SHRI SHANKARACHARYA TECHNICAL CAMPUS, BHILAI

(An Autonomous Institute affiliated to CSVTU, Bhilai)

SCHEME OF TEACHING AND EXAMINATION (Effective from 2020-2021 Batch)

B.Tech. (Mechanical Engineering) Fourth Semester

Sl. No.	Board of Studies (BOS)	Courses (Subject)	Course Code	Period per Week			Scheme of Examination			Total Marks	Credit
							Theory/Lab				
				L	T	P	ESE	CT	TA		
1.	Mechanical Engineering	Kinematics of Machines	ME107401	3	1	-	100	20	30	150	4
2.	Mechanical Engineering	Manufacturing Process	ME107402	2	1	-	100	20	30	150	3
3.	Mechanical Engineering	Fluid Mechanics and Machines	ME107403	3	-	-	100	20	30	150	3
4.	Mechanical Engineering	Turbo Machinery	ME107404	3	-	-	100	20	30	150	3
5.	Mechanical Engineering	Programming with Python	ME107405	3	-	-	100	20	30	150	3
6.	Mechanical Engineering	Kinematics of Machines Lab	ME107491	-	-	2	25	-	25	50	1
7.	Mechanical Engineering	Fluid Mechanics and Machines Lab	ME107492	-	-	2	25	-	25	50	1
8.	Mechanical Engineering	Programming with Python Lab	ME107493	-	-	2	25	-	25	50	1
9.	Mechanical Engineering	Mini Project – II (Basic modelling using CAD software)	ME107494	-	-	2	50	-	25	75	1
10.	Mechanical Engineering	Biology for Engineers	AC100492	-	-	-	-	-	25	25	-
Total				**14**	**2**	**8**	**625**	**100**	**275**	**1000**	**20**

Note:

(a) Abbreviations used : L-Lecture, T- Tutorial, P- Practical, ESE- End Semester Exam, CT- Class Test, TA- Teacher's Assessment

(b) The duration of end semester examination of all theory papers will be of three hours.

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code ME107401	KINEMATICS OF MACHINES	L = 3	T = 1	P = 0	Credits = 4
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
• To synthesis, both graphically and analytically, multilink mechanisms. • To perform mechanism analyses to find the position, velocity, acceleration, and dynamics of multi-bar mechanisms. • To synthesis mechanism to perform certain prescribed task/motion. • To analyze gear trains. • To analyze thrust bearings, Brakes and dynamometers.	At the end of this course, the students are expected to be able to: **CO1:** Apply knowledge of Kinematics of machine for understanding, formulating and solving engineering problems. **CO2:** Acquire knowledge and hands-on competence in applying the concepts kinematics of machine in the design and development of mechanical systems. **CO3:** Demonstrate creativeness in designing new systems components and processes in the field of engineering **CO4:** Identify, analysis, and solve mechanical engineering problems useful to the society. **CO5:** Work effectively with engineering and science teams as well as with multidisciplinary designs.

Unit – I: Relative velocity **CO1**

Elements, pairs, Mechanism, Four bar chain and its inversion, Velocity diagrams, Relative velocity method, Instantaneous center method. **[10 Hrs]**

Unit – II: Relative Acceleration **CO2**

Synthesis of mechanism, Pantograph, Lower pair mechanism, Relative acceleration diagram, Kliens construction, Coriolis component of acceleration. **[10 Hrs]**

Unit – III: Cams **CO3**

Classification of cams and followers, Nomenclature of a radial cam, Description of follower movement, Displacement diagrams, Uniform and modified uniform motion, Simple harmonic motion, Uniform acceleration motion and its modifications, Cycloidal motion, Synthesis of cam profile by graphical approach, Considerations of pressure angle. Cams with specified contours: Circular arc cam & tangent cam. **[8 Hrs]**

Unit – IV **CO4**

Gear: Types of gears, Gear terminology, Law of gearing, Gear tooth forms, Involute and Cycloid tooth profile, Interference and Undercutting of Involutes teeth, Minimum number of teeth on pinion to avoid interference.

Gear Trains: Simple, Compound, Reverted, and Epicyclical gear trains, computation of velocity ratio in gear trains by different methods. **[10 Hrs]**

Unit – V **CO5**

Friction: Applications of friction, Pivot and collar friction, Thrust bearing.

Belt-Drives: Ratio of tensions for flat belt & V-belt, Centrifugal tension, condition for maximum power transmission.

