Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

Government Aided Autonomous Institute under Mumbai University
Andheri (W), Mumbai - 400058

COURSE CONTENTS

FIRST YEAR
MECHANICAL ENGINEERING

SEMESTER –I & II

Academic Year: 2025-26

Regulation 23

LIST OF COURSES

BS-BTM 101: Differential Calculus & Complex Numbers

Course Code	Course Name
BS-BTM 101	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 concepts of partial differentiation to analyze functions of several variables and determine extreme values using Lagrange multipliers.
2. Represent and operate on complex numbers in Cartesian and polar forms, and apply De-Moivre's theorem to solve polynomial equations and express trigonometric and hyperbolic functions.
3. Employ numerical techniques such as interpolation, root-finding algorithms, and integration methods to solve algebraic equations and systems of linear equations with engineering relevance.

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 $\cos\theta$. Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of $\sin(n\theta)$, $\cos(n\theta)$.	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:
1. Shanti Narayan (2005), "Differential Calculus", S.Chand Publications,30th Edition, ISBN8121904714, 572 Pages
2. Kandasamy (2006), "Numerical Methods" S Chand & Company, ISBN 978-8121914383,640 Pages
3. B S Grewal (2014), "Higher Engineering Mathematics", Khanna Publications, 43rdEdition, ISBN 8174091955, 1315 Pages

Reference Books:
1. Erwin Kreyszig (2010), "Advanced Engineering Mathematics" Wiley Eastern Limited,Singapore 10th edition
2. M K Jain, S R K Iyengar, R K Jain (2020) "Numerical Methods: Problems And Solutions"New Age International Private Limited

BS BTM102: Engineering Physics

Course Code	Course Name
BS BTM102	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 analyze basic working principles and interpret basic properties of thin film interference and diffraction.   4. To analyze basic working principles of semiconductors and learn Physics behind them.   5. To explain working principles of LASERs and optical fibers.

Course Outcomes
At the end of the course the students shall be able to: 1. Distinguish between Newtonian and quantum mechanics; interpret wave-particle duality and apply Heisenberg's uncertainty principle to microscopic systems.   2. Solve time-dependent and time-independent Schrödinger equations and analyze their applications to quantum systems such as potential wells.   3. Analyze interference and diffraction patterns formed by thin films, single slits, and gratings, and apply these principles in wave optics.   4. Explain crystal structures and planes using unit cell geometry, and apply X-ray diffraction techniques to analyze material properties.   5. Describe principles of laser action and optical fiber transmission, and evaluate their working and applications in communication and imaging systems.

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	6

	well.	
3	**Thin film interference and diffraction**: 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.	8
4	**Solid State Physics:** Basic concepts: Seven basic types of crystal systems, lattice, basis, crystal axes, unit cells, lattice parameters, co-ordination number, atomic packing factor, void space. Crystal structures: SC, BCC, FCC, Diamond and NaCl. 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.	5
5	**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.	5

Topics for self study: Applications of LASERs and Optical Fibres.

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 Ajoy Ghatak, 'Lasers theories and application' Springer, 2nd Edition, (2006)

ES-BTM101: Engineering Graphics

Course Code	Course Name
ES-BTM101	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 engineering curves, orthographic projections, isometric drawings, and sectional views using manual and CAD tools.
2. Interpret and analyze geometric elements including points, lines, planes, and solids using projection techniques.
3. Solve engineering graphics problems involving projection of lines, planes, and solids by applying visualization and spatial reasoning skills.
4. Create and demonstrate engineering drawings using CAD and Augmented Reality tools for enhanced visualization and technical communication.

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 and Augmented Reality Software
- Construction of Engineering Curves using Sketch Book, CAD tool and AR.
- Construction of Projection of Lines & Traces of lines using Sketch Book, CAD tool and AR.
- Construction of Projection of Planes using Sketch Book, CAD tool and AR.
- Construction of Projection of Solids using Sketch Book, CAD tool and AR
- Construction of Orthographic projections for simple parts using CAD tool and Creation of Augmented reality experience of the same.
- Construction of Isometric projections for parts using CAD tool and Creation of Augmented reality experience of the same.

