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B. Tech. in Mechanical Engineering

Year 2nd   **Sem 4th**

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTMA301	ODS	APPLIED MATHEMATICS - III	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):
To introduce the students with the Fundamentals of the Calculus of the (A) Complex Variable, (B) Random Variable and (C) Fourier Analysis.

Course Outcomes (COs):
After the successful completion of this course students will be able to
1. Understand and apply the basics of the Calculus of the Complex variables.
2. Know the fundamentals of the Probability Theory and Random Process.
3. Apply the concepts of the Fourier Analysis
4. Know the techniques of the Fourier Transform.
5. Find the solution of the PDE.

Syllabus
Unit – I
Complex Analysis: Complex numbers, geometric representation, powers and roots of complex numbers. Functions of a complex variable: Limit, Continuity, Differentiability, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Harmonic conjugates. Elementary Analytic functions (polynomials, exponential function, trigonometric functions), Complex integration, Cauchy's integral theorem, Cauchy's integral formula. Taylor series and Laurent series. Zeros, Singularities and its classifications, Residues, Residue theorem and its applications.

Unit – II
Probability Theory and Random Process: Axiomatic construction of the theory of probability, independence, conditional probability, and basic formulae, random variables, binomial, Poisson

B. Tech. in Mechanical Engineering

Year 2nd   **Sem 4th**

and normal random variable, probability distributions, functions of random variables; Mathematical expectations, Definition and classification of random processes, discrete-time Markov chains, Poisson process, Correlation and Regression; Expectation and Variance.

Unit – III
Fourier series: Fourier Integral, Fourier series of 2p periodic functions, Fourier series of odd and even functions, Half-range series, Convergence of Fourier series, Gibb's phenomenon, Differentiation and Integration of Fourier series, Complex form of Fourier series.

Unit – IV
Fourier Transformation: Fourier Integral Theorem, Fourier Transforms, Properties of Fourier Transform, Convolution and its physical interpretation, Statement of Fubini's theorem, Convolution theorems, Inversion theorem

Unit – V
Partial Differential Equations: Introduction to PDEs, basic concepts, Linear and non-linear first order PDE, Higher order linear homogeneous PDE, Separation of variable and its application to the one dimensional wave and heat equation.

Reference Books:
1. *"Complex Variables and Applications", by R. V. Churchill and J. W. Brown, 5th Edition, McGraw-Hill, 1990.*
2. *"Introduction to Partial Differential Equations", by K. Sankara Rao, 2nd Edition, 2005.*
3. *"Introduction to Probability Theory", by P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2000.*
4. *"Probability and Statistics with Reliability, Queuing, and Computer Science Applications", by K. S. Trivedi, Prentice Hall of India, 1998.*
5. *"Probabilities, Random Variables and Stochastic Processes", by A. Papoulis and S. Unnikrishna Pillai4th Edition, Tata McGraw-Hill, 2002.*
6. *"Stochastic Processes", by S.M. Ross, 2nd Edition, Wiley, 1996.*
7. *"Higher Engineering Mathematics", by B. S. Grewal, Khanna Publishers, Delhi.*
8. *"Complex Analysis for Mathematics and Engineering", by 3rd Edition, J. H. Mathews and R. W. Howell, Narosa, 1998.*
9. *"Elements of Partial Differential Equations", by I. N. Sneddon, McGraw-Hill, 1957.*
10. *"Advanced Engineering Mathematics", by E. Kreyszig, 5th / 8th Edition, Wiley Eastern / John Wiley, 1983/1999.*

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B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*	L	T	P	CREDITS
BTME401	DCS	FLUID MECHANICS	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):
To introduction with (A) Fluid and its properties, (B) behavior of fluid under various conditions, (C) Applications.

Course Outcomes (COs):
After the successful completion of this course students will be able to
1. Correlate fundamentals of fluid mechanics with various mechanical systems.
2. Understand basics of compressible flow.
3. Understand fundamentals of flow through pipes.
4. Understand statics, dynamics and various approaches to fluid mechanics.

