

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: 2024-2025

Regulation 23

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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		
<ol style="list-style-type: none"> 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		
<ol style="list-style-type: none"> 1. Evaluate partial derivatives and apply it to estimate maxima and minima of multivariable function. 2. Define complex numbers in Cartesian and polar form, compute exponential and integrals powers of complex numbers. To apply De-Moivre's theorem to determine roots of polynomial and express hyperbolic, inverse hyperbolic functions. 3. Solve system of simultaneous linear equations, find roots of algebraic equations and evaluate definite integrals using numerical methods. 		
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's 1/3rd 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, 30th 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, 43rd Edition, ISBN 8174091955, 1315 Pages

Reference Books:-

Erwin Kreyszig (2010), "Advanced Engineering Mathematics" Wiley Eastern Limited, Singapore 10th 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

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		
<ol style="list-style-type: none"> 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		
<ol style="list-style-type: none"> 1. Analyse process of corrosion and its protection methods 2. Analyse water quality and application of water 3. Able to identify high performance materials 4. Able to characterize material with different techniques 		
Course Content		
Mod ule 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 - 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	08

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	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		
<ol style="list-style-type: none"> 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		
<ol style="list-style-type: none"> 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 7. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan 		

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		
<p>The objectives of this course are</p> <ol style="list-style-type: none"> 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		
<p>Upon successful completion of the course, students should be able</p> <ol style="list-style-type: none"> 1. To apply laws and theorems for analysing DC and AC electrical circuits. 2. To explain the working principle of electrical machines. 3. To explain the basics of rectifiers ,inverters ,filters and transistors. 4. To understand the working of sensors and transducers. 		
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

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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.

ES-BTC102- Engineering Mechanics-I

Course Code	Course Name
ES-BTC102	Engineering Mechanics-I

Course pre-requisites	Standard XII Physics
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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. Understand types of forces and apply the concept of equilibrium, resolution and composition to coplanar forces
2. Analyse statically determinate pin jointed frames
3. Find the centroid and moment of inertia of plane areas.
4. Analyse determinate beams using the principle of virtual work.

Course Content

Module No.	Details	Hrs.
1	<p>System of Coplanar forces: Introduction to coplanar & non-coplanar force system. Forces and their components. Moment of the force about a point, couple.</p> <p>Resultant of coplanar force system: Resultant of concurrent forces, parallel forces, non-concurrent non-parallel system of forces. Varignon's theorem.</p>	07
2	<p>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.</p>	07
3	<p>Analysis of pin jointed frame / truss: Perfect truss, Imperfect truss, Analysis of truss by method of joints and method of sections.</p>	05
4	<p>Principle of virtual work: Application to determine the reactions of determinate beams with / without internal hinges.</p>	03

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5	<p>Centroid of Plane Areas: Concept of centroid of plane areas. Problems on centroid of composite areas.</p> <p>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.</p>	06
TOTAL		28

Text Books
<ol style="list-style-type: none"> 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
<ol style="list-style-type: none"> 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 & Row 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.

BS-BTC103- Biology for Engineers

Course Code	Course Name	
BS-BTC103	Biology for Engineers	
<i>Course pre-requisites</i>	NA	
<i>Course objectives</i>		
<ol style="list-style-type: none"> 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 		
<i>Course Outcomes</i>		
<p>At the end of the course the student will be able to:</p> <ol style="list-style-type: none"> 1. Understand basic biological concepts required to engineer application related to problems associated in biology 2. Evaluate the principles of design and development, for exploring novel bioengineering projects. 3. Corroborate the concepts of biomimetic for specific requirements. 4. Think critically towards exploring innovative bio based solutions for socially relevant problems. 		
<i>Module No.</i>	<i>Details</i>	<i>No. of Lectures</i>
1.	<p>Introduction Requirement of engineers to study biology, Origin of life, Evolution and cells</p> <p>Biomolecules Lipids, Carbohydrates, water, amino acids, proteins, enzymes, nucleotides.</p>	2
2.	<p>Cell structure, Function and Genetics Prokaryotes and Eukaryotes, Cell cycle and Cell growth : Mitosis, meiosis, culture growth, Mendeleevian Genetics</p>	3
3	<p>DNA DNA structure, DNA Replication, transcription and translation</p>	3

4	<p>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.</p>	3
5	<p>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)</p>	3
<p>References books</p> <ol style="list-style-type: none"> 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 <p>Online Websites</p> <ul style="list-style-type: none"> • 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 		

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 Carryout hardness of water sample and able to remove by using suitable method
- 2 Find out composition of metals in different alloy
- 3 Prepare and characterize new composite material
- 4 Measure molecular/system properties such as flash point/ fire point, conductance of solutions, redox potentials.

