectives:

CLO1 Develop the skill of determining distribution coefficient.

CLO2 Acquire experimental skills in finding the rate of the reaction

Sl.NO	Experiments
1	Determination of percentage composition of sodium chloride solution by determining the miscibility temperature of phenol - water system.
2	Study the equilibrium of reaction $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$ by the distribution method.
3	Study the equilibrium of reaction I_2 (aq) + I^- $\rightarrow$ I^-_3 (aq) by the distribution method.
4	Study the kinetics of the Acid hydrolysis of methyl acetate with hydrochloric acid
5	Study the kinetics of saponification of ethyl acetate.
6	Verification of Freundlich and Langmuir isotherms for adsorption of acetic acid and selected organic dye(s) on activated charcoal
7	Determination of transition temperature of a salt hydrate by thermometric method.
8	Determination of distribution coefficient of acetic acid between water and butanol.
9	Determination of degree of dissociation of an electrolyte by ebullioscopic method.
10	Determination of distribution coefficient of benzoic acid between water and toluene

Course outcomes (Course Skill Set):

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

CO1 Determine percentage composition of salt.

CO2 Determine the equilibrium constant of reaction.

CO3 Estimate the kinetics of saponification.

CO4 Verify the adsorption isotherms.

CO5 Demonstrate of kinetic study and determination of rate constant.

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 timetable 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.

Suggested Learning Resources:

Text Books:

1.Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand, New Delhi, 2011.

2.Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry, Eighth Edition, McGraw-Hill(2003).

3 Halpern, A. M. and McBane, G. C. Experimental Physical Chemistry, Third Edition, W, H. Freeman (2003).

Reference books:

1. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).

SAMPLE TEMPLATE

Semester

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING			
Course Code	**21BSO371**	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 Learning Objectives: This course will develop a student;

1.Explain Artificial Intelligence and Machine Learning

2.Illustrate Artificial intelligence and Machine Learning algorithm and their use in appropriate applications

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

Artificial Intelligence: **05 hours**

What is artificial intelligence, Problems, problem spaces and search,

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Introduction to Artificial intelligence.

Module-2

Knowledge representation : **05 hours**

Knowledge representation issues, Predicate logic. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component:** Knowledge representation issues

Module-3

Decision Tree Learning: **05 hours**

Introduction, Decision tree representation, Appropriate problems, ID3 algorithm.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Introduction, Decision tree representation.**

Module-4

Bayesian Learning: **05 hours**

Introduction, Bayes theorem, Bayes theorem and concept learning, Navie Bayes classifier, EM Algorithm

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Introduction to Baysian Learning.**

Module-5

Instance-Base Learning: **05 hours**

Introduction, k-Nearest Neighbour Learning, locally weighted regression, Radial basis function, Case-Based

Pedagogy	Chalk and talk, Power point presentation, Videos **Practical Topics:** **Self study Component:** Introduction to Instance-Base learning

Course outcome (Course Skill Set)

- **Course outcomes:** The student will be able to :
  1. Appraise the theory of Artificial intelligence and Machine Learning.
  2. Illustrate the working of AI and ML Algorithms.
  3. Demonstrate the applications of AI and ML.

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. Tom M Mitchell,"Machine Lerning",1 st Edition, McGraw Hill Education, 2017. 2.
2. Elaine Rich, Kevin K and S B Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill Education, 2017.

Reference books:

1. Saroj Kaushik, Artificial Intelligence, Cengage learning

2. Stuart Rusell, Peter Norving , Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition
3. AurÈlienGÈron,"Hands-On Machine Learning with Scikit-Learn and Tensor Flow:
. Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
5. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press
6. Srinvivasa K G and Shreedhar, " Artificial Intelligence and Machine Learning", Cengage

Web links and Video Lectures (e-Resources):

1. **https://youtu.be/JyoO3kSKqGY**
2. **https://youtu.be/XCPZBD9lbVo**
3. **https://youtu.be/T3PsRW6wZSY**
4. **https://youtu.be/pKeVMlkFpRc**