Brakes and dynamometer: Simple block and shoe brake, Band brake, Band and block brake, and internal expanding shoe brake, Absorption dynamometer, Transmission dynamometer. **[10 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Theory of Machines	S. S. Rattan	McGraw-Hill Education
2	Theory of Machines	Thomas Bevan	Pearson Education

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Theory of Mechanisms and Machines	A. Ghosh, A.K. Mallik	Affliated East
2	Theory of Machines and Mechanisms	Shigley, J. E.	Oxford University Press
3	Theory of Mechanisms and Machines	Jagdish Lal	Metropolitan Book Company
4	Theory of Machines	Sadhu Singh	Pearson Education India

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code ME107402	MANUFACTURING PROCESS	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
• To impart an understanding of various manufacturing processes. • To provide an exposure to various casting processes. • To impart the knowledge of various welding processes. • To impart the knowledge of various metal removal process. • To provide a comparative study of the capabilities, advantages and the limitations of various manufacturing processes.	At the end of this course, the students are expected to be able to: **CO1:** Acquire knowledge and hands-on competence in applying the concepts of manufacturing science in the design and development of mechanical systems. **CO2:** Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular. **CO3:** Work effectively with engineering and science teams as well as with multidisciplinary designs. **CO4:** Skilfully use modern engineering tools and techniques for mechanical engineering design, analysis and application. **CO5:** Acquire knowledge, construction, working and various machining operations of milling, broaching, drilling, reaming and boring machines

Unit – I **CO1**

Introduction to Manufacturing Processes: Importance of Manufacturing Processes, classification, technological definitions.

Metal Casting (Foundry): Introduction: Principle, Advantages and Limitations, Applications.

Pattern Making: Pattern materials, allowances, types of pattern, color code scheme

Mould Making: Green and dry sand casting process, types of sand, molding sand and its properties, molding sand composition and applications. Elements of mould: Cores; Use, core material, types of cores, advantages and limitations, core prints, chaplets, Gating and Risering System, Sand casting defects: appearance, causes & remedies.

Special Molding Processes: investment casting process, Die casting process, shell molding process, continuous casting process, centrifugal casting processes **[8 Hrs]**

Unit – II **CO2**

Welding–I: Introduction: Principle, classification based on application of filler material & without filler material, source of energy, fusing and pressure welding processes, application of welding processes

Arc welding: Principle, welding electrodes- types, composition & specification, Metal Arc welding (MAW), flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes. (AHW).

Gas Welding: Principle, Oxy-Acetylene welding, Flame characteristics, Gas torch construction & working, forward and backward welding. ANSI Symbols **[7 Hrs]**

Unit – III **CO3**

Welding – II: Resistance Welding: General, principle of heat generation in resistance welding, application of resistance welding processes. Process details and working principle of spot, seam and projection welding, electrode materials, shapes of electrodes, electrode cooling, selection of welding currents, voltages.

Special type of welding: Friction welding, Explosive welding, Thermit welding, Laser welding, Electron beam welding, Electro slag welding, Ultrasonic welding; principle, equipment's, operations. Soldering,

Brazing, Welding Defects. **[7 Hrs]**

Unit – IV **CO4**

Machine Tools: Lathe: Principle of operation, basic parts of a lathe, types – speed lathe, engine, bench, tool room, capstan, turret, automatic, specification, operations-facing, turning, knurling, taper turning, thread cutting, drilling, boring, reaming, work holding devices & tools, mechanism and attachments for various operations.

Shaper: Principle of operation, parts, types horizontal, vertical, universal, Operations – horizontal cutting, vertical cutting, angular cutting, irregular cutting, specification, Quick return Mechanisms. Work holding devices.

Planner: Principle of operation, parts, and types. **[7 Hrs]**

Unit – V **CO5**

Milling: Principle of operation, parts, specification, types- horizontal, vertical, universal, milling operations – plain, face, slotting, gear cutting mechanisms and attachments for milling, indexing - simple, compound and differential. Numerical problems.