*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

   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 Publishing Co.
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-BTM102: Engineering Mechanics

Course Code	Course Name
ES-BTM102	Engineering Mechanics
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 and dynamics (mechanics), and to apply those fundamentals to solve engineering problems   2. To prepare the base for the students to study other engineering courses.

Course Outcomes
Upon successful completion of the course, students shall be able to   1. Construct engineering curves, projections of lines, planes, solids, orthographic and isometric views using manual and computer-aided drafting tools.   2. Interpret and analyze 2D and 3D geometries, and visualize missing views from given orthographic or isometric projections.   3. Solve geometrical problems related to projections of lines, planes, and solids using descriptive geometry techniques and CAD tools.   4. Create augmented reality-based models of engineering graphics elements and integrate AR tools to enhance visualization and design interpretation.

Course Content		
Module	**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. **Equilibrium of coplanar force system:** Meaning of equilibrium, free body diagrams, equilibrium of concurrent, parallel and non-concurrent non-parallel (general) system of forces.	08
2	**Centroid of Plane Areas:** Concept of centroid of plane areas such as rectangle, and circle. Problems on centroid of composite areas such as I section, and Channel section. **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.	05

3	**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, and relative velocity. (No derivations of formulas).	05
4	**Kinetics of particles:** Newton's laws of motion, D'Alembert's principle, linear motion, curvilinear motion. Introduction to friction.	03
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
	Kinetics of rigid bodies (Self study): D'Alembert's principle for bodies under rotational motion about a fixed axis.	02

Text Books

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

Reference Books

1. R. C. Hibbeler (2007); "Engineering Mechanics", Pearson Education Inc
2. A.K. Tayal (2010), 'Engineering Mechanics', Umesh Publication,.
3. B. N. Thadani (1966); "Engineering Mechanics", Asia Publishing House,
4. Beer & Johnson (2013), "Engineering Mechanics", Tata McGraw Hill,
5. F. L. Singer (1975), "Engineering Mechanics", Harper & Raw Publication,
6. Nelson (2009), "Engineering Mechanics", Tata McGraw Hill,
7. Shames (2006), 'Engineering Mechanics', Prentice Hall, India,.
8. K. L. Kumar (1998), "Engineering Mechanics", Tata McGraw Hill,.

BS-BTM103: Biology for Engineers

Course Code	Course Name
BS-BTM103	Biology for Engineers
Prerequisites	NA

Course Objectives
The objectives of the course are 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 Outcome
At the end of the course the student will be able to: 1. Explain fundamental biological concepts and relate them to engineering applications involving cells, biomolecules, and genetics. 2. Analyze biodesign principles to develop innovative engineering systems inspired by natural biological structures and processes. 3. Apply biomimicry approaches to design materials and systems that imitate biological efficiency for sustainable engineering solutions. 4. Propose bio-based, environmentally responsible technologies or processes to address current societal and engineering challenges.

Detailed Syllabus

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

BS-BTM151: Engineering Physics Laboratory

Course Code	Course Name
BS BTM151	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. Demonstrate the principle of thin film interference using wedge-shaped films and determine film thickness. 2. Determine the radius of curvature of a plano-convex lens using Newton's rings interference method. 3. Analyze Fraunhofer diffraction patterns using a diffraction grating to study light characteristics. 4. Identify crystal structures and interpret unit cell parameters of cubic systems. 5. Examine various crystal planes in cubic structures using model-based analysis. 6. Investigate diffraction of light using a laser and diffraction grating to understand optical behavior at small scales.