Syllabus
Unit - I
Flow and Fluid Properties: Viscosity, relationship between stress and strain-rate for Newtonian fluids, incompressible and compressible flows, differences between laminar and turbulent flows. Hydrostatics forces: Buoyancy and floatation, manometer, forces on submerged and floating bodies, stability conditions.

Unit - II
Kinematics: Types of fluid flow, rate of flow or discharge continuity equation, velocity and acceleration, velocity potential function and stream function, types of motion, vortex flow.
Ideal flow: Uniform flow, source flow, sink flow, free vortex flow.

Unit - III
Differential Analysis: Differential equations of mass and momentum for incompressible flows, inviscid - Euler equation and viscous flows - Navier-Stokes equations, Bernoulli's equation from

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P a g e 3 | 18

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

Euler's equation and assumptions, concept of fluid rotation, vorticity, stream function, Exact solutions of Navier-Stokes equation for Coquette Flow and Poiseuille flow, Orifices and mouthpieces: classifications of and flow through orifice, hydraulic coefficients, experimental determination of hydraulic coefficients, classification and flow through convergent and divergent mouthpiece.

Unit - IV
Dimensional Analysis: Introduction, secondary or derived quantities, methods of dimensional analysis, model analysis, similitudes-types of similarities, dimensionless numbers, models law and Concept of geometric, kinematic and dynamic similarity, some common non-dimensional parameters and their physical significance: Reynolds number, Froude number and Mach number.
Internal Flows: Fully developed pipe flow, various losses in pipe flow, and empirical relations for laminar and turbulent flows: friction factor and Darcy-Weisbach relation.
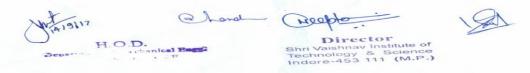
Unit-V
Prandtl Boundary Layer Equations: Concept and assumptions, qualitative idea of boundary layer and separation, streamlined and bluff bodies, drag and lift forces. Flow measurements: Basic ideas of flow measurement using venturimeter, Pitot - static tube and orifice plate.

Reference Books:
1. *"Fluid Mechanics and Fluid Power Engineering", by D.S. Kumar, S.K. Kataria & Sons*
2. *"Fluid Mechanics and Hydraulic Machines", by R.K. Bansal, Laxmi Publications*
3. *"Fluid Mechanics and Hydraulic Machines", by R.K. Rajput, S. Chand & Co.*
4. *"Fluid Mechanics", by Frank. M. White, McGraw Hill Publishing Company Ltd.*
5. *"Fundamentals of Fluid Mechanics", by Munson, Wiley India Pvt. Ltd*
6. *"Fluid Mechanics by A. K. Mohanty", PHI Learning Pvt. Ltd.*
7. *" Laboratory Manual Hydraulics and Hydraulic Machines", by R V Raikar*

List of Experiments
1. To understand pressure measurement procedure and related instruments/devices.
2. To study metacentric height of floating body.
3. Verification of Bernoulli's theorem.
4. To study the velocity of flow using Pitot tube.
5. To determine the Coefficient of discharge through different flow meters. (Any two out of Orifice meter, Venturi meter and Nozzle meter.)
6. To determine the different types of flow Patterns by Reynolds's experiment.
7. To study the Friction factor for the different pipes.
8. To study the loss coefficients for different pipe fittings.

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P a g e 4 | 18

B. Tech. in Mechanical Engineering

Year 2nd   **Sem 4th**

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*	L	T	P	CREDITS
BTME402	DCS	THEORY OF MACHINES	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

This course provides comprehensive knowledge of (A) Mechanism and machine (B) Kinematics of plane motion, (C) Cam and Follower, (D) Gears and Gear Train, (E) Gyroscope.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Students will be able to define systematically design and develop mechanisms to perform a specified task and demonstrate an understanding of the concepts of various mechanisms and pairs.
2. Students will be able to do the velocity and acceleration analysis of simple mechanisms.
3. Students will be able to explain effectively present written, oral, and graphical solutions to design problems & develop ability to come up with innovative ideas and design a layout of cam for specified motion.
4. Students will be able demonstrate an understanding of principle of gears.
5. Students will be able to synthesis simple gyroscopic forces and couple, and gyroscopic effect in airplanes, ship and vehicle.

