Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

Government Aided Autonomous Institute under Mumbai University

Andheri (W), Mumbai - 400058

COURSE CONTENTS

FIRST YEAR
CIVIL ENGINEERING

SEMESTER – I & II

Academic Year: 2025-2026

Regulation 23

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

List of Courses

BS-BTC01- Differential Calculus & Complex Numbers

Course Code	Course Name:
BS-BTC101	**Differential Calculus and Complex Numbers (DCCN)**
Course pre-requisites	Std. XI and XII Mathematics

Course Objectives

The main objectives of the course are

1. To Introduce Partial Differentiations and its applications to find Maxima and Minima, Jacobian.
2. To Introduce Complex Numbers and its applications to find roots of equations.
3. To Introduce Numerical Methods.

Course Outcomes

At the end of the course the students shall be able to

1. Apply the concepts of partial differentiation to evaluate higher-order derivatives, analyze composite functions, and solve optimization problems including maxima, minima, and constrained optimization using Lagrange's method.
2. Represent complex numbers in various forms and apply De-Moivre's theorem and hyperbolic function concepts to solve polynomial equations and analyze complex expressions.
3. Apply numerical techniques to solve systems of linear and nonlinear equations and perform numerical integration using standard methods such as Newton-Raphson, Trapezoidal rule, Simpson's rules, and iterative matrix techniques.

Course Content

Module No.	***Details***	***Hrs.***
1	**Partial Differentiations:** Partial differentiation, Partial derivatives of first and higher order, Total Differentiation, Differentiation of Composite & Implicit functions. Homogeneous Functions, Euler's Theorem on Homogeneous function with two & three independent variables (with proof), Deductions from Euler's Theorem.	06
2	**Applications of Partial Differentiations:** Maxima & Minima of a function of two independent variables. Lagrange's method of undetermined multipliers	02
3	**Complex Numbers:** Cartesian, Polar and exponential form of complex numbers. De- Moivre's Theorem. Expansion of $\sin(n\theta)$, $\cos(n\theta)$ in terms of powers of $\sin\theta$ and $\cos\theta$.	08
4	**Complex Numbers:** Circular and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Logarithm of complex numbers functions, Roots of complex numbers.	06

5	**Numerical Methods:** Numerical solution of linear and non-linear equations using False position method, Newton-Raphson method. Numerical integration using Trapezoidal rule, Simpson's1/3rd rule, Simpson's 3/8th rule. Solution of system of linear algebraic equations, by Gauss Elimination Method, Gauss Jordan Method, Gauss Jacobi Iteration Method and Gauss Seidel Iteration Method	06

For Self-study:
Successive differentiations, n^{th} -derivative of Exponential, Trigonometric & Algebraic functions. Leibnitz's theorem and related examples. Expansion of functions, Taylor's series, Maclaurin's series and examples

Text Books:-

Shanti Narayan (2005), "Differential Calculus", S.Chand Publications,30^{th} Edition, ISBN 8121904714, 572 Pages
Kandasamy (2006), "Numerical Methods" S Chand & Company, ISBN 978-8121914383, 640 Pages B S Grewal (2014), "Higher Engineering Mathematics", Khanna Publications, 43^{rd} Edition, ISBN 8174091955, 1315 Pages

Reference Books:-

Erwin Kreyszig (2010), "Advanced Engineering Mathematics" Wiley Eastern Limited, Singapore 10^{th} edition, ISBN 8126554231, 1148 Pages.
M K Jain, S R K Iyengar, R K Jain (2020) "Numerical Methods: Problems And Solutions" New Age International Private Limited; Third edition, ISBN 978-9388818926, 432 pages

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

BS-BTC102-Engineering Chemistry

Course Code	Course Name
BS-BTC102	**Engineering Chemistry**
Course pre-requisites	Std. XII Chemistry

Course Objectives

The objectives of this course are

1. To introduce the students to basic knowledge of , corrosion and its protection , water chemistry and high performance polymers and materials
2. To introduce the student to theory, principles and mechanism of chemical processes.
3. To introduce the application of chemistry in engineering and technology
4. To introduce the student with different material characterization technique

Course Outcomes

Upon successful completion of the course, students should be able

1. Analyze the causes and mechanisms of various types of corrosion and apply appropriate methods for corrosion prevention and protection in engineering materials.
2. Evaluate water quality parameters, treatment methods, and pollution control techniques for applications in industrial and environmental engineering.
3. Identify and distinguish high-performance polymers and advanced materials used in engineering systems, including biomedical and electronic applications.
4. Characterize materials using modern analytical techniques such as spectroscopy, microscopy, and thermal analysis, and interpret results for engineering applications.

Course Content

Module No.	Details	Hrs.
1	**Corrosion and surface chemistry** Definition, Types of corrosion-Dry or Chemical Corrosion, Voltaic Cells / Galvanic Cells, Electrolytic Cells, Reversible Cells, Wet or Electrochemical corrosion, Bi-metallic corrosion, Concentration cell corrosion-differential Aeration corrosion, Pitting Corrosion, Water Line Corrosion, stress Corrosion, Inter-granular Corrosion. Electrochemical & Galvanic series, Polarization, over voltage, Passivity, Factors affecting rate of corrosion. Corrosion in electronic devices and photonic devices.	06
2	**Corrosion Prevention** Different technique for Corrosion prevention, Cathodic and Anodic Protection, Cathodic and Anodic coatings, Method for metal coating ,Galvanising & Tinning, Metal Cladding, Electroplating. Organic and Inorganic coating, paint, varnish Enamels, phosphate and chromate coating	04
3	**Water Chemistry** Hardness of water, types of hardness, units of Hardness, determination of hardness by EDTA method and numerical problems. Internal treatment of hard water. External Treatment of hard water by i) lime soda method with equations in general & Numerical problems. ii) Zeolite or permutit process & numerical problems. iii) Ion exchange method. Desalination of BRACKISH WATER -	08

	Reverse osmosis Ultra filtration and it's industrial applications. Methods to determine extent of water pollution i) BOD. ii) COD Chemical Analysis of water with special reference to Total Dissolved Salts TDS Methods to control water pollution – activated sludge process for sewage treatment, flow sheet diagram for sewage treatment, water for energy and fuel production, electrolysis, hydrogen gas production	
4	**High Performance Polymers and Materials** High-Performance Polymers for Engineering-Based Composites, New Smart Materials via Metal Mediated Macromolecular Engineering, Materials for Biomedical Applications, Engineering Thermoplastics, Semiconducting polymers, Semiconducting Polymers Towards Device Applications, High performance materials, eg., Silicon nitride	06
5	**Analytical technique for materials evaluation and characterization** Atomic Force Microscopy (AFM, Auger Electron Spectroscopy (Auger). Energy Dispersive X-ray Fluorescence Spectroscopy, Fourier Transform-infrared Spectroscopy, Ultraviolet /Visible Spectroscopy, Thermal Methods/Thermogravimetric Analysis, Gas Chromatography / Mass Spectrometry, Ion Chromatography, Scanning Electron Microscopy, Thermal Analysis (DSC, TGA), X-ray Photoelectron Spectroscopy, Metallographic Study, Rockwell Hardness Testing, UV, Fluorescence and its applications in medicine. Mechanical Testers and Tribological Tools: Microindentation, Hardness Testing, Nanoindentation Hardness Testing, Rockwell Hardness Testing, ISO, EN, ASTM standardisation.	06

Text Books

1. S. S. Dara&Dara (1986), 'Engineering Chemistry', S. Chand & Company Ltd, 12th Edition, ISBN 8121903599, 992 Pages
2. O.P. Khanna (2010), 'Material Science for engineering students', DhanpatRai, Publications (p) Ltd., ISBN 8189928317, 1179 Pages
3. University chemistry, by B. H. Mahan

Reference Books

1. P.C.Jain& Monica Jain (2004), 'Engineering Chemistry', DhanpatRai publishing company Pvt. Ltd, 15th Edition, ISBN 8187433175, 1288 Pages
2. Emil Roduner (2006), 'Nano Scopic Materials', RSC Publishing, ISBN 0854048571, 285 Pages
3. VasantGowarikar (1986), 'Polymer science', New Age International Pvt Ltd, ISBN 0852263074, 505 Pages
4. Cotlon (1994), 'Basic Inorganic Chemistry', Wiley India, 3rd Edition, ISBN 0471505323, 856 Pages
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
6. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Sardar Patel College of Engineering,
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ES-BTC101- Basic Electrical and Electronics Engineering

Course Code	Course Name
ES-BTC101	Basic Electrical and Electronics Engineering
Course pre-requisites	XII Standard Physics

Course Objectives

The objectives of this course are

1. To discuss various laws/ theorems to analyse DC and AC networks.
2. To introduce construction and working principle of Electrical Machines
3. To introduce the basics of rectifiers ,filters,inverters and transistors.
4. To introduce the basics of sensors and transducers..

Course Outcomes

Upon successful completion of the course, students should be able

1. Apply basic electrical laws and network theorems to analyze direct current (DC) and alternating current (AC) circuits, including single and three-phase systems.
2. Explain the construction, working principles, and types of electrical machines such as transformers and induction motors.
3. Understand the operation and application of basic electronic components including rectifiers, filters, inverters, and transistors.
4. Describe the working principles, characteristics, and applications of various sensors and transducers used in engineering measurements.