Course Content		
Module	**Details**	**Hrs.**
1	Wedge Shaped films interference pattern.	2
2	To find Radius of curvature of a planoconvex lens using Newton's Rings.	2
3	Diffraction through a diffraction grating using a spectrometer.	2
4	Demonstration of unit cell properties of different cubic structures and crystal planes.	2
5	LASER diffraction technique using a diffraction grating	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-BTM151: Engineering Mechanics Laboratory

Course Code	Course Name
ES-BTM151	Engineering Mechanics-I Lab
Course pre-requisites	Standard XII Physics
Course Objectives	
The objectives of this course is: 1. To introduce the students to the experimental methods to verify the principles and methodsof statics (mechanics).	
Course Outcomes	
Upon successful completion of the course, students shall be able to: 1. Experimentally verify fundamental principles of statics and friction through mechanical setups and analyze the results to validate theoretical laws.	
List of Experiments	

1. To verify polygon law of forces (Concurrent force system)

2. To verify Lami's theorem using simple jib crane

3. Equilibrium of non-concurrent non parallel force system

4. To verify moment equilibrium condition using bell crank lever

5. To determine coefficient of friction using friction plane

6. To determine coefficient of friction using angle of repose method

SE-BTM101: Design Thinking and Innovations

Course Code	Course Name
SE BTM101	**Design Thinking and Innovation**
Prerequisites	NA

Course Objective
The objectives of the course are to 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 Outcome
Course Outcomes: At the end of the course the student will be able to: 1. Identify real-world problems and convert them into viable innovation opportunities using structured design thinking methods. 2. Develop and articulate user-centered product or service ideas by applying need-finding and problem-framing techniques. 3. Utilize empathy-based research tools to understand user behavior, define user needs, and synthesize insights. 4. Design, prototype, and test solutions effectively, and communicate the final concept through structured pitching techniques.

Course Contents		
Module No	**Topics**	**Hours**
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-Empathise, Define (theproblem), Ideate, Prototype, and Test.	8
3	**Empathize -** Understand customers, Empathy Maps, Empathise-Stepinto customers shoes Customer Journey Maps, Define- Analysis & Drawing Inferences from Research	6
4	**Ideation tools & exercises.** Sample Design Challenge, Introduction to the Design Challenge Themes, Storytelling and Tools for Innovation	6

5	**The Design Challenge**: Define the Design Challenge, Prototyping & Iteration- Feasibility Study, Testing Documentation and the Pitching	6

Text Book
1. Karmic Design Thinking by Prof. Bala Ramadurai,
2. Design Thinking for Strategic Innovation: What They Can't Teach You at Businessor 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 InspiresInnovation, 2009
3. Zero to One: Note on Start-Ups, or How to Build the Future

The Lean Startup: How Constant Innovation Creates Radically SuccessfulBusinesses

VS-BTM101: Workshop Practice

Course Code	Course Name
VS-BTM101	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 equipment 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
Upon successful completion of this course student will be able to: 1. Identify and describe various tools, machines, and devices used in basic engineering workshops. 2. Demonstrate knowledge of standard workshop operations and basic electrical wiring practices. 3. Apply appropriate safety practices during engineering workshop processes to prevent accidents and ensure operational efficiency. 4. Interpret technical drawings and electrical diagrams to plan and perform manufacturing and wiring tasks using suitable processes and materials.

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:** 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
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.

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.

Online Reference Material
1. https://www.youtube.com/watch?v=YV9Y_J1Ipa0 (Video in Marathi Language). 2. https://www.youtube.com/watch?v=jbRgJbIGAwc (Video in Hindi Language). 3. https://www.youtube.com/watch?v=-1ov1jn7m-w (Video in Hindi Language).

VE-BTM101: Ethics, Values and Life skills

Course Code	Course Name
VE-BTM101	**Human Ethics**
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 after cross examination.

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.

6. 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 Outcome

1. Demonstrate practical life skills such as self-awareness, self-management, and emotional intelligence to function effectively in diverse personal and professional contexts.
2. Present themselves with integrity and create a favorable impression by practicing humility, empathy, and responsible behavior.
3. Apply rational thinking and moral reasoning to assess ethical dilemmas and make sound value-based decisions.
4. Practice righteousness and identify the ultimate goals of human life by integrating ethical principles into daily conduct.
5. Realize their individual potential and act ethically and responsibly in their social and professional environments.