Syllabus
Unit - I
Mechanisms and Machines: Mechanism, machine, plane and space mechanism, kinematic pairs, kinematic chains their classification, degrees of freedom, Grubler's criterion, kinematics inversions four bar mechanism and slider crank mechanism, equivalent linkages, pantograph, straight line motion mechanism, Davis and Ackermann's steering mechanism, Hooke's joint.

B. Tech. in Mechanical Engineering

Year 2nd   **Sem 4th**

Unit - II
Motion: kinematics of Plane motion, Absolute & Relative motion, Displacement, Velocity and Acceleration Analysis by Graphical & Analytical methods, Velocity image, Velocity of rubbing, Kennedy's Theorem, Acceleration image, Acceleration polygon, Coriolis acceleration component, Klein's construction, Velocity and Acceleration Analysis using complex Raven's methods.

Unit - III
Cams: Classification of Cams and Followers, Radial Cam Terminology, Analysis of Follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), Pressure Angle, Radius of Curvature, Cam Profile for radial and offset followers Synthesis of Cam Profile by Graphical Approach.

Unit - IV
Gears: Classification of gears and its type, Gear Terminology, Law of gearing, Tooth profiles, velocity of sliding, Path of contact, Arc of contact, Contact Ratio, Interference and Undercutting, Conjugate action.
Gear Trains: Simple, compound, reverted and epi-cyclic gear trains. Velocity ratio and torque calculation in gear trains

Unit - V
Gyroscope: Gyroscopic Action in Machines, Angular Velocity and Acceleration, Gyroscopic torque/ couple, gyroscopic effect on Naval Ships, Stability of Two and Four Wheel Vehicles, Rigid disc at an angle fixed to a rotating shaft.

Reference Books:
1. *"Mechanism and Machine Theory", by Ambekar AG; PHI. Eastern Economy Edition 2015*
2. *"Theory of machines & Mechanism", by Uicker & Shigley, Second Edition Oxford University Press*
3. *"Theory of Machines", by Dr. Jagdish Lal; Metropolitan Book Co; Delhi*
4. *"Mechanism and Machine Theory", by Rao J S and Dukkipati; New Age Delhi.*
5. *"Theory of Machines", by S.S. Rattan, (2009), Third Edition, Tata McGraw-Hill*

List of Experiments:
1. To synthesize and demonstrate the inversion of four bar mechanism through animation and model.
2. To synthesize and demonstrate the inversion of single slider and double slider crank mechanism through animation and model.
3. To synthesize and demonstrate the inversion of double slider crank mechanism through animation and model.

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

4. To construct and demonstrate the steering mechanism based on Davis & Ackerman's steering mechanisms principles.
5. To find out velocity & acceleration of slider crank mechanism by Klein's Construction.
6. To draw Involutes profile of a gear by generating method.
7. To find out velocity ratio of various gear trains.
8. To study working of sun and planet epicycle gear train mechanism using models.
9. To study various types of belt drives & find out the velocity ratio of the drive.
10. To finds out gyroscopic couple.

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSSTMENT*	L	T	P	CREDITS
BTME403	DCS	APPLIED THERMODYNAMICS	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):
(A) To gain knowledge of Economics of Steam Power Plant, Different types of Boilers & their application with Ash and Coal Handing Systems, and Heat Balance Sheet calculation during Combustion in Boiler. (B) To study of various vapour cycle of Steam Power plant and Effect on efficiency of this vapour cycle of various operating conditions etc. (C) To study of Ideal gas relationship, Mach number and its significance, Effect of Mach number on compressibility etc. (D) To gain knowledge of One Dimensional Isentropic Flow. (E) To study of various types of condenser and their applications in steam power plant.

Course Outcomes (COs):
After completions of this course student will be able to understand the following points.
1. Student will be able to understand steam generators, its application in steam power plant also able to make calculation of steam generator efficiency and steam plant economics.
2. They will understand various vapour cycles and also able to analyze them.
3. Student will be able to understand Fundamentals of Compressible Flow and relationship between stagnation temperature, pressure, density and enthalpy in terms of Mach number.
4. Student will understand One Dimensional Isentropic Flow and flow in nozzle under various conditions.
5. Student will get idea about the various types of Circulating Water System, Feed water, Condenser and their application according to requirements.