Course Content

Module No.	Details	Hrs
1	DC Networks: Kirchhoff's laws, Nodal and Mesh analysis, source transformation, Superposition principle, Thevenin's and Norton's theorem, Maximum Power Transfer theorem	6
2	AC. Circuits: Single phase AC circuits - A.C. source specifications, Steady state behavior of resistance, inductance and capacitance with AC source, R-L, R-C, R-L-C circuits, phasor diagrams, power and power factor. Three Phase AC Circuits: star and delta connections with Balanced load, Relationship between phase and line current and voltages, three phase power calculation.	8
3	Machines: (No numericals expected) Single phase transformers, Single and three phase Induction motors - construction, principle of operation, types and applications.	4
4	Basic Electronics:(No numericals expected) Basics of Rectifiers, filters, Zener as voltage regulator, BJT-principle of operation, BJT as a switch, Concept of Inverter.	4
5	Sensors and Transducers:(No numericals expected) Basics of sensors and Transducers-, characteristics of transducers, measurement of temperature, vibration, velocity (speed), flow, water level, strain gauge, LVDT.	6

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. Joseph A. Edminster (1965), 'Electrical Circuits', Tata McGraw Hill, New Delhi, 4 th Edition, ISBN 0070189749.
3. H. Cotton (2011), 'Advanced Electrical Technology', Wheeler Publication, Allahabad, ISBN 8190630717, 1293 Pages.
4. Robert Boylestad and Louis Nashelsky (2009), 'Electronic devices and circuits', Prentice Hall of India. 10th Edition, ISBN 0135026490, 894 Pages.
5. Mottershed Allen (1973), 'Electronic Devices and Circuits an Introduction', Prentice Hall of India,1st Edition, ISBN 8120301245, 656 Pages..
6. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. Sawhney A.K. "A course in Electrical and electronics measurements and Instrumentation" by Dhanpat Rai and Sons 17th edition

Reference Books

1. Mittal and Mittal (2005), 'Basic Electrical Engineering', Tata McGraw Hill.
2. Ian Sinclair, Sensors and Transducers, Elsevier
3. D. Patranabis, Sensors and Transducers, PHI.

Sardar Patel College of Engineering,
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ES-BTC102- Engineering Mechanics-I

Course Code	Course Name
ES-BTC102	**Engineering Mechanics-I**
Course pre-requisites	Standard XII Physics

Course Objectives

The objectives of this course are:

1. To introduce the students to the principles and methods of statics (mechanics), and to apply those fundamentals to solve the problems on statics.
2. To prepare the base for the students to study other engineering/structural engineering courses.

Course Outcomes

Upon successful completion of the course, students shall be able to

1. Apply the principles of force systems to analyze the equilibrium, resolution, and composition of coplanar forces.
2. Analyze statically determinate pin-jointed frames using the methods of joints and sections.
3. Determine the centroid and moment of inertia for composite plane areas using standard theorems.
4. Apply the principle of virtual work to compute support reactions in determinate beams.

Course Content

Module No.	Details	Hrs.
1	**System of Coplanar forces:** Introduction to coplanar & non-coplanar force system. Forces and their components. Moment of the force about a point, couple. **Resultant of coplanar force system:** Resultant of concurrent forces, parallel forces, non-concurrent non- parallel system of forces. Varignon's theorem.	07
2	**Equilibrium of coplanar force system:** Meaning of equilibrium, free body diagrams, equilibrium of concurrent, parallel and non-concurrent non-parallel (general) system of forces. Types of supports, determination of reactions at supports for various types of determinate beams.	07
3	**Analysis of pin jointed frame / truss:** Perfect truss, Imperfect truss, Analysis of truss by method of joints and method of sections.	05
4	**Principle of virtual work:** Application to determine the reactions of determinate beams with / without internal hinges.	03

5	**Centroid of Plane Areas:** Concept of centroid of plane areas. Problems on centroid of composite areas. **Moment of Inertia:** Moment of inertia of plane areas, parallel axis theorem. Introduction to polar moment of inertia, product of inertia and mass moment of inertia. Problems on moment of inertia of composite areas.	06
TOTAL		**28**

Text Books

1. N. H. Dubey (2017); "Engineering Mechanics Statics and Dynamics", McGraw Hill Education, ISBN 9780071072595, 800Pages
2. M. D. Dayal (2017); "Engineering Mechanics", Published by M.D.Dayal

Reference Books

1. R. C. Hibbeler (2007); "Engineering Mechanics", Pearson Education Inc., ISBN 0132215098, 656 pages.
2. A.K. Tayal (2010), 'Engineering Mechanics', Umesh Publication, ISBN 9380117388, 740 pages.
3. B. N. Thadani (1966); "Engineering Mechanics", Asia Publishing House, ISBN 0210269405, 655 pages.
4. Beer & Johnson (2013), "Engineering Mechanics", Tata McGraw Hill, ISBN 1259062919, 470 pages.
5. F. L. Singer (1975), "Engineering Mechanics", Harper & Raw Publication, ISBN 0060462329, 724 pages.
6. Nelson (2009), "Engineering Mechanics", Tata McGraw Hill, ISBN 0070146143
7. Shames (2006), 'Engineering Mechanics', Prentice Hall, India, ISBN 8177581236, 837 pages.
8. K. L. Kumar (1998), "Engineering Mechanics", Tata McGraw Hill, ISBN 0070681813, 673 pages.

Sardar Patel College of Engineering,
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BS-BTC103- Biology for Engineers

Course Code	Course Name
BS-BTC103	**Biology for Engineers**
Course pre-requisites	**NA**

Course objectives

1. To familiarize the students with the basic biological concepts and their engineering applications.
2. To enable the students with an understanding of biodesign principles to create novel devices and structures.
3. To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
4. To motivate the students to develop the interdisciplinary vision of biological engineering

Course Outcomes

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

1. Explain foundational biological concepts relevant to solving engineering problems involving living systems.
2. Apply principles of biological design and development to conceptualize innovative bioengineering solutions.
3. Analyze biomimetic concepts and demonstrate their application in engineering systems.
4. Develop interdisciplinary and critical thinking skills to propose bio-based solutions for socially relevant challenges.

Module No.	Details	No. of Lectures
1.	**Introduction** Requirement of engineers to study biology, Origin of life, Evolution and cells **Biomolecules** Lipids, Carbohydrates, water, amino acids, proteins, enzymes, nucleotides.	2
2.	**Cell structure, Function and Genetics** Prokaryotes and Eukaryotes, Cell cycle and Cell growth : Mitosis, meiosis, culture growth, Mendelevian Genetics	3
3	**DNA** DNA structure, DNA Replication, transcription and translation	3

4	**Nature-Bioinspired Materials And Mechanisms** Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and per fluorocarbons (PFCs). Biomimicry in Buildings constructed.	3
5	**Trends In Bioengineering** Bio printing techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bio imaging and Artificial Intelligence for disease diagnosis. Self-healing Bio concrete (based on bacillus spores, calcium lactate nutrients and bio mineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic)	**3**

References books

1. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
2. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
3. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
4. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
5. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press. · Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
6. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
7. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
8. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press

Online Websites

- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

Sardar Patel College of Engineering,
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BS-BTC151- Engineering Chemistry- Lab

Course Code	Course Name
BS-BTC151	**Engineering Chemistry Lab**
Course pre-requisites	Std. XII Chemistry& Engineering Chemistry

Course Objectives

The objectives of this course are

1. To introduce the students to basic knowledge of material chemistry
2. To correlate theory with experiment
3. Application of chemistry in engineering and technology

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
Upon successful completion of the course, students should be able

1. Determine the hardness of water samples and apply suitable techniques for its removal.
2. Analyze the composition of metals in alloys using standard titrimetric and instrumental methods.
3. Synthesize and characterize new materials and composites for engineering applications.
4. Measure and interpret system properties such as flash point, conductance, redox potential, and acid/base content using chemical methods.

List of experiments

List of Experiments:

1. To determine Total, Temporary & Permanent hardness of water sample
2. Removal of hardness of water by Ion-Exchange Column
3. To determine COD of an effluent sample
4. To determine ion exchange Capacity of ion exchange resin
5. Estimation of Cu by iodometrically
6. Estimation of Zn by complexometric titration
7. Estimation of Ni by complexometric titration
8. To determination of chloride content of water
9. To determine Flash-Point/Fire-Point of lubricating oil
10. To determine Acid-Value of the given Lubricating Oil
11. To determine sulphur content in unknown sample
12. Thin layer chromatography
13. Determination of chloride content of water
14. Preparation of biodiesel from edible oil

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

ES-BTC152- Engineering Mechanics Lab

Course Code	Course Name
ES-BTC151	Engineering Mechanics-I Lab
Course pre-requisites	Standard XII Physics

Course Objectives

The objectives of this course are:

1. To introduce the students to the experimental methods to verify the principles and methods of statics (mechanics).

Course Outcomes

Upon successful completion of the course, students shall be able to:

1. Demonstrate teamwork and collaborative skills while conducting engineering mechanics experiments.
2. Perform and analyze experiments to verify fundamental principles of statics, such as force equilibrium, friction, and support reactions.