Course Contents		
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.	03
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.	03
03	**Intellectual, Emotional, Creative, Ethics and spiritual development:** Aesthetic sense, Self-dependency, Activeness.	02
04	**Choosing the right path:** Character, Righteousness and Virtues for a Meaningful Life: Self- Awareness, Self -Management, Ego lessness, Humility, Righteousness, Purity, Truthfulness,	03
05	**Mindfulness:** Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maturity, Comradeship, Cooperation, Tolerance.	03

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 by Dr.B.Ramaswamy
3. Handbook on Human Values and Professional Ethics 2 by Dr S K

CC-BTM101: CO-CURRICULAR ACTIVITY-1

Course Code-	Course Name
CC- BTE101	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. Align body, breath, and mind through the consistent practice of yoga asanas and pranayama techniques. 2. Apply self-regulated bodyweight exercises to build physical strength, flexibility, and endurance. 3. Demonstrate awareness of balanced lifestyle practices including proper diet, rest, and stress-relief techniques. 4. Cultivate mindfulness, emotional regulation, and clarity through meditative and breathing practices. 5. Develop a positive and conscious approach to personal and professional challenges through yogic principles.

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 & ChandraBhedna, 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**	06

	the Primary series Flow **Nauli Kriy**a Technique, **Simhasana Garjanasana**	
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 AsanasLearning 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

**FIRST YEAR
MECHANICAL ENGINEERING**

SEMESTER – II

Academic Year: 2023-24

Regulation 23

BS-BTM201: Integral Calculus and Differential Equations

Course Code	Course Name
BS-BTM201	**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. Solve first-order and higher-order ordinary differential equations and apply them to model and analyze engineering systems.
2. Evaluate double and triple integrals using various coordinate systems for mathematical modeling in engineering.
3. Apply multiple integrals to compute area, volume, and mass of bounded regions in engineering contexts.

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
2. Shanti Narayan (2005), "Integral Calculus", S.Chand Publications,35th Edition,
3. Vinod Kumar Sharma "Applied Mathematics-II" 2nd edition Tech Max Publications
4. B S Grewal (2014), "Higher Engineering Mathematics", Khanna Publications, 43rd Edition,

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-BTM202: Engineering Chemistry

Course Code	Course Name
BS-BTM202	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 , fuel Lubricant, 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 corrosion and propose suitable prevention methods for various industrial applications.
2. Evaluate the quality and characteristics of different fuels and assess their suitability for combustion and energy conversion technologies.
3. Identify and select high-performance polymers and smart materials for engineering and technological applications.
4. Analyze the properties and applications of various lubricants and additives in terms of their chemical composition and industrial performance.

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	**Fuel**	
	Calorific Value-Gross and Net Calorific Value, Conversion & numerical problems. Proximate and Ultimate Analysis of Fuels, numerical problems. Combustion-Calculations for given Solid, Liquid, Gaseous Fuel Biodiesel-Methods to obtain Biodiesel. Cracking, Knocking, Octane Value of Petrol, Cetane Value of Diesel, Anti-Knocking Agents. Recent technologies for catalytic converter. Fuel cells and photovoltaic cells, types of fuel, proton exchange membrane, polymer electrolyte, solid oxide fuel cells	06
4	**Lubricants**	
	Definition, classification, functions, characteristic properties of an ideal lubricant with special reference to flash point, fire point, cloud point, pour point, Acid Value, saponification value and numerical problems on acid value & saponification value, Polymer-based lubricant additives for friction reduction, wear protection, or viscosity improvement, Biodegradable Polymers as Lubricant Additives	06
5	**High Performance Polymers and Materials**	06
	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	