SAMPLE TEMPLATE

Semester

RENEWABLE ENERGY SOURCES			
Course Code	21BSO372	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 Learning Objectives: This course will develop a student;

1. To introduce the concepts and applications of Solar energy, wind energy, Biomass energy and Geo thermal energy as alternative energy sources.
2. To explore society's present needs and future demands.
3. 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. 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

Renewable Energy Sources: **05 hours**

Energy sources, India's productions and reserves of commercial energy sources, need for non-conventional energy sources, energy alternatives, solar, thermal, photovoltaic, water power, wind biomass, ocean temperature difference, tidal and waves, Geothermal, Tar sands, and oil shale, Nuclear, advantages, and disadvantages, Comparison,

Pedagogy	Chalk and talk, Power point presentation, Videos Self study Component: Energy sources, India's productions and reserves of commercial energy sources

Module-2

Solar Energy: **05 hours**

Introduction, The Sun as Source of Energy, The Earth, Sun. Earth radiation spectrum, Extra -terrestrial and Terrestrial radiations, Solar Constant, Solar Radiation at the earth's Surface, Spectral power Distribution of solar radiation, Depletion of Solar radiation. application of Solar energy , Solar water heaters Solar Passive space heating and cooling Systems, Solar industrial heating systems, Solar refrigeration and air conditioning systems

Pedagogy	Chalk and talk, Power point presentation, Videos Self study Component: Introduction ,Earth Sun radiation spectrum.

Module-3

Wind and Tidal Energy: **05 hours**

Properties of Wind, availability of wind energy in India, Wind velocity and power from wind, Major problems associated with wind Power, Wind machines, Types of wind machines and their characteristics, horizontal and vertical axis, wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design, numerical examples.

Tides and waves as energy suppliers and their mechanism, fundamental characteristics of tidal power, harnessing tidal energy, limitations.

	Chalk and talk, Power point presentation, Videos Self study Component: Characteristics of Wind and Tidal energy.

Module-4

Ocean and Geothermal Energy Conversions; **05 hours.**

Principle of working, Rankine cycle, OETC power stations in the world, problems associated with OETC. Principle and working of Geothermal stations, Types of geothermal stations with schematic diagram, Geothermal plants in the world, Problem associated with geothermal conversion, Scope of geothermal energy.

Pedagogy	Chalk and talk, Power point presentation, Videos Self study Component: About Ocean and Geo thermal energy conversion process.

Module-5

Bio Mass and Hydrogen Energy; **05 hours.**

Photosynthesis, Photosynthetic Oxygen production, energy plantation, Bio gas production from Organic wastes by Anaerobic fermentation, description of Bio gas plants, Transportation of Bio gas, Problems involved with bio gas production, application of bio gas,

Hydrogen energy: Properties of Hydrogen with respect to its utilization as a renewable form of Energy. Source of Hydrogen, Production of hydrogen, Electrolysis of water, Thermal decomposition of water, Thermo chemical production, Bio Chemical Production.

Pedagogy	Chalk and talk, Power point presentation, Videos Practical Topics: Self study Component: Photo synthesis Photo synthetic Oxygen production, Properties of Hydrogen.

Course outcome (Course Skill Set)

Course outcomes: After a successful completion of the course, the student will be able to:

1.Describe the environmental aspects of non-Conventional energy resources.
2.Describe the use of Solar energy and the various components used in energy productions with respect to its applications.
3.Appreciate the need of wind energy and the components used in energy generation.
4.Understand the Concept of Bio mass energy resources and its applications.
5. Compare the Solar, Wind ,and Bio mass energy systems, their prospects, advantages and limitations,

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. Renewable Energy Sources and Conversion Technology by N.K. Bansal,Manfred, Kleeman & Mechael Mellis. Tata McGrawHill -2004
2. Non-Conventional Energy resources by B.H.Khan, Mc Graw Hill Education pvt Ltd. 3rd Edition.
3. Non-Conventional Energy Sources by G.D.Rai, Khanna Publishers-2003.