List of Experiments

1. To find reactions of simply supported beam (Parallel force system)
2. To verify polygon law of forces (Concurrent force system)
3. To verify Lami's theorem using simple jib crane
4. Equilibrium of non-concurrent non parallel force system
5. To verify moment equilibrium condition using bell crank lever
6. To determine coefficient of friction using friction plane
7. To determine coefficient of friction using angle of repose method

ES-BTC152- Basic Electrical and Electronics Engineering Lab

Course Code	Course Name
ES-BTC152	**Basic Electrical and Electronics Engineering Lab**
Course pre-requisites	Standard XII Physics

Course Objectives

1. Understand use of various network laws/ theorems.
2. Introduce to AC circuits and power measurement.
3. Introduce to construction and working of machines.
4. To understand working of rectifiers, sensors and transducers.

Course Outcomes

Upon successful completion of the course, the students will have

1. Apply DC circuit theorems such as Kirchhoff's laws and network theorems to analyze electrical circuits experimentally.
2. Analyze AC circuits and determine electrical parameters like impedance, phase angle, and power factor using laboratory instruments.
3. Demonstrate understanding of the construction and working principles of basic electrical machines through lab-based experiments.
4. Operate electronic devices and measure physical parameters using sensors and transducers in experimental setups.

Course Content

List of suggested experiments-

Lab- Hardware experiments (Any eight to ten experiments from following list)

1)Verification of Kirchoffs Laws.
2) Verification of Theorems (Superposition, Thevenin, Norton ,Maximum Power Transfer Theorem).
3) To Determine Inductance & Internal Resistance of R-L circuits.
4) To Determine Capacitance of R-C circuits.
5) To observe waveforms and phase difference in AC circuits.
6) Experiment based on Power factor improvement.
7) Single phase and Three phase power measurement.
8) Experiment based on Rectifiers and filters.
9) Demonstration of machines.
10) Measurement of physical parameters with Sensors and Tranducers.

References-

1. Joseph A. Edminster (1965), 'Electrical Circuits', Tata McGraw Hill, New Delhi, 4 th Edition, ISBN 0070189749
2. M.E. Van Valkenburg: Network Analysis. Prentice-Hall of IndiaPvt. Limited, Eastern Economy Edition.
3. Mittle and Mittle (2005), 'Basic Electrical Engineering', Tata McGraw Hill.
4. Sawhney A.K. "A course in Electrical and electronics measurements and Instrumentation" by Dhanpat Rai and Sons 17th edition

Sardar Patel College of Engineering,
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SE-BTC101- Design thinking and Innovation

Course Code	Course Name
SE-BTC101	**Design thinking and Innovation**
Course pre-requisites	Standard XII Physics

Course Objectives

1. Study a problem from multiple perspectives
2. Learn how to frame the design challenge properly.
3. Learn how to ideate, prototype and Iterate solutions.
4. Learn from the overall design process how to create value as entrepreneurs
5. Learn how to design succeful products or enterprises

Course Outcomes

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

1. Identify real-world problems and convert them into innovation opportunities using structured design thinking approaches.
2. Develop user-centric product or service ideas through problem framing, ideation, and value proposition design.
3. Apply empathy-based research tools to gather insights into user behaviors, challenges, and expectations.
4. Design, prototype, test, and effectively communicate solutions with an entrepreneurial and iterative mindset.

Module No.	Details	Hrs
1.	**Introduction to Design Thinking** Introduction to Design Thinking: LRI Assessment, Introduction to Design Thinking, Understanding the Mindsets-Empathy, Optimism, Embrace Ambiguity, Make it, Learn from Failure, Iterate, Create Confidence, Creativity Convergent & Divergent Thinking	8
2.	**Design Thinking Methodology:** The 5 Stages of the Design Thinking Process-Empathize, Define (the problem), Ideate, Prototype, and Test.	8
3	**Empathize -** Understand customers, Empathy Maps, Empathize-Step into customers shoes, Customer Journey Maps, Define- Analysis & Drawing Inferences from Research	8
4	**Ideation tools & exercises.** Sample Design Challenge, Introduction to the Design Challenge Themes, Story- telling and Tools for Innovation	8
5	**The Design Challenge**: Define the Design Challenge, Prototyping & Iteration- Feasibility Study, Testing Documentation and the Pitching	8

Text book

1. Karmic Design Thinking by Prof. Bala Ramadurai, available at Amazon (paperback), Amazon (e-book), Flipkart, Pothi, halfpricebooks.in
2. Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, 2013, Wiley Publications

References

1. Innovation and Entrepreneurship by Peter F. Drucker (Special Indian Edition). Routledge
2. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, 2009
3. Zero to One: Note on Start-Ups, or How to Build the Future
4. The Lean Startup: How Constant Innovation Creates Radically Successful Businesses
5. Start With Why: How Great Leaders Inspire Everyone To Take Actions.

SE-BTC102- Programming for problem solving

Course Code	Course Name
SE-BTC102	**Problem solving and Programming**
Course pre-requisites	Basic Knowledge of computers

Course Objectives

1. Master basic procedural programming constructs for decision and iteration.
2. Write and debug small programs.
3. Manipulate various Data types and Apply basic programming concepts like loops, functions, arrays in programs.
4. Apply Object Oriented programming approach to various problem statements.

Course Outcomes

Upon successful completion of the course, the students will be able to

1. Construct programs using conditional and looping control structures to solve computational problems.
2. Develop modular code using functions and arrays for data-driven applications in the C++ programming language.
3. Apply object-oriented programming concepts like classes, inheritance, and polymorphism to build structured, extensible programs.
4. Analyze, debug, and correct errors in existing code using structured debugging techniques and best practices.

Course Content

Module No.	Details	Hrs
1.	**Basics of Programming:** Defining problem statement, solution development using Algorithmic approach. Concept of Variables and constants, Data types, operators, Input / Output from console, expression, etc. **Skill to be developed**: 1. Given a problem statement student should be able to give an approach to code the program which can be in forms of steps (algorithm) or graphical (Flow chart). 2. Students should be able to build a basic C++ program. 3. Students should be able to Write Programs Using Operators and Expressions.	**6**

2.	**Control Structure**: Conditional execution Iteration Looping **Skill to be developed**: 1. Students should be able to Write Programs Using If-Else statement, Switch statement. 2. Students should be able to Write Programs Using nested If-Else statement. 3. Students should be able to write Programs Using While, Do-While loops. 4. Students should be able to Write Programs Using FOR loops. **5.** Students should be able to write Programs Using nested Loops.	**6**
3.	**Functions:** Defining Functions- Procedural decomposition of problems, localizing variables, parameter passing– value and reference, return values.	**6**
	Special Functions Concepts: Recursive functions **Skill to be developed**: 1. Students should be able to Write Programs Using Functions of various types. 2. Students should be able to Write Programs Using special functions.	
4.	**Introduction to Data Structures** Arrays **–** one-dimensional, Multidimensional **Strings** **Skill to be developed**: 1. Students should be able to Write Programs Using 1-D arrays. 2. Students should be able to Write Programs for matrix manipulations using 2-D arrays. 3. Students should be able to Write Programs involving strings and its manipulations.	**6**
5.	**Introduction to Object Oriented Programming** Object Oriented Language concepts – classes, objects, Constructor and Destructors. Inheritance – Access specifiers, Types of Inheritance with examples. **Skill to be developed**: 1. Students should be able to write basic OOPs Programs Using classes and objects. 2. Students should be able to Write Programs using Constructor and constructor overloading 3. Students should be able to Write Programs involving Inheritance	**6**
6.	**Features of Object Oriented Programming** **Compile time polymorphism** Introduction to **Runtime Polymorphism**. **Skill to be developed**: 1. Students should be able to write Programs Using function overloading 2. Students should be able to Write Programs using operator overloading	**6**

Text Books:

1. BalaguruSwami (2008),"Object Oriented Programming with C++", Tata McGraw-Hill PublishingCompany Ltd., 3 rd Edition, ISBN 0070669074, 624 Pages
2. BjarneStroustrup (2013) ,"The C++ Programming Language", Addison Wesley Publishing Company, 4 th Edition, ISBN 0321563840, 1368 Pages.

Reference Books:

1. Mahesh Bhave and Sunil Patekar (2012), "Object- Oriented Programming with C+ + , Pearson Education, st Edition, ISBN 8131798585, 688 Pages.
2. Robert Lafore (2001), "Object-Oriented Programming in C++", Sams Publishing 4 th Edition, ISBN 0672323087, 1040 Pages

Sardar Patel College of Engineering,
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VS-BTC101- Workshop Practice – I

Course Code	Course Name
VS-BTC101	**Workshop Practice – I**
Course pre-requisites	Basic Sciences of XII or Diploma

Course Objectives

The objectives of this course are

1. To impart skill-based knowledge to students about types workshop in engineering.
2. To give "hands on" training and practice to students for use of various tools, devices, machines, and electrical circuitry and equipments in the workshops.
3. To develop ability of students to understand, plan and implement various processes and operations to be performed on the raw material to create object of desired shape and size.
4. To impart knowledge on various safety standards practiced while working different types of workshops.