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

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. Develop collaborative skills to work in a team/group.
2. Experimentally verify the principles of statics (mechanics).

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	
<ol style="list-style-type: none"> 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	
<p>Upon successful completion of the course, the students will have</p> <ol style="list-style-type: none"> 1. Ability to apply circuit theorems for DC circuit analysis. 2. Analyse AC circuits and determine different circuit parameters. 4. To understand the construction and working of machines. 3. To understand the functioning of electronic devices and to measure physical parameters using Sensors and Transducers. 	
Course Content	
List of suggested experiments-	
<p>Lab- Hardware experiments (Any eight to ten experiments from following list)</p> <ol style="list-style-type: none"> 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 India Pvt. 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

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 successful products or enterprises		
Course Outcomes		
At the end of the course the student will be able to: 1. Identify an Opportunity from a Problem 2. To frame a Product/Service Idea 3. Empathize with the customers 4. Design and develop a Prototype 5. Pitch their idea		
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		
<ol style="list-style-type: none"> 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		
<p>Upon successful completion of the course, the students will be able to</p> <ol style="list-style-type: none"> 1. Construct programs using Control Structures. 2. Implement the use of functions and Arrays in C++ language. 3. Carry out programming using different features of OOPs. 4. Apply debugging to already existing codes 		
Course Content		
Module No	Details	Hrs
1.	<p>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.</p> <p>Skill to be developed:</p> <ol style="list-style-type: none"> 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.	<p>Control Structure: Conditional execution Iteration Looping</p> <p>Skill to be developed:</p> <ol style="list-style-type: none"> 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.	<p>Functions: Defining Functions- Procedural decomposition of problems, localizing variables, parameter passing– value and reference, return values.</p>	6

	<p>Special Functions Concepts: Recursive functions</p> <p>Skill to be developed:</p> <ol style="list-style-type: none"> 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.	<p>Introduction to Data Structures Arrays – one-dimensional, Multidimensional Strings</p> <p>Skill to be developed:</p> <ol style="list-style-type: none"> 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.	<p>Introduction to Object Oriented Programming Object Oriented Language concepts – classes, objects, Constructor and Destructors. Inheritance – Access specifiers, Types of Inheritance with examples.</p> <p>Skill to be developed:</p> <ol style="list-style-type: none"> 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.	<p>Features of Object Oriented Programming Compile time polymorphism Introduction to Runtime Polymorphism.</p> <p>Skill to be developed:</p> <ol style="list-style-type: none"> 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 Publishing Company 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 Bhawe and Sunil Patekar (2012), "Object- Oriented Programming with C+ + , Pearson Education, 1 st Edition, ISBN 8131798585, 688 Pages.
2. Robert Lafore (2001), "Object-Oriented Programming in C++", Sams Publishing 4 th Edition, ISBN 0672323087, 1040 Pages

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. Know various tools, machines, devices used in engineering practice for creating objects from raw material.
2. Know various operations in basic engineering shops and electrical circuitry and appliances.
3. Know various safety precautions to be taken before, during and after the various basic engineering operations.
4. Interpret job drawings and electrical circuitry, plan and execute processes and operations to produce basic components and basic electrical circuits.

Course Content

Module No.	Details	Hrs.
01	Fitting: - <ul style="list-style-type: none"> • Use and settings of fitting hand tools for marking, chipping, cutting, filing, centre punching, hammering, drilling, tapping. • Term work to include one job: - Male –female joint involving above operations. 	08
02	Carpentry:- <ul style="list-style-type: none"> • Use of planning tool, Table saw, hand saw, mortise tool, marking tools, chisel and mallet. • Term work to include one job: Cross Lap Joint involving above carpentry tools. 	08

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03	<p>Forging / Smithy: -</p> <ul style="list-style-type: none"> • 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	<p>Electrical Workshop: -</p> <ul style="list-style-type: none"> • Electrical Board Wiring: - House wiring, Staircase wiring, Go-down wiring, Single phase Fan connection, Three phase connection for electrical motors. • Demonstration of fluorescent tube light connection. • 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 promoters 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).