Text Books

1.   S. S. Dara &Dara (1986), 'Engineering Chemistry', S. Chand & Company Ltd, 12th Edition,
2.   O.P. Khanna (2010), 'Material Science for engineering students', DhanpatRai, Publications (p) Ltd.,
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,
2. Emil Roduner (2006), 'Nano Scopic Materials', RSC Publishing,
3. VasantGowarikar (1986), 'Polymer science', New Age International Pvt Ltd,
4. Cotlon (1994), 'Basic Inorganic Chemistry', Wiley India, 3rd Edition,
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

ES-BTM201: Basic Electrical and Electronics Engineering

Course Code	Course Name
ES-BTM201	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. Describe the operation and applications of basic electronic components including rectifiers, filters, inverters, and transistors.

4. Explain the principles, characteristics, and applications of 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, waterlevel, 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,
3. H. Cotton (2011), 'Advanced Electrical Technology', Wheeler Publication, Allahabad
4. Robert Boylestad and Louis Nashelsky (2009), 'Electronic devices and circuits', Prentice Hall of India.
5. Mottershed Allen (1973), 'Electronic Devices and Circuits an Introduction', Prentice Hall of India,
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

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.

PC-BTM201: Manufacturing Processes

Course Code	Course Name
PC-BTM201	Manufacturing Processes
Course pre-requisites	XII Standard Physics

Course Objectives
The objective of this course is: • To give fundamental insights of the common and advanced manufacturing processes practiced in the industries. • To provide exposure to basic machines tools which are used to carryout different manufacturing processes.

Course Outcomes
Upon successful completion of the course, students should be able 1. Explain the basic principles of manufacturing processes and the tools used in metal forming, casting, and molding. 2. Distinguish between various manufacturing processes and tools based on their applications and operational principles. 3. Select appropriate manufacturing processes for given engineering applications considering material, geometry, and accuracy. 4. Plan the sequence of machining processes to improve manufacturing efficiency and economy.

Course Content

Module No	Content	Hrs.
1	Introduction to engineering material and manufacturing processes Ferrous and non-ferrous. Alloys, Composites, Polymers. **Metal Casting Processes and Equipment**: Fundamentals of metal casting processes, Gate system, Pattern and Accessories etc. Defects in metal casted components, Die casting processes, Special metal casting processes-centrifugal casting, investment mold casting, Plaster mold casting, continuous casting. etc. Plastic Molding: Compression molding, Injection molding, Blow molding, Transfer molding shell molding etc	6

2	**Introduction to Joining Processes:** Welding of metals: Fusion welding: Arc welding, Gas welding, Resistance welding. Solid state welding: Friction stir welding, Diffusion welding process, special welding processes and its types. Weldability and welding defects. Soldering and Brazing. **Introduction to Rolling processes, Forging processes, and its types.**	8
3	**Material Removing Process and Equipment-1** Fundamental of machining process **Lathe machine tool**- Classification of lathe machine tools, different operations of lathes machine tool, attachments and accessories, type of cutting tools, operating parameters **Milling machine tool**- Milling operation, classification and construction, milling cutters and their applications **Drilling machine tool**- Drilling operation, types of machine, types of drilling tool and its operation- drilling, boring, reaming, spot facing, counter boring, counter sinking and tapping.	4
4	**Material Removing Process and Equipment-2** Advancements in machine tool technology: NC, CNC, accessories to condition and monitor machines tool processes, machining centers and types, Four and Five axis machine tools and its application. **Non-Conventional Material Removal Processes** Ultrasonic Machining (USM), Water-Jet Machining & Abrasive-Jet Machining (AJM), Chemical Machining, Electrochemical Machining (ECM), Electrical-Discharge Machining (EDM), High-Energy-Beam Machining, Laser-beam machining (LBM) – Electron-beam machining (EBM)	4
5	**Surface Finishing and prototyping processes** Fundamental of material removal and compositional specification of grinding wheel. Its machine tool operations, classification of grinding machine tool, effect of different grinding wheel parameters for different applications, fundamental of abrasive materials. Prototyping Processes- Subtractive Processes, Additive Processes, Direct Manufacturing and Rapid Tooling Selection of a manufacturing process	6