Course Outcomes

on successful completion of this course student will be able to:

1. Identify and operate hand tools, machines, and devices used in basic engineering workshops for shaping and fabricating components.
2. Demonstrate standard workshop operations in fitting, carpentry, smithy, and electrical wiring with adherence to prescribed procedures.
3. Apply appropriate safety measures before, during, and after carrying out mechanical and electrical operations.
4. Interpret job drawings and electrical circuit diagrams to plan and execute basic fabrication and wiring tasks.

Course Content

Module No.	Details	Hrs.
01	Fitting: - 1. Use and settings of fitting hand tools for marking, chipping, cutting, filing, centre punching, hammering, drilling, tapping. 2. Term work to include one job: - Male –female joint involving above operations.	08

02	Carpentry:- 1. Use of planning tool, Table saw, hand saw, mortise tool, marking tools, chisel and mallet. 2. Term work to include one job: Cross Lap Joint involving above carpentry tools.	08
03	Forging / Smithy: - 1. Term work to include one job: - Lifting Hook and Handle to be demonstrated by instructor to batch in group of 4-5 students.	04
04	Electrical Workshop: - 1. Electrical Board Wiring: - House wiring, Staircase wiring, Go-down wiring, Single phase Fan connection, Three phase connection for electrical motors. 2. Demonstration of fluorescent tube light connection. 3. Demonstration of Soldering.	04

Term Work
Term work shall comprise of The evaluation based on the skills learned while completing the job in each workshop trade and the submission of the job along with the Workshop Journal.

Text Books
• S. K. & A. K. Hajra Choudhary, "*Workshop Technology, Vol. I, II*", Media promotors and publishers pvt. Limited, 2007. • R. S. Khurmi, J. K. Gupta, "A Textbook of Workshop Technology (Manufacturing Processes)", S Chand & Company Pvt. Ltd. 2008.
• **Reference Books**
• G. Boothroyd & W.A. Knight, "Fundamental of Machining and Machine Tools, third edition", CRC. • W. A. J. Chapman, "*Workshop Technology- Part I, II and III*", Edward Arnold.
• **Online Reference Material**
• https://www.youtube.com/watch?v=YV9Y_J1Ipa0 (Video in Marathi Language). • https://www.youtube.com/watch?v=jbRgJbIGAwc (Video in Hindi Language). • https://www.youtube.com/watch?v=-1ov1jn7m-w (Video in Hindi Language).

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

VE-BTC101- Ethics, Values and Life skills

Course Code	Course Name
VE-BTC101	Ethics, Values and Life skills
Course pre-requisites	NA

Course Objectives

1	To enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world- view
2	To develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality.
3	To increase one's knowledge and awareness of emotional competency and emotional intelligence at place of study/work.
4	To develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5	To enhance one's ability to be fully self-aware by helping oneself to overcome all fears and insecurities and to grow fully from inside out and outside and achieve excellence with ethics.

Course Outcomes

Upon successful completion of the course, the students will be able to

1. Demonstrate self-management and interpersonal skills for positive personal and professional conduct.
2. Apply logical and rational thinking to analyze and resolve ethical and moral dilemmas.
3. Practice righteousness and understand the deeper values and purpose of life.
4. Exhibit emotional maturity, empathy, and social awareness in diverse environments.

Course Content

Module No.	Details	Hrs.
01	**Ethics and Human Interface:** Why Study Ethics and values? Basics of Ethics, Human Values and its importance, Ethics in private and public relations, Moral thinkers and philosophers. Human Life, its aim and significance: Ethical and decision-making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.	**3**

02	**Development of positive attitude**: Harmony in Personal and Social Life: Concept of personal and group Ethics; Balance between - rights and duties- welfare of self and welfare of all. Creating a value based work culture in hostel, classroom and other places in the campus and society.	**3**
03	**Intellectual, Emotional, Creative, Ethics and spiritual development**: Aesthetic sense, Self-dependency, Activeness.	**2**
04	**Choosing the right path**: Character, Righteousness and Virtues for a Meaningful Life: Self- Awareness, Self -Management, Ego lessness, Humility, Righteousness, Purity, Truthfulness,	**3**
05	**Mindfulness**: Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maturity, Comradeship, Cooperation, Tolerance.	**3**

Assignments:

1. Project based assignment
2. Internal Assessment
3. Mind mapping, Journaling
4. Presentations
5. Story Writing

Text Books

1. A Textbook on Human Values and Ethics; Debrata Basu & Samarpan Chakraborty; October 2020: New Delhi publishers
2. Social Ethical And Moral Values & The Indian Education System Hardcover 1 January 2019 by Dr.B.Ramaswamy (Author)
3. Handbook on Human Values and Professional Ethics Dr SK Jain

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

CC-BTC101- Co-Curricular Course Yoga

Course Code	Course Name
CC-BTC101	**Yoga**
Course pre-requisites	NA

Course Objectives

The main objectives of the course are

1. Strength Development & Balanced Lifestyle
2. Physical & Mental Health Conditioning
3. Relaxation from anxiety & stress
4. Emotional Discipline & Control

Course Outcomes

At the end of the course the students shall be able to

1. Integrate breath, body, and mind through asanas and pranayama for holistic well-being.
2. Apply yoga-based physical exercises to build strength, flexibility, and self-discipline.
3. Adopt a balanced lifestyle including dietary awareness and daily routines aligned with yogic principles.
4. Enhance self-awareness, mindfulness, and emotional control for personal growth.
5. Cultivate a conscious, resilient, and positive mindset in real-life situations.

Course Content

Module No.	Details	Hrs.
1	**Definition & Historical Background of Yoga** Introduction to Ashtanga Vinyasa Sanskrit Shlokas: Opening & Closing Prayer Pranayama Techniques: Surya & Chandra Nadi pranayama, Surya & Chandra Bhedna, Nadi Shodhan, Omkara Meditation, Bhastrika Pranayama, Kapalbhatti Pranayama, Bhramari Pranayama. **Suryanamaskara A & Suryanamaskara B**	06
2	**Traditional Ashtanga Vinyasa Primary Series**: Standing Asanas - Sitting Asanas Learning the Vinyasa flow Technique Closing Asanas in the Primary series Flow Nauli Kriya Technique, Simhasana Garjanasana	06
3	**Meditative Asanas:** Siddhasana, Padmasana, Vajrasana, Sukhasana, Gaumumkhasana and performing the pranayama in the above asanas. Inversions & Arm Balance Asanas Learning the **Varki Kriya** Eye Palming and RotationsBlinking, Flexing Techniques	04

	4	**Spinal Twists:** Performing the Kapalbhati Pranayama in these Twisting Asanas Learning the technique of **Yogic Bandhas** & applying it during the meditation Five Norms of Social & Personal Living Eight Limbs of Ashtanga Yoga	02
5	**Types of Asanas:** Introduction to Ayurveda PanchaMahaBhoota Detailed Discussion on Doshas & Types Balanced Diet & Lifestyle (Dincharya) Introduction to Koshas & Types		02

For Self-Practise: Suryanamaskara A & Suryanamaskara B, Breathing Techniques in Sukhasana, Omkara Chanting & Meditation, Cat & Cow Stretch, SetuBandh Asana, Malasana, Spinal Twists in Sukhasana, Gaumukhasana, Padmasana, Back Bends with wall, Tadasana.

Reference Books:-

1. Yoga Mala: The Original Teachings of Ashtanga Yoga Master Sri K. Pattabhi Jois
2. Yoga Makaranda Book by Tirumalai Krishnamacharya
3. **Ashtanga Yoga: The Practice Manual** by David Swenson
4. Light on Pranayama: The Yogic Art of Breathing by B.K.S. Iyengar

Video Links:-

Guided Ashtanga Half Primary Series by Laruga Glaser
https://youtu.be/hW9mu7rEfQ4?si=aFymgVHh2aKIuNye

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

Government Aided Autonomous Institute under Mumbai University

Andheri (W), Mumbai - 400058

COURSE CONTENTS

Semester II

First Year B.Tech.

CIVIL ENGINEERING

Academic Year: 2023-2024
Regulation 23

BS-BTC201- Integral Calculus and Differential Equations

Course Code	Course Name
BS-BTC201	Integral Calculus and Differential Equations (ICDE)
Course pre-requisites	BS-BT101 (DCCN)

Course Objectives

The main objectives of the course are

1. Introduce Ordinary Differential Equations of First Order and Higher Order with constant coefficients.
2. Introduce Double and Triple Integrals.
3. Apply Double and Triple Integrals to find area, mass and volume.

Course Outcomes

At the end of the course the students shall be able to

1. Apply analytical techniques to solve first-order and higher-order ordinary differential equations in engineering contexts.
2. Formulate and evaluate double and triple integrals in various coordinate systems for engineering applications.
3. Use multiple integrals to compute area, volume, and mass of geometric and physical systems relevant to engineering.