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		
<ol style="list-style-type: none"> 1. Demonstrate a set of practical skills such as self-management, and learn to make a positive and favorable impression 2. Train their mind to think rationally and logically and help a person to deliberate upon moral principles 3. Become conscious practitioners of righteousness and deepen understanding of the ultimate goal in life 4. Realize their potential as human beings and conduct themselves properly in the ways of the world 		
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

CC-BTC101- Co-Curricular Course Yoga

Course Code CC-BTC101	Course Name: Yoga	
Course Objectives		
The main objectives of the course are		
<ol style="list-style-type: none"> 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		
<ol style="list-style-type: none"> 1. Establish an overall Mind, Body & Breathe Alignment 2. Develop a true form of own self-weight exercises through the asana series 3. Maintain overall physical health through forms & balanced diet 4. Establish an increase in the range of motion & Self-awareness & mindfulness 5. Cultivate a positive Mindset and Conscious approach towards any situation 		
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, Kapalbhathi 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 Kapalbhathi Pranayama in these Twisting Asanas Learning the technique of Yogic Bandhas & applying it during the meditation	02

	Five Norms of Social & Personal Living Eight Limbs of Ashtanga Yoga	
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=aFymgVHh2aKluNye>

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Bharatiya Vidya Bhavan's
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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		
<ol style="list-style-type: none"> 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		
<ol style="list-style-type: none"> 1. Apply the knowledge of first order and higher ordinary differential equation in different engineering applications. 2. Set up and evaluate multiple integrals for regions in the plane. 3. Find Area of the region bounded by curves and to find volume and Mass of solid geometric figures. 		
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:

5. Richard Bronson (2010), “Schaum’s Outline of Differential Equations”, McGraw Hill Education; 4th edition ISBN 978-0071824859, 408 pages
6. Shanti Narayan (2005), “Integral Calculus”, S.Chand Publications, 35th Edition, ISBN 8121906814, 360 Pages
7. Vinod Kumar Sharma “Applied Mathematics-II” 2nd edition Tech Max Publications
8. 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		
<ol style="list-style-type: none"> To explain particle related properties of waves and wave related properties of particles, introduce students to Quantum mechanics basic concepts. To explain Schrodinger's time dependent and time independent equations. To explore different crystal structures, crystal plane orientations in cubic structures, and determine crystal properties using X-rays. To examine various ways of producing ultrasonic waves and its applications. To explain working principles of LASERs and optical fibres. 		
Course Outcomes		
<ol style="list-style-type: none"> Learn basic differences between Newtonian mechanics and Quantum mechanics, analyse particle properties of waves and wave nature of particles from different experiments, concept of wave function and analyse Heisenberg's uncertainty principle with the aid of examples. Learn Schrodinger's time dependent and time independent equations and applications of these equations. Explain types of crystal structures using unit cell properties and crystal planes in cubic structures and learn the application of X-rays for determining these crystal structures and crystal planes. Learn principles of production of ultrasonic waves using magnetostriction and piezoelectric methods and various applications related to ultrasonics. Explain different absorption and emission processes, population inversion condition and pumping schemes which differentiate LASERs from normal light sources and explain working of certain LASERs using these concepts and further explain application of LASERs in holography. Explain working principle of optical fibres and its 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	<p>Ultrasonics Principles of production, piezoelectric and magnetostriction effects, piezoelectric and magnetostriction oscillators, ultrasonic materials – quartz and ferroelectric materials. Applications: Echo sounding, Non-Destructive Techniques</p>	5
5	<p>Fiber optics communication and LASER: Optical fiber: Propagation of light in an optical fiber- TIR, Angle of Acceptance; Numerical Aperture; Types of Optical Fibers; Advantages of Optical Fiber, Applications. LASER: Absorption, spontaneous and stimulated emission, Einstein's coefficients. Terms Associated with Lasers: population inversion, metastable state, pumping and pumping schemes, active medium, and resonant cavity. Ruby laser, He-Ne Laser, Nd:YAG laser. Applications.</p>	5