Term work:
1. One assignment on each module of the syllabus.
2. Industrial visit report (format should be provided by teacher)
3. Seminar presentation on the topic related to any one of the topics [Desirable: inclusion of video of the manufacturing process of any product]
4. Tutorial in every instructional week.
5. One Guest lecture by industry expert

Text Books:
1. S. Kalpakjian & S.R. Schmid, "Manufacturing Engineering and Technology, fourth edition", PEARSON
2. O.P. Khanna, "A Textbook of Production Technology", Dhanpat Rai Publications
3. Dr. P.C. Sharma, "*Production Technology*", S Chand and Co.
4. M. Lal and O P Khanna, "*Textbook of Foundary Technology*", S Chand and Co.

Reference Books:
1. G. Boothroyd & W.A. Knight, "*Fundamental of Machining and Machine Tools*", third edition", CRC.
2. Milton C. Shaw, "*Metal Cutting Principles*", OXFORD University Press
3. W. A. J. Chapman, "*Workshop Technology- Part I, II and III*", Edward Arnold
4. S K & A K Hajra Choudhary, "*Workshop Technology, Vol. I, II*", Media promotors and publishers Pvt. Limited, 2007
5. L E Doyle, "*Manufacturing Processes & materials for Engineers*", Prentice Hall
6. Cyril Donaldson, "*Tool Design*", Tata McGraw Hill, 2012

Recommended websites:
- www.nptel.ac.in
- www.swayam.gov.in

BS-BTM251: Engineering Chemistry Laboratory

Course Code	Course Name
BS-BTM251	Engineering Chemistry Lab
Course pre-requisites	Std. XII 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 ofchemistry relevant to the study of science and engineering.
Upon successful completion of the course, students should be able
  1. Determine physicochemical properties of lubricants such as acid value and flash/fire point using standard lab procedures.
  2. Estimate the metal content in various alloys through titrimetric and instrumental methods.
  3. Synthesize and characterize composite or biodiesel materials relevant to engineering applications.
  4. Measure solution properties such as conductance, ion-exchange capacity, hardness, and chloride/sulphur content using analytical techniques.

List of experiments

List of Experiments:
   1. To determine acid-value of the given lubricating oil
   2. To determine flash-point/fire-Point of lubricating oil
   3. Estimation of Cu by iodometrically
   4. Estimation of Zn by complexometric titration
   5. Estimation of Ni by complexometric titration
   6. Thin layer chromatography
   7. Preparation of biodiesel from edible oil
   8. To determine Total, Temporary & Permanent hardness of water sample
   9. Removal of hardness of water by Ion-Exchange Column
  10. To determine ion exchange Capacity of ion exchange resin
  11. To determination of chloride content of water
  12. To determine sulphur content in unknown sample

ES-BTM251: Basic Electrical and Electronics Engineering Lab

Course Code	Course Name
ES-BTM251	**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 fundamental circuit theorems to analyze and verify DC networks through practical implementation.
2. Analyze single-phase and three-phase AC circuits and determine parameters like power factor and impedance using instruments.
3. Explain and observe the construction and working principles of basic electrical machines.
4. Demonstrate the functioning of electronic components and use sensors/transducers to measure physical parameters.

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
2. M.E. Van Valkenburg: Network Analysis. Prentice-Hall of IndiaPvt. Limited
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

SE-BTM201: Problem Solving and Programming

Course Code	Course Name
SE-BTM201	**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. Develop structured programs using control structures such as conditional and iterative statements.
2. Apply modular programming concepts through functions and arrays in C++.
3. Implement object-oriented programming constructs such as classes, objects, inheritance, and polymorphism.
4. Debug and correct logical or syntactical errors in given program code using standard debugging techniques.