Syllabus
Unit -1
Economics of Power Plant: Review of thermodynamics, Steam Power Plant, Layout and Design of Power Plant, Site selection of Steam Power Plant, Power Plant Economics and Consideration, Load duration curves, Indian energy scenario.

B. Tech. in Mechanical Engineering

Year 2nd   **Sem 4th**

Unit-II
Steam Boiler: Introduction of steam generating equipment's boiler and its various types of Steam Boiler, high and low pressure boiler, boiler mountings and accessories, critical and non-critical boiler, coal and Ash handling system, combustion in boilers, performance and rating of boilers, heat balance sheet, boiler draught, overview of boiler codes, Performance and rating of boilers.

Unit – II
Analysis of Steam Cycles: Carnot Cycle, Rankine Cycle, Mean Temperature of Heat Addition, Effect of Variation of Steam Condition on Thermal Efficiency, Reheating of Steam, Regeneration, Feed water Heater, Optimum Degree of Regeneration, Ideal and actual regenerative cycle with single and multiple heaters, Supercritical Pressure Cycle, Deaerator.
Combined Cycle: Binary Vapour Cycles, Coupled Cycles, Combined Cycle Plants.

Unit - IV
Fundamentals of Compressible Flow: Ideal gas relationship, The adiabatic energy equation, Mach number and its significance, Mach waves, Mach cone and Mach angle, static and stagnation states, relationship between stagnation temperature, pressure, density and enthalpy in terms of Mach number, stagnation velocity of sound, reference speeds, various regions of flow, Effect of Mach number on compressibility, Area velocity relationship

Unit - V
One Dimensional Isentropic Flow: General features of isentropic flow, performance curve, Comparison of adiabatic and isentropic process, One dimensional isentropic flow in ducts of varying cross-section- nozzles and diffusers, operation of nozzles under varying pressure ratio, mass flow rate in nozzles, diffusers, critical properties and choking, area ratio as function of Mach number, Impulse function, non-dimensional mass flow rate in terms of pressure ratio, area ratio and Mach number, Working charts and gas tables, Application of Isentropic flow.

Reference Books:
1. *"Power plant Engineering", by Nag PK, TMH*
2. *"Basic and applied Thermodynamics", by P. K. Nag, TMHR.*
3. *"Thermal Engineering", by R. Yadav.*
4. *"Fundamental of Compressible flow", by S. M. Yahya, New age international Publication, Delhi*
5. *"Fundamentals of compressible fluid dynamics", by P. Balachandran, PHI Learning, New Delhi*
6. *"The dynamics and thermodynamics of Compressible fluid low Volume-I", by Ascher H. Shapiro, the Ronald Press Company, New York.*

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P a g e 9 | 18

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

7. *"Gas Dynamics", by E. Rathakrishnan, PHI Learning Pvt. Ltd*

List of Experiments
1. To Study different types of boilers with application.
2. To Study boiler mountings and accessories.
3. To study performance and rating of boiler.
4. To study different types of coal & Ash handling system.
5. Determination of thermal efficiency of steam power plant.
6. To study Regenerative & Reheat cycle of steam power plant.
7. To study Binary Vapour & Combined cycle plant.
8. To determine mass flow for different condition of Nozzle.
9. To determine mass flow for different condition of Diffuser.
10. To study performance curve for one dimensional isentropic flow.

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTME404	DCS	MACHINE DESIGN I	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based following components: Quiz/Assignment/
Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

(A) To understand the design methodology for machine elements. (B) To analyse the forces acting on a machine element and apply the suitable (C) design methodology. (D) To understand the various standards and methods of standardization. (E) To apply the concept of parametric design and validation by strength analysis.

Course Outcomes (COs):

Student will be able to
1. Analyze and select machine elements/components.
2. Know the applications of the various elements, materials used to make them, and methods used.
3. Integrate various machine elements and components into the design of a machine or mechanical system through a design project.
4. To apply various theories of failure to design.
5. To Ability to select the material and configuration of different machine elements under a variety of environmental and service conditions. These includes, Shafts, Screws, bolts and their types, power screws.