Course Content

Module No.	Details	Hrs.
1	**First Order and First Degree Ordinary Differential Equations** Exact differential equations, Differential Equations which are reducible to the exact form by using integrating factors. First order linear differential equations and differential equations reducible to the linear form. Numerical Solution of first order ordinary differential equations using Taylor's series, Euler and Modified Euler's methods, Runge Kutta method of fourth order.	08
2	**Higher Order Linear Differential Equations** Higher Order Linear differential equations with constant coefficients. Complimentary Functions, Particular Integrals of differential equations of the type $F(D)y = Q(x)$. Cauchy's homogenous linear differential equations and Legendre's differential equations. Simple applications of differential equations of first and second order to Engineering problems.	06
3	**Double Integrals** Introduction to Double Integrals, Change of order of double integral. Evaluation of double integral by changing to polar coordinates.	06
4	**Triple Integrals** Introduction to Triple Integrals, Evaluation of Triple Integrals using Cartesian, Cylindrical and Spherical Polar coordinates.	06

5	**Applications of Multiple Integrals** Applications double integrals to find area and mass of lamina Applications of Triple Integrals to find volume.	02

Course Content For Self-study: Gamma function, reduction formula. Beta function. Duplication formula, Relation between Gamma and Beta Functions. Curve tracing in Cartesian and Polar Coordinates. Rectification of plane curves.

Text Books:

1. Richard Bronson (2010), " Schaum's Outline of Differential Equations", McGraw Hill Education; 4th edition ISBN 978-0071824859, 408 pages
2. Shanti Narayan (2005), "Integral Calculus", S.Chand Publications,35th Edition, ISBN 8121906814, 360 Pages
3. Vinod Kumar Sharma "Applied Mathematics-II" 2nd edition Tech Max Publications
4. B S Grewal (2014), "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, ISBN 8174091955, 1315 Pages.

Reference Books:-

1. Erwin Kreyszig (2010), "Advanced Engineering Mathematics" Wiley Eastern Limited, Singapore 10th edition, ISBN 8126554231, 1148 Pages.
2. George Simmons (2002), "Differential Equations with Applications and Historical Notes" McGraw Hill Education; 2nd edition, ISBN 978-0070530713, 656 page.

BS-BTC202- Engineering Physics

Course Code	Course Name
BS-BTC202	Engineering Physics
Course pre-requisites	XII Physics, Mathematics of differential equations.

Course Objectives

1. To explain particle related properties of waves and wave related properties of particles, introduce students to Quantum mechanics basic concepts.
2. To explain Schrodinger's time dependent and time independent equations.
3. To explore different crystal structures, crystal plane orientations in cubic structures, and determine crystal properties using X-rays.
4. To examine various ways of producing ultrasonic waves and its applications.
5. To explain interference and diffraction in optics and LASERs.

Course Outcomes

1. Analyze the dual nature of matter and radiation, interpret wave function behavior, and apply Heisenberg's uncertainty principle to quantum phenomena.
2. Apply Schrödinger's equations to model basic quantum mechanical systems like free particles and particles in potential wells.
3. Classify and describe different crystal structures and crystal planes, and use X-ray diffraction principles to determine structural properties.
4. Explain the working principles of ultrasonic wave generation using piezoelectric and magnetostriction effects, and explore their applications in engineering diagnostics.
5. Analyze interference and diffraction phenomena, and explain the fundamental processes involved in LASER operation and their engineering applications.

Course Content

Module No.	Details	Hrs.
1	**Wave nature of particles** Wave particle duality, X-rays- types of X-rays, continuous and characteristic X-rays, de Broglie wavelength; experimental verification of de Broglie theory; properties of matter waves; wave packet, group velocity and phase velocity; Wave function, Physical interpretation of wave function. Heisenberg's uncertainty principle; Electron diffraction experiment and Gamma ray microscope experiment; Applications of uncertainty principle.	6
2	**Quantum Mechanics:** Schrodinger's time dependent form, steady state form of Schrodinger's equation, Motion of free particle, Particle trapped in one dimensional infinite potential well.	6

3	**Crystal Physics** Basic concepts: Seven basic types of crystal systems, lattice, basis, crystal axes, unit cells, lattice parameters, co-ordination number, atomic packing factor, packing efficiency, void space. Crystal structures: SC, BCC, FCC, HCP, Diamond, ZnS. Crystal planes and directions: Miller indices, drawing of crystal planes and directions in a simple cubic unit cell, interplanar spacing between planes, important planes of SC, BCC and FCC structures, Bragg's law.	8
4	**Ultrasonics** Principles of production, piezoelectric and magnetostriction effects, piezoelectric and magnetostriction oscillators, ultrasonic materials – quartz and ferroelectric materials. Applications: Echo sounding, Non-Destructive Techniques	5
5	**Optics and LASER:** Interference in thin films- equal thickness and wedge shaped films, Newton's rings. Applications. Types of diffraction, Fraunhofer diffraction through a single slit and diffraction grating, grating spectra, resolving power of a grating.	5

For Self-study : Applications of Ultrasonics.

Text Books:

1. Kshirsagar and Avadhanulu, 'A textbook of Engineering Physics', S. Chand Publications, 1992
2. A.S. Vasudeva, 'Modern Engineering Physics', S. Chand Publications, (2008),
3. Hitendra K Malik and AK Singh , 'Engineering Physics', McGraw Hill Publications, (2013)
4. G Vijayakumari, 'Engineering Physics', Vikas Publishing house, (2006)

Reference Books:

1. Arthur Beiser , 'Concepts of Modern Physics', Tata McGraw Hill, 6th Edition, (2009)
2. Robert Eisberg, Robert Resnick , 'Quantum Physics of atoms, molecules, solids, nuclei and particles', Wiley India pvt. Ltd, 2nd Edition, (2006)
3. Charles Kittel, 'Introduction to Solid State Physics', John Wiley & Sons, 8th Edition, (2004)
4. S.O. Pillai, 'Solid State Physics', 6th Edition, New Age International Publishers, (2010)
5. K. Thyagarajan and AjoyGhatak , 'Lasers theories and application' Springer, 2nd Edition, (2006)

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

ES-BTC201- Engineering Graphics

Course Code	Course Name
ES-BTC201	**Engineering Graphics**
Course pre-requisites	Standard XII Physics and Mathematics

Course Objectives

1. To understand the fundamental principles of solid geometry
2. To understand the concepts of projections of 2D & 3D object.
3. To solve Engineering Graphics problems using Sketchbook & any CAD software
4. Develop skills in reading & interpretation (visualization) of Engineering Drawings
5. To develop competence in use of CAD as an effective tool for Engineering Graphics

Course Outcomes

Upon successful completion of the course, students should be able

1. Construct and analyze geometrical curves, lines, planes, and solids using manual and computer-aided drafting techniques.
2. Identify and differentiate between various two-dimensional and three-dimensional geometric entities used in engineering graphics.
3. Apply projection principles to draw orthographic, sectional, and isometric views of engineering components.
4. Interpret and visualize engineering drawings accurately using CAD tools and techniques.

Course Content

Module No.	Details	Hrs.
1	Lines, Lettering, Dimensioning and Scales. Engineering Curves: Conics - Parabola, Ellipse and Hyperbola. Involutes, Cycloidal Curves: Cycloid, Epi-cycloid, Hypocycloid,Spirals, Helix etc.	06
2	Projection of points & lines inclined to both the reference planes.Traces of the Lines on the Reference Planes.	04
3	Projection of Planes inclined to both the Reference Planes	03
4	Projection of Right regular Solids: Regular Polyhedrons (Tetrahedron), Prisms, Pyramids, Cylinders, Cones inclined to both the Reference Planes.	04
5	Orthographic Projections, Sectional Orthographic, Missing views.Isometric Projections using Natural Scale, four center method, method of points, typical practical problems.	07

Term work/ Tutorial*

- Introduction to any CAD
- Construction of Engineering Curves using Sketch Book and CAD tool
- Construction of Projection of Lines & Traces of lines using Sketch Book and CAD tool.
- Construction of Projection of Planes using Sketch Book and CAD tool
- Construction of Projection of Solids using Sketch Book and CAD tool
- Construction of Orthographic projections for simpleparts using CAD tools.
- Construction of Isometric projections for parts usingCAD tool.

***Minimum 03 problems are expected to be constructed on each module using CAD software tools**

Text Books

1. N.D.Bhatt,'Elementary Engineering Drawing',Charotar Publishing House,
2. T.Jeyapovan, 'Engineering Drawing and Graphics, Vikas Publishing House
3. K.L.Narayana & P.Kannaiah, 'Engineering Graphics', Tata McGraw-Hill
4. Schmalstieg/Hollerer, 'Augmented Reality: Principles & Practice'

Reference Books

1. K.Venugopal, 'Engineering Drawing and Graphics', New Age International Publishers,
2. Giesecke, Mitchell, Spencer & Hill, 'Technical Drawing', Macmillan PublishingCo.
3. Warren H. Luzadder, 'Fundamentals of Engineering Drawing', Prentice Hall ofIndia Pvt.Ltd
4. M.B.Shah & B.C.Rana, 'Engineering Drawing', Pearson Education
5. M.L. Dabhade, 'Engineering Graphics', Association of Technical Authors,

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

ES-BTC202- Engineering Mechanics-II

Course Code	Course Name
ES-BTC202	Engineering Mechanics-II
Course pre-requisites	Standard XII Physics, ES-BTC102, ES-BT154

Course Objectives

The objectives of this course are

1. To introduce the students to the principles and methods of dynamics (mechanics), and to apply those fundamentals to solve the problems on dynamics.
2. To prepare the base for the students to study other engineering/structural engineeringcourses at a later stage.