Broaching: Principle of operation, parts, types of broaches- horizontal, vertical, pull, surface-internal and external broaching machines, nomenclature, of broach. **[7 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Manufacturing Technology (Vol - I & II)	P.N. Rao	Tata McGraw Hill Pub. Company, New Delhi
2	Production Technology (Manufacturing Processes)	P.C. Sharma	S. Chand and Company Ltd., New Delhi

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Manufacturing Science	A. Ghosh & A.K. Mallik	East West Press Pvt. Ltd., New Delhi
2	Manufacturing Engineering & Technology	S. Kalpakjian & S.R. Schmid	Addision Wesley Longman, New Delhi
3	Production Technology	R. K. Jain	Khanna Publishers, New Delhi
4	Production Technology (Vol. I & II)	O.P. Khanna	Dhanpat Rai & Sons, New Delhi

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code ME107403	FLUID MECHANICS & MACHINES	L = 3	T = 0	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
The objective of the course is to develop an understanding of the behavior of fluids at rest or in motion and the subsequent effects of the fluids on the boundaries as the mechanical engineers has to deal with fluids in various applications. This enables students to apply the analytical tools to solve different types of problems related to fluid & fluid flow.	At the end of this course, the students are expected to be able to: **CO1:** Explain fluid properties and basic principles of fluid statics and analyze the problem related to manometry, forces on submerge plane, buoyancy and flotation. **CO2:** Explain basic principles of fluid kinematics and analyze related practical problem **CO3:** Explain basic principles of fluid dynamics and analyze related practical problem. **CO4:** Derive relationships for various flow characteristics of laminar flow, turbulent flow and energy losses in pipe flow and apply to analyze related practical problems. **CO5:** Apply dimensional analysis to derive a relationship among connected variables and apply model laws to predict the behavior of the prototype in given circumstances.

Unit – I **CO1**

Properties of fluid: Fluid, ideal and real fluid, properties of fluid : mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Newtonian and non-Newtonian fluids

Fluid Statics: Pressure, Pascal's law, Hydrostatic law, Hydrostatic force on submerged plane & curved surface, Buoyancy & Flotation. **[8 Hrs]**

Unit – II **CO2**

Fluid Kinematics: Description of fluid motion, Langragian & Eulerian approach, Type of fluid flow, Type of flow lines-path line, streak line, stream line, stream tube. Continuity equation, acceleration of a fluid particle, motion of fluid particle along curved path, Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, circulation, stream and potential function, flow net ,its characteristics and utilities. Liquid in relative equilibrium.

Fluid Dynamics: Euler's Equation, Bernoulli's equation and its practical application, Venturimeter, Orifice meter, Nozzle, Pitot tube, Impulse momentum equation, Momentum of Momentum equation, Kinetic energy and Momentum correction factor, Vortex motion, Radial flow. **[8 Hrs]**

Unit – III **CO3**

Laminar Flow: Reynold's experiment, flow of viscous fluids in circular pipe, shear stress and pressure gradient relationship, Velocity distribution, Hagen-Poiseuille Equation, flow of viscous fluids between two parallel plates (Coutte flow) shear stress and pressure Gradient relationship, Velocity distribution, Drop of pressure head.

Turbulent flow: Effect of turbulence, Expression for loss of head due to friction in pipes (Darcy Weisbach equation), Expression for Co-efficient of friction in terms of shear stress. **[6 Hrs]**

Unit – IV **CO4**

Dimensional Analysis: Methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, Limitations.

Model analysis: Dimensionless number and their significance, model laws, Reynolod's model law, Fraude's model law, Euler's model law, Weber's model law, Mach's model law, Type of models, scale effect in model, limitation of hydraulic similitude. **[7 Hrs]**

Unit – V **CO5**

Turbines:

(A) Impulse Turbine: Classification of turbine, impulse turbine, Pelton wheel, Construction working, work done, head efficiency and Design aspects

(B) Reaction Turbine: Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over Pelton wheel. Axial flow reaction turbine Propeller and Kaplan turbine, specific speed, unit quantities, degree of reaction. **[7 Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Fluid Mechanics and Fluid Power Engineering	D.S. Kumar	Kataria & Sons, New Delhi
2	A text of Fluid Mechanics	R. K. Rajput	S. Chand & Company Ltd., New Delhi
3	Fluid Mechanics	Yunush A Cengel, John M. Cimbala	TMH, New Delhi

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Fluid Mechanics & Hydraulics Machines	R.K.Bansal	Laxmi Publications. New Delhi
2	Engineering Fluid Mechanics	K.L. Kumar, Eurasia	Publication House, New Delhi
3	Introduction to Fluid Mechanics and Fluid Machines	S.K. Som and G. Biswas	TMH , New Delhi
4	Hydraulics and Fluid Mechanics Including Hydraulic Machine	PN Modi,& SM Seth	Standard, New Delhi
5	Hydraulic Machines: Fundamentals of Hydraulic Power Systems	P. Kumar	BSP Books Pvt, Ltd.,Hyderabad
6	Mechanics of Fluid	B.S. Massey	English Language Book Society(U.K.)