Syllabus

Unit -I
Introduction: Introduction to Design process, Design considerations, engineering materials properties and processes of their selection, BIS designation of steels, manufacturing considerations in design, Bending and Torsional stress equations, Impact and Shock loading, Stress concentration factor, Size factor, Surface limits factor, Design stress.

Unit -II
Fatigue strength and design of springs: Variable and cyclic loads, Fatigue Strength, Endurance limit, S- N Curve, Soderberg, Gerber and Goodman equations, fatigue failure, design consideration in fatigue,

B. Tech. in Mechanical Engineering

Year 2nd   **Sem 4th**

classification and spring materials, Spring end formation, Design of helical compression springs, helicalextension springs, torsion springs, laminated springs, Protective coatings, Equalized stress in spring leaves. Multi - leaf springs. Surge in springs, Nipping and shot peening.

Unit -III
Shafts, keys and couplings: Shafts design on strength basis, torsional rigidity basis, ASME codes for shafts, Keys and cotter design, Flat and square keys, Splines, Rigid and flange couplings, Flexible couplings.

Unit -IV
Threaded and welded joints: Forms of threads, basic types of screw fastenings, ISO metric screw threads, eccentrically loaded bolted joints, Torque requirement for bolt tightening, Fluctuations loads on bolted joints, fasteners, Joints with combined stresses. Power screws, Force analysis. Collar friction, Differential and compound screws design. Types and strength of weld joints subjected to bending and fluctuating loads, cotter and knuckle joints, welded joints, different types welded joints and their design aspects.

Unit - V
Journal Bearing: Types of lubrication, viscosity, hydrodynamic theory, design factors, temperature and viscosity considerations, Reynold's equation, stable and unstable operation, heat dissipation and thermal equilibrium, boundary lubrication, dimensionless numbers, Design of journal bearings, Rolling-element Bearings: Types of rolling contact bearing, bearing friction and power loss, bearing life; Radial, thrust & axial loads; Static & dynamic load capacities; Selection of ball and roller bearings; lubrication and sealing.

Reference Books:
1. *"Design of Machine elements", by Bhandari. V.B. (2010) Tata Mc Graw Hill Book Co, Third Edition.*
2. *"Machine Design", by R.S. Khurmi, J.K. Gupta. (2008) Eurasia Publishing House (Pvt.) Ltd.Revised Edition.*
3. *"Machine Design", by Shingley J.E, TMH.*
4. *"Design of Machine elements", by Sharma and Purohit; PHI.*
5. *"Machine Design", by Wentzell Timothy H, Cengage learning.*
6. *"Machine Design", by Mubeen; Khanna Publisher.*
7. *"Design of Machine Elements", by Ganesh Babu K and Srithar k, TMH.*
8. *"Machine Design", by Sharma & Agrawal; Kataria & sons.*

List of Experiments (Please Expand it):
Designing and sketching of components contained in the syllabus.

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTME405	DCS	ADVANCE MACHINING PROCESSES	0	0	0	0	50	0	0	4	2

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):
(A) To introduce students, the basics of rapid prototyping/manufacturing technologies and systems and its applications in various fields. To teach the principles of (B) material removal mechanism of advanced machining processes such as mechanical, electro- chemical and thermal. To provide in depth knowledge in selection of (C) advanced machining process to fabricate intricate and complex shapes in difficult to machine material. To provide awareness of (D) advanced finishing processes to achieve submicron/Nano surface finish.

Course Outcomes (COs):
Student will be able to
1. Demonstrate the knowledge of Rapid Prototyping/Manufacturing technologies.
2. Identify and suggest the suitable manufacturing process for advanced materials and critical finishing.
3. Deal with sophisticated and advanced equipment such as IBM, EBM, PAM etc.,

Syllabus
Unit - I
Introduction: Introduction to Rapid Prototyping, Need & Development of RP systems, RP process chain, Impact of Rapid Prototyping on Product Development, Digital prototyping, Virtual prototyping, Rapid Tooling, Benefits & Applications.