Course Outcomes

Upon successful completion of the course, students shall be able to develop analytical skills:

1. Analyze and solve engineering problems involving dry friction on horizontal and inclined surfaces, including applications to systems like wedges and ladders.
2. Determine the position, velocity, and acceleration of particles undergoing rectilinear and curvilinear motion using principles of kinematics.
3. Apply Newton's laws, D'Alembert's principle, and dynamic equilibrium to solve problems in kinetics of particles and rigid bodies.
4. Utilize work-energy and impulse-momentum principles to analyze particle dynamics and impact behavior in engineering applications.

Course Content

Module No.	Details	Hrs.
1	**Friction:** Laws of friction, angle of friction, angle of repose, cone of friction, Equilibrium of bodies on rough horizontal and inclined plane, application to problems involving wedges, ladder. Belt friction- flat belts on the flat pulleys (Only problems, no derivation of formula). **Self-Learning:** Derivation of formula for Belt friction- flat belts on the flat pulleys.	08
2	**Kinematics of particle:** Velocity and acceleration in terms of rectangular coordinate system, rectilinear motion, motion along plane curved path, tangential and normal component of acceleration, relative velocity, and projectile motion. (No derivations of formulas).	08
3	**Kinetics of particles:** Newton's laws of motion, D'Alembert's principle, equation of dynamic equilibrium, linear motion, curvilinear motion.	03
4	**Energy principles:**	04

	Work done by a force, potential and kinetic energy, power, workenergy equation, principle of conservation of energy.	
5	**Momentum Principles:** Momentum, impulse and momentum principle, principle of conservation of momentum, impact of solid bodies, elastic impact, semi-elastic impact and plastic impact.	05
	TOTAL	**28**

Text Books

1. N. H. Dubey (2017); "Engineering Mechanics Statics and Dynamics", McGraw Hill Education, ISBN 9780071072595, 800Pages
2. M. D. Dayal (2017); "Engineering Mechanics", Published by M. D. Dayal

Reference Books

1. B. N. Thadani (1966); "Engineering Mechanics", Asia Publishing House, ISBN0210269405, 655 pages.
2. Beer & Johnson (2013), "Engineering Mechanics", Tata McGraw Hill, ISBN1259062919, 470 pages.
3. F. L. Singer (1975), "Engineering Mechanics", Harper & Raw Publication, ISBN0060462329, 724 pages.
4. Shames (2006), 'Engineering Mechanics', Prentice Hall, India, ISBN 8177581236, 837pages.
5. K. L. Kumar (1998), "Engineering Mechanics", Tata McGraw Hill, ISBN 0070681813,673 pages.

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

PC-BTC201- Building Materials and Construction

Course Code	Course Name
PC-BTC201	**Building Materials and Construction**
Course pre-requisites	NA

Course Objectives

The objectives of this course are:

1. To introduce the students the components of a building and their functions
2. To understand different construction activities and methods of execution
3. To identify qualities of good materials used in construction

Course Outcomes

Upon successful completion of the course, students should be able

1. Identify and classify various structural and non-structural components of a building and select appropriate construction materials based on their properties and standards.
2. Explain standard construction methods, techniques, and procedures used in the execution of different parts of buildings.
3. Select suitable construction materials and supervise site execution ensuring quality, safety, and durability of built structures.
4. Prepare detailed and accurate drawings of different building components for use in construction documentation and interpretation.

Module No.	Details	No. of lecture
1	Building Materials Role of material in construction, Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks: Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick Earth, Different forms of bricks, Testing of bricks as per BIS. Defects of bricks. Blocks: Cement Concrete blocks, Stabilized Mud Blocks, Aerated concrete blocks, fly ash bricks /blocks, Sizes, and requirement of good blocks. Aggregates: Classification, Characteristics, Deleterious substances, Soundness, Alkali – aggregates reaction, Fine aggregates, Coarse aggregates, Testing of aggregates Lime: Impurities in limestone, Classification, Slaking and hydration, Hardening, Testing, Storage, Handling **Cement**:-Manufacture of Portland cement, Chemical composition, Hydration of cement, OPC: PPC, Slag cement. **Concrete:** Ingredients, production of concrete, W/C ratio, Workability measurement of workability, cohesion and segregation, bleeding, Mortars: Classification, Uses, Characteristics of good mortar, Ingredients. Cement mortar, Lime mortar, Lime cement mortar, special mortars,	**12**

	Wood and Wood Products: Classification of Timber, Structure, Characteristics of good timber, Seasoning of timber, Defects in Timber, Diseases of timber, Decay of Timber, Preservation of Timber Testing of Timber, Veneers and Laminates , Plywood, Fibre Boards, Particle Boards, Chip Boards , Black Boards, Button Board and Laminated Boards, Applications of wood and wood products Paints, Enamels and Varnishes: Water based and oil paints, Composition and characteristic of an ideal paint, preparation of paint, covering power of paints, Painting: Plastered surfaces, painting wood surfaces, painting metal Surfaces. Defects, Effect of weather, enamels, distemper, water wash and colour wash, Varnish , French Polish, Wax Polish, melamine Polish Miscellaneous Materials: Gypsum: Classification, Plaster of Paris, Gypsum wall Plasters, calcium silicate boards, Gypsum Plaster boards, Moisture resistant gypsum boards, cement boards Adhesives, Heat and sound insulating materials, Geosynthetics.	
2	Foundation: Function of Foundations, Essential requirement of good foundation, Types of structures based on load transfer, function and requirements of good foundation, preliminary investigation of soil, safe bearing capacity of soil, types of foundation - shallow foundations - introduction to spread, isolated, combined , strap, mat and deep foundations - pile foundation	03
3	Masonry Definition and terms used in masonry. Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Brick masonry: Definitions, Rules for bonding, Type of bonds – stretcher bond, Header bond, English bond, Flemish Bond, Comparison of English Bond and Flemish Bond (one and one and half brick thick wall) Types of walls; load bearing, partition walls, cavitywalls	05
4	Lintels, Arches, Floors And Roofs Definition, function and classification of lintels, balconies, chajja and canopy. Arches; elements and stability of an arch. Floors, requirement of good floor, components of ground floor, selection of flooring material, laying of Concrete, mosaic, marble, granite, tile flooring, cladding of tiles – skirting, dado. Roof, requirement of good roof, types of roof, elements of a pitched roof, trussed roof, king post truss, queen ost truss, steel truss, different roofing materials, RCC slab	03

5	Doors, Windows And Ventilators Location of doors and windows, technical terms, Materials for doors and windows, Panelled door Flush door, Collapsible door, Rolling shutter, PVC Door, Toughened glass door, sliding door, automated door Panelled and glazed Window, Bay Window, French window. Ventilators. Sizes as per IS recommendations Glazing systems - unitized, semi unitized, stick systems. Hardware and locking systems - Dead locks, mortice locks, regular or concealed door closers, hold open door closers, pivot systems, types of hinges, concealed latch, regular latch.	02
6	Stairs Definitions, technical terms and types of stairs, Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.	02
7	Plastering, Pointing And Painting Purpose, materials and methods of plastering and pointing, defects in plastering- Stucco plastering, lathe plastering Damp proofing- causes, effects and methods. Paints- Purpose, types, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.	03
8	Formwork Introduction to form work, types of formwork - scaffolding, shoring, under pinning, materials for formwork, requirement of good formwork	02

Term work
Term work shall comprise of To prepare drawings of following works: 1. Signs and Symbols required in civil engineering drawings 2. Types of foundations 3. Types of masonry bonds 4. Types of stairs 5. Types of doors and windows 6. Types of floors and roofs 7. Types of pointing 8. Types of Damp Proofing Course 9. Types of Electrical Fittings and Plumbing Fixtures 10. Elements of building construction – typical cross section of a two storied building showing foundation, plinth, wall, lintel, chajja, door and window.

Text Books
1. S. P. Bindra, S. P. Arora, Building Construction, Dhanpat Rai Publication, New Delhi, Fourth Edition, 1988. 2. M.G. Shah, C.M. Kale, S. Y. Patki, Building Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, Third Edition. 3. B. C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, Basic Civil Engineering, Firewall Media, 2003. 4. M. L. Gambhir, "Concrete Technology", Tata McGraw Hill Publications, 5. M. S. Shetty, "Concrete Technology", S. Chand Publication
Reference Books
1. Roy Chudley, Roger Greeno, Building Construction Handbook, Butterworth-Heinemann, Tenth Edition, 2006 2. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain., "Soil Mechanics and foundations", Laxmi Publications (P) LTD, March 2005.