Reference books:

1. Solar Energy by Subhas P Sukhatme -Tata Mc Graw Hill- 2nd Edition 1996.
2. Renewable Energy Technologies, by Ramesh.R & Kumar K.U.- Narosa Publishing House New Delhi.

Web links and Video Lectures (e-Resources):

https://youtu.be/w1EurQ1HrFg
https://youtu.be/cjBPnIXK60U
https://youtu.be/7ccKVLODqBo
https://youtu.be/mh51mAUexK4

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

http://nptel.ac.in
https://youtu.be/UeGJpwC1aiQ

SAMPLE TEMPLATE

Semester

CONSTRUCTION MATERIALS			
Course Code	21BSO373	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 Learning Objectives: This course will develop a student;

1. To recognize good construction materials based on properties.
2. To investigate soil properties and design suitable foundation.
3. To understand the types and properties of masonry materials and supervise masonry construction.
4. To gain knowledge of structural components like lintels, arches, staircase and roofs.

To understand the finishes in construction like flooring, plastering, paining

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

Building Materials: **05 hours**

Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, waterabsorption, efflorescence, dimension and warpage.
Cement Concrete blocks, Autoclaved Aerated Concrete Blocks, Sizes, requirement of good blocks.Timber as construction material.
Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisturecontent, deleterious materials.

Pedagogy	Chalk and talk, Power point presentation, Videos Self study Component: Stone as Building material, requirement of good building stones, Classification of bricks.

Module-2

Foundation: **05 hours**

Preliminary investigation of Soil, Function and requirements of good foundation, Types of foundation,
Masonry; Definition and terms used in masonry, Brick masonry characteristics and requirement of good brick masonry, bonds in brick work.
Stone masonry, requirements of good stone masonry**, classification, characteristics of different stone masonry ,joints in stone masonry.**
Types of walls: Load bearing, partition walls and cavity walls.

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

Module-3

Lintels and Arches: **05 hours**

Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.

Floors and roofs: Floors; Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring, Cladding of tiles.

Roof: Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Different types of lintels and floors.**

Module-4

Doors, Windows and Ventilators: **05 hours**

Location of doors and windows, technical terms, Materials for doors and windows: PVC, CPVC and Aluminum. Types of Doors and Windows: Paneled, Flush, Collapsible, Rolling shutter, Paneled and glazed Window, Bay Window, French window. Steel windows, Ventilators. Sizes as per IS recommendations.

Formwork: Introduction to form work, scaffolding, shoring, under pinning.

Pedagogy	Chalk and talk, Power point presentation, Videos **Self study Component: Location of windows and doors.**

Module-5

Plastering and Pointing: **05 hours**

Mortar and its types. Purpose, materials and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, defects in plastering. Water proofing with various thicknesses.

Damp proofing- causes, effects and methods.

Paints- Purpose, types, technical terms, ingredients and defects, Preparation and applications of paintsto new and old plastered surfaces, wooden and steel surfaces.

Pedagogy	Chalk and talk, Power point presentation, Videos **Practical Topics:** **Self study Component:** Materials and method of plastering and painting.

Course outcome (Course Skill Set)

Course outcomes: After a successful completion of the course, the student will be able to:

1. Select suitable materials for buildings and adopt suitable construction techniques.
2. Decide suitable type of foundation based on soil parameters
3. Supervise the construction of different building elements based on suitability
4. Exhibit the knowledge of building finishes and form work 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 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. Sushil Kumar "Building Materials and construction", 20th edition, reprint2015, Standard Publishers
2. Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
   Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.

Reference books:

3. S. K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016National Building Code(NBC) of India
4. P C Vergese, "Building Materials", PHI Learning Pvt.Ltd
5. Building Materials and Components, CBRI, 1990,India
6. Jagadish. K.S, "Alternative Building Materials Technology", New Age International,2007.
7. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/XsFeVuVQE-E
2. https://youtu.be/3XGt-p-hpdU
3. https://youtu.be/UEMHDi2_SYs
4. https://youtu.be/wOyQBVfM1eo

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
https://youtu.be/05lQlQSBXm4