For Self-study :

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)

ES-BTC201- Engineering Graphics

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

Course Objectives
<ol style="list-style-type: none"> 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
<p>Upon successful completion of the course, students should be able</p> <ol style="list-style-type: none"> 1. Students will be able to draw & solve the problems on curves, lines, planes, solids 2. Students will be able to identify the various geometries. 3. Students will be able to differentiate line, planes, solids etc. 4. Students will able to practice & interpret the drawing of orthographic, isometric, missingviews using any CAD software.

Course Content		
Module No.	Details	Hrs.
1	Lines, Lettering, Dimensioning and Scales. Engineering Curves: Conics - Parabola, Ellipse and Hyperbola. Involutcs, 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 simple parts using CAD tools.
- Construction of Isometric projections for parts using CAD 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 of India Pvt.Ltd
4. M.B.Shah & B.C.Rana, 'Engineering Drawing', Pearson Education
5. M.L. Dabhade, 'Engineering Graphics', Association of Technical Authors,

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		
<ol style="list-style-type: none"> To introduce the students to the principles and methods of dynamics (mechanics), and to apply those fundamentals to solve the problems on dynamics. To prepare the base for the students to study other engineering/structural engineering courses at a later stage. 		
Course Outcomes		
Upon successful completion of the course, students shall be able to develop analytical skills:		
<ol style="list-style-type: none"> Analyse and solve problems related to friction between surfaces To solve the problems on kinematics of particles. To solve the problems on kinetics of particles and kinetics of rigid bodies. 		
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: Work done by a force, potential and kinetic energy, power, work	04

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	energy 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, ISBN 0210269405, 655 pages.
2. Beer & Johnson (2013), “Engineering Mechanics”, Tata McGraw Hill, ISBN 1259062919, 470 pages.
3. F. L. Singer (1975), “Engineering Mechanics”, Harper & Row Publication, ISBN 0060462329, 724 pages.
4. Shames (2006), ‘Engineering Mechanics’, Prentice Hall, India, ISBN 8177581236, 837 pages.
5. K. L. Kumar (1998), “Engineering Mechanics”, Tata McGraw Hill, ISBN 0070681813, 673 pages.

Sr. N o.	Examination	Module
1	T-I	1
2	T-II	2
3	End Sem	1 to 5

PC-BTC201- Building Materials and Construction

Course Code	Course Name
PC-BTC201	Building Materials and Construction

Course pre-requisites	NA
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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 different elements or components (structural and non-structural) of a building and recognizing good materials to be used for the construction work of a building
2. Define the methods, procedures and techniques of construction of a building
3. Select the materials, design and supervise the construction work and take suitable measures
4. Draw the details of various elements or components (structural and non-structural) of a building.

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, 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	12

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	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.

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 setup theory related laboratory experiments on optics, Lasers and semiconductors so as to apply his/her theoretical knowledge to a practical situation.		
Course Outcomes		
1. Explain unit cell properties of different crystal structures studied in the theory. 2. Identify different crystal plane orientations. 3. Calculate the velocity of sound in a given medium using ultrasonic interferometer. 4. Explain Hall effect in semiconductors. 5. Explain LASER diffraction. 6. Optical Fibre communication technique/ Optical techniques of interference (Newton's rings setup) to find wavelength of sodium light source.		
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	Hall effect in semiconductors	2
4	Ultrasonic interferometer- measuring velocity of ultrasonic waves in a given medium.	2
5	Optical Fibre communication technique/ Optical techniques of interference (Newton's rings setup) to find wavelength of sodium light source.	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)

ES-BTC252- Engineering Graphics Lab

Course Code	Course Name
ES-BTC252	Engineering Graphics Lab
Course pre-requisites	Standard XII Physics and Mathematics
Course Objectives	
<ol style="list-style-type: none"> 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	
<p>Upon successful completion of the course, students should be able</p> <ol style="list-style-type: none"> 1. Students will be able to draw & solve the problems on curves, lines, planes, solids 2. Students will be able to identify the various geometries. 3. Students will be able to differentiate line, planes, solids etc. 4. Students will be able to practice & interpret the drawing of orthographic, isometric, missing views using any CAD software. 	
Course Content	
<ul style="list-style-type: none"> • 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 simple parts using CAD tools. • Construction of Isometric projections for parts using CAD tool. <p>*Minimum 03 problems are expected to be constructed on each module using CAD software tools</p>	

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'

PC-BTC253- Material Testing

Course Code	Course Name
PC-BTC 253	Material Testing & Evaluation Lab.