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

BS- BTC251- Engineering Physics Lab

Course Code	Course Name
BS-BTC251	Engineering Physics Lab
Course pre-requisites	XII Physics, Engineering Physics theory

Course Objectives

1. To explain application of thin film interference using wedge shaped films
2. To explain application of Newton's rings interference setup to find Radius of curvature of a plano convex lens.
3. To explain Fraunhofer diffraction through a diffraction grating.
4. To explore crystal structures using basic unit cell properties.
5. To explore different crystal planes in Cubic structures.
6. To explain LASER diffraction.

Course Outcomes

1. Determine the thickness of a thin wire or paper using interference patterns produced by wedge-shaped films.
2. Measure the radius of curvature of a plano-convex lens using Newton's rings interference method.
3. Calculate the wavelength of spectral lines using Fraunhofer diffraction through a grating with a spectrometer.
4. Identify different cubic crystal structures by analyzing unit cell properties.
5. Examine and distinguish various plane orientations in cubic structures using planar atomic densities.
6. Analyze laser diffraction patterns using diffraction grating and determine wavelength of laser light.

Course Content

Module No.	Details	Hrs.
1	Demonstration of unit cell properties of different cubic structures.	2
2	Demonstration of important plane orientations and planar atomic densities of cubic planes.	2
3	Wedge Shaped films interference pattern.	2
4	LASER diffraction technique using a diffraction grating	2
5	Newton's Rings experiment.	2
6	Diffraction through a diffraction grating using a spectrometer.	2

Text Books:

1. Kshirsagar and Avadhanulu, 'A textbook of Engineering Physics', S. Chand Publications, 1992
2. A.S. Vasudeva, 'Modern Engineering Physics', S. Chand Publications (2008),
3. Hitendra K Malik and AK Singh , 'Engineering Physics', McGraw Hill Publications, (2013)
4. G Vijayakumari, 'Engineering Physics', Vikas Publishing house, (2006)

Reference Books:

1. Arthur Beiser , 'Concepts of Modern Physics', Tata McGraw Hill, 6th Edition, (2009)
2. Robert Eisberg, Robert Resnick , 'Quantum Physics of atoms, molecules, solids, nuclei and particles', Wiley India pvt. Ltd, 2nd Edition, (2006)
3. Charles Kittel, 'Introduction to Solid State Physics', John Wiley & Sons, 8th Edition, (2004)
4. S.O. Pillai, 'Solid State Physics', 6th Edition, New Age International Publishers, (2010)
5. K. Thyagarajan and AjoyGhatak , 'Lasers theories and application' Springer, 2nd Edition, (2006)

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

ES-BTC252- Engineering Graphics Lab

Course Code	Course Name
ES-BTC252	Engineering Graphics Lab
Course pre-requisites	Standard XII Physics and Mathematics

Course Objectives

1. To understand the fundamental principles of solid geometry
2. To understand the concepts of projections of 2D & 3D object.
3. To solve Engineering Graphics problems using Sketchbook & any CAD software
4. Develop skills in reading & interpretation (visualization) of Engineering Drawings
5. To develop competence in use of CAD as an effective tool for Engineering Graphics

Course Outcomes

Upon successful completion of the course, students should be able

1. Construct and analyze engineering curves, lines, planes, and solids using CAD software and traditional tools.
2. Identify and interpret the geometric properties and spatial relationships of 2D and 3D engineering objects.
3. Differentiate between the graphical representations of lines, planes, and solids in various projections.
4. Develop and interpret orthographic, isometric, and missing views using CAD tools for engineering visualization.

Course Content

- Introduction to any CAD
- Construction of Engineering Curves using Sketch Book and CAD tool
- Construction of Projection of Lines & Traces of lines using Sketch Book and CAD tool.
- Construction of Projection of Planes using Sketch Book and CAD tool
- Construction of Projection of Solids using Sketch Book and CAD tool
- Construction of Orthographic projections for simpleparts using CAD tools.
- Construction of Isometric projections for parts usingCAD tool.

***Minimum 03 problems are expected to be constructed on each module using CAD software tools**

References-

1. N.D.Bhatt,'Elementary Engineering Drawing',Charotar Publishing House,
2. T.Jeyapovan, 'Engineering Drawing and Graphics, Vikas Publishing House
3. K.L.Narayana & P.Kannaiah, 'Engineering Graphics', Tata McGraw-Hill
4. Schmalstieg/Hollerer, 'Augmented Reality: Principles & Practice'

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

PC-BTC253- Material Testing

Course Code	Course Name
PC-BTC 253	**Material Testing & Evaluation Lab.**
Course pre-requisites	Building materials and construction

Course Objectives

The objectives of this course are
1. To investigate the behavior of an elastic member subjected to compression, flexure, abrasion etc. and
2. To investigate various physical properties of cement.

Course Outcomes

Upon successful completion of the course, students will be able to

1. Conduct standard laboratory tests to determine the physical and mechanical properties of construction materials such as bricks, tiles, timber, cement, and concrete elements, and interpret the results in accordance with Indian Standards.

Course Content

Sr. No.	List of Experiments
1	Water absorption and compression test of bricks.
2	Water absorption and transverse load test on tiles
3	Moisture content and flexural strength test on timber.
4	Compression test on timber (Parallel / perpendicular to the grains).
5	Physical properties of cement: Fineness, consistency, Setting time, Soundness, Compressive strength.
6	Compression test on Paver blocks
7	Water absorption, density and compression test on masonry blocks
8	Abrasion test on tiles

For Self-study (if any):

Text Books:

1. S. S. Bhavikatti (2012); “Building Materials”, Vikas Publishing House Pvt Ltd.ISBN- 13: 978-9325960442. 488p.
2. Rangwala (2012);"Engineering materials”, Charotar Publications. ISBN-13: 978- 9380358796.
3. S.K. Duggal (2010); “Building Materials”, New Age International Publishers. ISBN- 13: 978-8122433791. 616p.
4. Varghese P. C (2005); “Building Materials” PHI. ISBN-13: 978-8120328488. 180p.
5. M. Gambhir (2011); “Building Materials Products, Properties and Systems” McGraw Hill Education (India) Private Limited. ISBN-13: 978-0071077606.
6. IS codes of different materials, BIS publications.

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

VS-BTC201- Civil Workshop

Course Code	Course Name
VS-BTC201	**Workshop Practice – II**
Course pre-requisites	Basic Sciences of XII or Diploma

Course Objectives

The objectives of this course are

1. To impart skill-based knowledge to students about types workshop in engineering.
2. To give "hands on" training and practice to students for use of various tools, devices, machines in the workshops.
3. To develop ability of students to understand, plan and implement various processes and operations to be performed on the raw material to create object of desired shape and size.
4. To impart knowledge on various safety standards practiced while working in different types of workshops.

Course Outcomes

Upon successful completion of this course student will be able to:

1. Identify and operate common engineering tools, equipment, and machines in specialized workshop settings.
2. Apply standard procedures for basic operations in trades such as welding, masonry, sheet metal work, and electrical wiring.
3. Follow safety standards and protocols in workshop environments during mechanical and electrical tasks.
4. Interpret technical drawings and electrical circuits to fabricate basic mechanical components or complete simple electrical assemblies.

Course Content

Module No.	Details	Hrs.
01	Welding: • Edge preparation for welding jobs, arc welding, demonstration on different types of joints such as Lap Welding and Butt Welding.	08
02	Sheet Metal with usage of Power Tools: • One job on Sheet metal working having operations like planning the development, cutting as per development, bending etc. to complete the job. • Above job will be completed using power tools like Hand Drill, Hand Grinder, and Chop saw.	08
03	Pipe Fitting: • Demonstration of various pipe fittings and its functions. • Connecting the pipe fittings as per given piping network.	08
04	Masonry and Bar Bending: • Skills to use of masonry tools like trowels, hammer, spirit level, square, plumb line and pins etc. • Demonstration of mortar making, single and one and half brick masonry, English and Flemish bonds, block masonry, pointing	08

	and plastering, Bar bending.	
05	Advance Electrical Workshop I: • Wiring, control and maintenance of domestic appliances like Mixer machine, Electric Iron, fan, motor, etc. • Energy measurement and understanding electricity billing. • Electrical Installations demonstration: Components of LT Switchgear such as Switch Fuse Unit (SFU), MCB, ELCB, Types of Wires and Cables, different types of batteries. • Study of Electric shock phenomenon, precautions, preventions, Earthing.	08
06	Advance Electrical Workshop II: • Study of estimation and costing of wiring. • Wiring of Motor starters • Energy measurement and tariff calculation • Familiarization of electronic components, colour code, multimeters. • Bread board assembling- given electronic circuit. • Soldering practice-any one circuit. • PCB wiring and fault Identification of appliances like Electronic Ballast, fan regulator, inverter, UPS.	08

Instructions

Department can select any three trades in the semester of their specialization trades.

Term Work

Term work shall comprise of

The evaluation will be based on the skills learned while completing the job in each workshop trade and

the submission of the job/Journal/report on demonstration.