Unit - II
Moulding practices: Introduction to casting and foundry industry; basic principles of casting processes; sequence in foundry operations; patterns; molding practice; ingredients of moulding sand and core sand, sand testing; different moulding processes.

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

Unit - III
Melting furnaces: Types of furnaces used in foundry; furnaces for melting; melting practice for steel, cast iron, aluminum alloys, copper alloys and magnesium alloys; safety considerations; fluxing, degassing and inoculation.

Unit - IV
Gating and Risering: Concept of solidification, directional solidification, role of chilling, principles of gating and risering systems: types and design calculations.

Unit – V
Foundry Defects: Defects in castings and its remedies. Energy saving and quality control in foundries.

Reference Books:
1. *"Rapid Prototyping: Principles and Applications", by Noorani, R. (2006), John Wiley & Sons, Inc., New Jersey.*
2. *"Principles of Metal Casting", by Heine R. W., Loper C. R., Rosenthal P. C., ,2ndEdition, Tata McGraw Hill Publishers, 1996.*
3. *"Foundry Technology", by Srinivasan N. K., Khanna Publications, 2001.*
4. *"Foundry Engineering", by Wulff B., Taylor H. F., Fleming M. C., Wiley Eastern, 1999,*
5. *"Principles of Foundry Technology", by Jain P. L., 3rd Edition, Tata McGraw Hill, 2000*

List of Experiments
1. CAD Model preparation.
2. Geometric modelling of components.
3. To design and manufacture a wooden pattern for a given casting.
4. To prepare a casting for the given solid pattern using green sand moulding processes.
5. To prepare aluminum casting for the given split pattern using green sand moulding processes.
6. To Study and analyze the Gating Designs for Green sand Mould Casting.
7. To Study the Defects in Casting.
8. Inspection of Casting Defects through NDT Techniques.
9. To evaluate the dry strength of Green sand mould.
10. To Study Remedies of Casting Defects.

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P a g e 14 | 18

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTME406	DS	INTELLECTUAL PROPERTY RIGHTS	0	0	0	0	30	0	0	2	1

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*****Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) To acquaint students with the basic concepts and properties of Material Science. (B) To impart a fundamental knowledge of Materials Processing. (C) Selection and application of different Metals & Alloys. (D) To understand the structure of Engineering Materials.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Student would be able to understand the fundamental aspect of intellectual property rights.
2. Student would be able to understand the patent system of India.
3. Students will be able to understand the basics of copyright and protect copyright.
4. Student would be able to demonstrate the related rights.
5. Students would be able to demonstrate various case studies based on patent, copyrights and related rights.

Syllabus

Unit - I
Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR) IPR in India – Genesis and Development IPR in abroad some important examples of IPR.

Unit - II
Patents: Macro economic impact of the patent system Patent and kind of inventions protected by a patent**,** Patent document, Granting of patent Rights of a patent, patent protection, drafting of a patent, Filing the different layers of the international patent system
Copyright: Definition, Need of copyright, Steps to protect copyright.
Related rights: Definition, Distinction between related rights and copyright, Rights covered by

B. Tech. in Mechanical Engineering

Year 2ⁿᵈ   **Sem 4ᵗʰ**

copyright.

Unit - III
Trademarks: Definition, Rights of trademark, Signs that can be used as trademarks, Types of trademark function does a trademark perform, Steps to protect trademark, Trademark registration steps, Domain name and how does it relate to trademarks.
Geographical indications: Definition, Steps to protect geographical indication, Reason to protect geographical indications.

Unit - IV
Industrial designs: Definition, Steps to protect industrial designs, Reason to protect industrial designs, Usefulness of industrial designs protection.
New plant varieties: Definition, Reason to protect new varieties of plants, Step measures commences to protected new varieties of plants.
Unfair competition: Definition, Relationship between unfair competition and intellectual property laws.

Unit-V
Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures
Intellectual Property: Overview of Biotechnology and Intellectual Property Biotechnology Research and Intellectual Property Rights Management Licensing and Enforcing Intellectual Property Commercializing Biotechnology Invention.