Course Contents		
Module	**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.	10

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. Students should be able to write Programs Using nested Loops.	**10**
3.	**Functions:** Defining Functions- Procedural decomposition of problems, localizing variables, parameter passing– value and reference, return values. **Special Functions Concepts**: Recursive functions **Skill to be developed**: 1. Students should be able to Write Programs Using Functions of various types. Students should be able to Write Programs Using special functions.	**10**
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. Students should be able to Write Programs involving strings and its manipulations.	**10**
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 Students should be able to Write Programs involving Inheritance	**12**
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 Students should be able to Write Programs using operatoroverloading	**12**

Text Books:
1. Balaguru Swami (2008),"Object Oriented Programming with C++", Tata McGraw-Hill Publishing Company Ltd.,
2. BjarneStroustrup (2013) ,"The C++ Programming Language", Addison Wesley Publishing Company,

Reference Books:
1. Mahesh Bhave and Sunil Patekar (2012), "Object- Oriented Programming with C+ + , Pearson Education,
2. RobertLafore (2001), "Object-Oriented Programming in C++", Sams Publishing 4 th Edition,

VS-BTM201: Mechanical Workshop

Course Code	Course Name
VS-BTM201	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 describe various department-specific tools, machines, and devices used in engineering practice for shaping materials.
2. Demonstrate fundamental operations in welding, sheet metal, and pipe fitting using appropriate tools and equipment.
3. Apply standard safety protocols and personal protective practices during workshop operations.
4. Interpret engineering job drawings and execute fabrication or assembly tasks as per given specifications.

Course Content		
Module	**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

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.

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_rI
4. https://www.youtube.com/watch?v=3XGt-p-hpdU

AE-BTM201: Communication Skills

Course Code	Course Name
AE-BTM201	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. Apply advanced vocabulary and summarization techniques to comprehend and express ideas effectively in academic and competitive environments.
2. Demonstrate effective verbal, non-verbal, and interpersonal communication skills in personal, social, and professional contexts.
3. Develop proficiency in Listening, Speaking, Reading, and Writing (LSRW) for clear and structured expression in professional scenarios.
4. Compose effective business correspondences such as emails, letters, blogs, and technical documents tailored for different stakeholders.
5. Exhibit professional behavior, etiquette, and teamwork skills essential for effective collaboration in the workplace.

Course Content		
Modules	**Details**	**Hours**
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 Communication, Theories of Communication, Purpose of Professional Communication, Barriers to Communication (Cultural, Semantic,	09

	Psychological, physical, mechanical, organizational), Different Forms of Communication: Verbal, Non-Verbal, Intrapersonal. **Communication Channels in an Organization:** Different types of communication flow: Internal, External, Upward, Downward, Horizontal, Grapevine, Problems and Solutions.	
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.	**Etiquette and Mannerism in the Professional world:** • Introduction to Corporate Etiquette, Grooming, Clothing & Accessorizing • Technology Etiquette (social media, Telephone,)	04
	➢ **Tutorial work: 14 hours per batch** **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, Etiquette Case Studies, 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

IK-BTM201: Indian Traditional Knowledge

Course Code	Course Name
IK-BTM201	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 concepts and values of Indian tradition and traditional knowledge systems.
2. Describe Indian traditional practices in healthcare, technology, and their scientific significance.
3. Interpret major elements of Indian artistic, linguistic, and philosophical heritage.
4. Analyze the relevance and applicability of Indian traditional knowledge in the context of modern science and technology.

Course Content		
Module	**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.	06
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.	06
4	**Indian Traditional Health Care:** Importance and Practice of Yoga, Pranayam and other prevailing health care techniques.	06

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.	06
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	06
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.
   1. Sharma D.S., The Upanishadas- An Anthology, Bharatiya Vidya Bhavan, 1989.
   2. 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.
   4. Krishna Chaitanya, *Arts of India*, Abhinav Publications, 1987.
      Jha V.N., *Language, Thought and Reality*

CC-BTM 201: CO CURRICULAR ACTIVITY-2
CC-BTM 201