Course pre-requisites	Building materials and construction
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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. Experimentally determine the various material properties and physical properties of cement.

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.

VS-BTC201- Civil Workshop

Course Code	Course Name
VS-BTC201	Workshop Practice – II

Course pre-requisites	Basic Sciences of XII or Diploma
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Course Objectives		
The objectives of this course are		
<ol style="list-style-type: none"> To impart skill-based knowledge to students about types workshop in engineering. To give “hands on” training and practice to students for use of various tools, devices, machines in the workshops. 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. 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:		
<ol style="list-style-type: none"> Know various department specific tools, machines, devices used in engineering practice for creating objects from raw material. Know various department specific operations in basic engineering shops and electrical circuitry and appliances. Know various safety precautions to be taken before, during and after the various basic engineering operations. Interpret job drawings and/or electrical circuitry, plan and execute processes and operations to produce basic components and/or basic electrical circuits. 		
Course Content		
Module No.	Details	Hrs.
01	Welding: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> Demonstration of various pipe fittings and its functions. Connecting the pipe fittings as per given piping network. 	08
04	Masonry and Bar Bending: <ul style="list-style-type: none"> 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

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	and plastering, Bar bending.	
05	Advance Electrical Workshop I: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 promoters 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.

Reference Books

1. G. Boothroyd & W.A. Knight, “*Fundamental of Machining and Machine Tools, third edition*”, CRC.
2. W. A. J. Chapman, “*Workshop Technology- Part I, II and III*”, Edward Arnold.
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_rl
 4. <https://www.youtube.com/watch?v=3XGt-p-hpdU>
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AE-BTC201- Communication Skills

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

Course Objectives		
<ol style="list-style-type: none"> 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		
<p>Upon successful completion of the course, students should be able</p> <ol style="list-style-type: none"> 1. Read, write and summarize technical articles, journal papers effectively with the help of expanded technical vocabulary. 2. Understand the communication process, models & barriers to effective communication. 3. Communicate result-oriented writing through Emails, Blogs, and Technical Writing. Business writing, storytelling, both within and outside organization. 4. Students will inculcate effective listening, writing, reading and speaking skills (LSRW) and be equipped to express effective interpersonal skills. 5. Types and channels of communication in an organization. 		
Course Content		
Modules	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

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	communication, Purpose of Professional Communication, Barriers to Communication (Cultural, Semantic, Psychological, physical, mechanical, organizational), Different Forms of Communication: Verbal, Non-Verbal, Intrapersonal				
3	<p>Techniques to Improve Communication:</p> <ul style="list-style-type: none"> • 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	<p>Business Writing: Letters (Introduction), Emails, Netiquette & Story Writing</p> <ul style="list-style-type: none"> • 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	<p>Communication Channels in an Organization: Different types of communication flow: Internal, External, Upward, Downward, Horizontal, Grapevine, Problems and Solutions.</p>	04			
<p>Tutorial work:</p> <p>➤ Assignments:</p> <ol style="list-style-type: none"> 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	2 nd	1

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

IK-BTC201- Indian Traditional Knowledge

Course Code	Course Name
IK-BTC201	Indian Traditional Knowledge

Course pre-requisites	Higher Secondary Education
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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 basics of Indian tradition and Indian traditional knowledge systems.
 2. Describe basics of Indian traditional health care, technologies and its scientific perspectives.
 3. Explain basics of Indian artistic, linguistic and philosophical tradition.
 4. Co-relate the Indian traditional knowledge in modern scientific perspective

Course Content

<i>Module No.</i>	<i>Details</i>	<i>Hrs.</i>
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, Vaishepik, 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 5th 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*

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Co-Curricular Activity II