Reference Books:
1. *"Biotechnology Applications and Research",by P.N. Cheremisinoff, R.P. Ouellette and   R.M. Bartholomew, Technomic Publishing Co., Inc. USA, 1985*
2. *"Concepts in Biotechnology", by D. Balasubramaniam, C.F.A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman, University Press (Orient Longman Ltd.), 2002*
3. *"Biotechnology: Demystifying the Concepts", by Bourgagaize, Jewell and Buiser, Wesley Longman, USA, 2000.*
4. *"Indian Patents Law Legal & Business", by Ajit Parulekar and Sarita D' Souza, Implications; Macmillan India ltd, 2006.*

List of Experiments (Please Expand it):
Complete Experiments as per the syllabus.

B. Tech. in Mechanical Engineering

Year 2nd   **Sem 4th**

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*	L	T	P	CREDITS
BTCS408	ODS	COMPUTER PROGRAMMING-III	0	0	0	0	20	0	0	2	1

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical;   C - Credit;
*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

Students will have ability (A)To translate mathematical methods to MATLAB code (B)To break a complex task up into smaller, simpler tasks (C)To represent mathematical objects as data structures (D) To tabulate results and represent data visually.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes
1.   Solve basic mathematical problems in MATLAB.
2.   Develop MATLAB Programming & Simulation for engineering problems.
3.   Discover significance of this software for Lab Experimentation.
4.   Tell significance of software's in research by data visualization.

Syllabus

Unit - I

Introduction to Matlab , Overview of features and workspace ,Matlab Interactive Sessions ,Menus and the toolbar , Computing with Matlab , Script files and the Editor Debugger , Matlab Help System Programming in Matlab.

Unit-II

Arrays and Function, Files, Arrays, Multidimensional Arrays, Element by Element Operations, Polynomial Operations Using Arrays, Cell Arrays, Structure Arrays. Elementary Mathematical Functions, User Defined Functions) Advanced Function Programming, Working with Data Files.

Unit-III

B. Tech. in Mechanical Engineering

Year 2nd   **Sem 4th**

Programming Techniques, Program Design and Development , Relational Operators and Logical Variables , Loops : For ,While ,Do ,While , Logical Operators and Functions ,Conditional Statements , Loops ,The Switch Structure ,Debugging Mat Lab Programs.

Unit-IV
Plotting XY- plotting functions , Subplots and Overlay plots , Special Plot types , Interactive plotting , Function Discovery ,Regression , 3-D plots , Data Manipulation: Fits , Extrapolation and regression

Unit-V
Introduction to Linear Algebra, basic Matrix equations, modeling systems of equations, Implementation project on Image Processing Vector Graphics Morphological Image Processing Filtering

Text Books:
1. Stephen J. Chapman "Essentials of MATLAB Programming, 3e" Publisher: Cengage Learning Copyright: 2018.
2. Holly Moore , "MATLAB for Engineers, 5e "Publisher: Pearson Education Inc ,Copyright: 2018
3. David R. Hill, Bernard Kolman, Elementary Linear Algebra with Applications, 9e, Publisher: Prentice Hall Copyright: 2018.

Reference Books:
1. G. H. Golub and C. F. Van Loan, Matrix Computations, 3 rd Ed., Johns Hopkins University Press, 1996.
2. 2. B. N. Datta, Numerical Linear Algebra and Applications, Brooks/Cole, 1994 (out of print).
3. 3. L. Elden, Matrix Methods in Data Mining and Pattern Recognition, SIAM Press, 2007.

Practical's List :(List is only suggestive, Instructor may change as per the need)
1. Understand the main windows in matlab desktop?
2. To perform operations on signals and sequences such as addition, multiplication, Scaling, Shifting, folding.
3. Generate rectangular pulse function by using MATLAB.
4. Perform the experiment auto- correlation and cross- correlation of given sequences in MATLAB.
5. Perform the experiment and find FFT and IFFT of the given sequence using MATLAB.
6. Evaluation of represent the difference equation using MATLAB.
7. To Design digital Butterworth IIR filter using Mat Lab
8. Write a matlab program to generate a triangular wave with amplitude = 8, frequency 10Hz.
9. Write a matlab program to generate a square wave with amplitude = 2, frequency 10kHz.