Text Books

1. S. K. & A. K. Hajra Choudhary, "*Workshop Technology, Vol. I, II*", Media promotors and publishers pvt. Limited, 2007.
2. R. S. Khurmi, J. K. Gupta, "A Textbook of Workshop Technology (Manufacturing Processes)", S Chand & Company Pvt. Ltd. 2008.
3. K. B. Raina & S. K. Bhattacharya, Electrical Design Estimating and costing, New Age International Publishers, New Delhi, 2005.
4. Uppal S. L., Electrical Wiring & Estimating, Khanna Publishers---5th edition, 2003.
5. John H. Watt, Terrell Croft American Electricians' Handbook: A Reference Book for the Practical Electrical
6. Man, 9th ed. McGraw-Hill, 2002.
7. G. Randy Slone, Tab Electronics Guide to Understanding Electricity and Electronics, 2nd ed. McGraw-Hill, 2000.
8. Jerry C Whitaker, The Resource Handbook of Electronics, CRC Press-2001.

Online Reference Material

1. https://www.youtube.com/watch?v=ZLWZlyLa00Y (Video in Marathi Language).
2. https://www.youtube.com/watch?v=NELhcl_23vs (Video in Hindi Language).
3. https://www.youtube.com/watch?v=mP7zbTGV_rI
4. https://www.youtube.com/watch?v=3XGt-p-hpdU

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

AE-BTC201- Communication Skills

Course Code	Course Name
AE-BTC201	**Communication Skills**
Course pre-requisites	Standard XII English

Course Objectives

1. To learn the basics of grammar so as to help improve communication and speak a neutral and correct form of English so as to acquire proficiency in language and technical vocabulary.
2. To make the learners capable of understanding the importance of communication and understand the verbal and non-verbal forms of communication so as to create an understanding of the barriers to communication and to overcome them in the Social and Professional sphere.
3. To acquaint the students with channels of communication in an organization and use them effectively in professional world.
4. To guide and teach the students the appropriate language skills with the purpose of improving the existing LSRW, and make the student proficient in public speaking and presentation skills
5. To make the learner capable of creating official correspondences through principles of business correspondence for effective communication in the global world

Course Outcomes

Upon successful completion of the course, students should be able

1. Summarize technical texts and journal articles using an expanded technical vocabulary and enhanced reading comprehension skills.
2. Explain communication models, processes, and barriers, and distinguish between verbal and non-verbal communication forms.
3. Compose effective business and technical correspondence including emails, blogs, and formal documents tailored to professional contexts.
4. Demonstrate proficiency in listening, speaking, reading, and writing (LSRW) skills and interpersonal communication strategies for professional engagement.
5. Identify and analyze various communication channels within an organization to facilitate effective internal and external communication.

Course Content

Modules No.	Details	Hrs.
1	**Building advanced vocabulary:** Common errors, Pairs of confused words, Enriching vocabulary through Synonyms, antonyms, words through situations, one word substitution, comprehending technical passages, GRE passages, journal papers, articles to test the analytical skills and expression.	06
2	**Fundamentals of Communication:** Meaning, Definitions, Components, Objectives, Importance of	09

	communication, Purpose of Professional Communication, Barriers to Communication (Cultural, Semantic, Psychological, physical, mechanical, organizational), Different Forms of Communication: Verbal, Non-Verbal, Intrapersonal	
3	**Techniques to Improve Communication:** • Reading Skills – Barriers to Reading and Techniques to improve reading • Speaking Skills – Voice Modulation, Good Pronunciation, -Speaking without Fear, -Extempore & Prepared Speaking, Role play in different Situations. • How to present effective speeches through Talk power Program – Storytelling. Story Writing – Daily story writing (approx. 100 words) to inculcate the practice of structured writing. • Listening Skills – Barriers to Listening, Listening & Note taking. • Writing Skills – Barriers and Techniques to writing skills	05
4	**Business Writing: Letters (Introduction), Emails, Netiquette & Story Writing** • Principles of Business Correspondence, Routine letters, Business Correspondence: (Letter Writing) Introduction, Importance, Layout, Elements of style and Language, Types of formats-3, Types of letters: Routine letters, Enquiry and Reply, Order, Complaint and Adjustments, Sales Letters. • Emails – Tailoring effective email writing for different audiences: Senior Managers, Managers, and Team Members.	06
5	**Communication Channels in an Organization:** Different types of communication flow: Internal, External, Upward, Downward, Horizontal, Grapevine, Problems and Solutions.	04

Tutorial work:

- **Assignments:**
  1. 2 assignments on Summarization and Comprehension, One word substitute
  2. 3 assignments on techniques to improve communication
  3. 3 practical sessions through public speaking, Speeches and Presentation
  4. 3 assignments on Communication Theory, Case Study, Communication in a business environment
  5. 2 assignments on Business writing
  6. Group Activity and role play
  7. Daily story writing in 100 words for a period of 1 month

Text Books and Reference Books

Sr. No.	Text Book Titles	Author/s	Publisher	Edition	Module Nos.
1	Communication in Organizations	Dalmar Fisher	Jaico Publishing House	2nd	1

2.	Business Communication: Connecting at work	Hory Shankar Mukherjee	Oxford University Press	1st	All
3	Communication Skills	Meenakshi Raman & Sangeeta Sharma	Oxford University Press	1st	1
4	Business Correspondence & Report-writing	R.C. Sharma & Krishna Mohan	Tata McGraw Hill	2nd	2
5	Effective Technical Communication	Ashraf Rizvi	Tata McGraw-Hill	1st	5
6	Technical Writing & Professional Communication for non-native speakers of English	Thomas N. Huckin & Leslie A. Olsen	McGraw Hill	2nd	5
7	Mastering Communication	Nicky Stanton	Palgrave Master Series	3rd	1

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

IK-BTC201- Indian Traditional Knowledge

Course Code	Course Name
IK-BTC201	**Indian Traditional Knowledge**
Course pre-requisites	Higher Secondary Education

Course Objectives

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course provides an introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system. The course also provides offers an overview of Indian philosophical traditions, Indian linguistic Tradition, and Indian artistic tradition.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Explain the foundational principles and value systems embedded in Indian traditional knowledge.
2. Describe key aspects of India's traditional healthcare systems, technologies, and scientific heritage.
3. Identify the significant features of Indian artistic, linguistic, and philosophical traditions.
4. Relate traditional Indian knowledge systems with modern scientific perspectives and sustainability concepts.

Course Content

Module No.	Details	Hrs.
1	**Indian Tradition:** Fundamental unity of India, India‟s heroic role in world civilization, The Indian way of life, Introduction to Indian tradition, The Scientific Outlook and Human Values.	04
2	**Basic structure of Indian Knowledge System:** Indian Traditional Scriptures, Exposure to 4-Vedas, 4-Upvedas (Ayurveda, Dhanurveda, Gandharvaveda, Sthapatya etc.), 6-Vedangas (Shiksha, Kalp, Nirukta, Vyakaran, Jyotish), 6-Upangas (Dharmashastra, Meemansa, Puranas, Tarkashastra/Logic) etc.	06
3	**Indian Knowledge System and Modern Science:** Relevance of Science and Spirituality, Science and Technology in Ancient India, Superior intelligence of Indian sages and scientists.	04
4	**Indian Traditional Health Care:** Importance and Practice of Yoga, Pranayam and other prevailing health care techniques.	04

5	**Indian Artistic Tradition:** Introduction and overview of significant art forms in ancient India such as painting, sculpture, Civil Engineering, Architecture, Music, Dance, Literature etc.	06
6	**Indian Linguistic Tradition:** Ancient Indian languages and literary Heritages, Phonology, Morphology, Syntax and Semantics.	04
7	**Indian Philosophical Tradition:** (Sarvadarshan)- Nyay, Viaishepik, Sankhya, Yoga, Meemansa, Brief understanding of Philosophy of Charvaka, Bhagwan Mahaveer Jain, Bhagwan Buddha, Kabeer, Guru Nanak Dev and other eminent	04

Term Activities
The Term Activities will consist of one assignment on each module, group discussions, presentations, case study on various topics based on above curriculum. Required attendances, involvement in academic activities related to course and overall conduct carry weightage.

Text Books:

1. Ajwani L.H., *Immortal India*, Vora & Co. Publishers, 1997.
2. Swami Jitatmananda, *Modern Physics and Vedanta*, Bharatiya Vidya Bhavan, 2004.
3. Krishnamurthy, V. *Science and Spirituality- A Vedanta Perception,* Bharatiya Vidya Bhavan, 2002.
4. Sharma D.S., The Upanishadas- An Anthology, Bharatiya Vidya Bhavan, 1989.
5. Raman V.V., *Glimpses of Indian Heritage,* Popular Prakashan,1993.

Reference Books:

1. Sivaramakrishnan, V., *Cultural Heritage of India- Course Material*, Bharatiya Vidya Bhavan, Mumbai 5_{th} Edition, 2014.
2. Capra F., Tao of Physics, Shambhala, 2010.
3. Chaterjee S.C. and Datta D.M., *An Introduction to Indian Philosophy*, University of Calcutta, 1984.
1. Krishna Chaitanya, *Arts of India*, Abhinav Publications, 1987.
2. Jha V.N., *Language, Thought and Reality*

Sardar Patel College of Engineering,
Andheri (West), Mumbai 400058

Co-Curricular Activity II