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code ME107404	TURBO MACHINERY	L = 3	T = 0	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
• To study classifications of turbo-machines. • To study construction and working of different turbo- machines • To acquire the knowledge and skill of analyzing different turbo- machines	At the end of this course, the students are expected to be able to: **CO1:** Apply knowledge of turbo machinery for understanding steam turbines **CO2:** Explain basic principles of Impulse reaction turbines and analyze related practical problem **CO3:** Explain basic principles of state point locus and reheat factor and analyze related practical problem **CO4:** Explain gas turbines and analyze the problem related to gas turbines **CO5:** Explain compressors and analyze the problem related to turbo compressors and axial flow compressors

Unit – I **CO1**

Impulse Turbine: Steam turbine – Principal of operation of steam turbine, types of impulse turbine, compounding of steam turbine-pressure compounded, velocity compounded and pressure velocity compounded impulse turbine. Velocity diagram for impulse turbine, force on the blade and work done. Blade or diagram efficiency, axial thrust, gross stage efficiency. Influence of ratio of blade velocity to steam velocity on blade efficiency in a single stage impulse turbine. Efficiency of multi-stage turbine. Impulse blade sections, choice of blade angle. Blade height in velocity compounded impulse turbine. **[8 Hrs]**

Unit – II **CO2**

Impulse Reaction Turbine: Velocity diagram, degree of reaction, impulse-reaction turbine with similar blade section and half degree of reaction. (Parson's turbine) Height of reaction turbine blading ,Losses in steam turbine ,Internal losses-throttling losses, ,Nozzle friction losses, blade friction losses, disc friction losses, blade windage losses or partial admission losses, leakage or clearance losses, loss due to wetness of steam, carry-over loss. , residual loss, radiation loss, external losses-Mechanical friction and bearing losses. **[7Hrs]**

Unit – III **CO3**

State Point Locus and Reheat Factor: Stage efficiency of impulse turbines, stage point locus of an impulse turbine, state point locus for multistage turbine, reheat factor. Internal efficiency, overall efficiency, relative efficiency, Governing of steam turbine. Throttle governing, nozzle governing, bypass governing, combination of throttle and nozzle, governing and combination of bypass and throttle governing. Effect of governing on the performance of steam turbine. **[7Hrs]**

Unit – IV **CO4**

Gas Turbine: Classification of gas turbine. Applications, Simple open cycle gas turbine, Ideal and actual cycle for gas turbine, polytrophic or small stage efficiency, cycle air rate, cycle work ratio, Optimum pressure ratio for maximum specific output in actual gas turbine ,optimum pressure ratio for maximum cycle thermal efficiency, means of improving the efficiency and specific output. Open cycle gas turbine with regeneration, reheat and inter cooling and effect of these modification on efficiency and output. Closed cycle gas turbine. **[7Hrs]**

Unit – V **CO5**

Turbo Compressors: Introduction, classifications of Centrifugal compressors – components, working, velocity diagrams, calculations of power and efficiencies. Slip factor, surging and choking, power and efficiencies.

Axial Flow Compressor: Construction and working, velocity diagram, calculation of power and efficiencies. Degree of reaction, work done factor, stalling, and comparison of centrifugal and axial flow compressor. **[7Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Turbine, Compressors and Fan	S.M. Yahya	TMH, Delhi
2	Steam and Gas Turbine and Power Plant Engineering	R. Yadav	Central Publishing House, Allahabad

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Gas Turbine	V. Ganeshan	TMH, Delhi
2	Fundamental Of Compressible Flow	S.M. Yahya	TMH, Delhi
3	Fundamentals Of Compressible Fluid Dynamics	P. Balachandran	PHI, Delhi
4	Fundamental of Gas Dynamics	K. L.Yadao	Khanna Publications, Delhi

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code ME107405	PROGRAMMING WITH PYTHON	L = 3	T = 0	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
• To introduce basic concepts of Python programming language as well as common packages and libraries. • To generate an ability to design, analyze and perform experiments on real life problems in mechanical engineering using python.	At the end of this course, the students are expected to be able to: **CO1:** Read and write simple Python programs and to develop Python programs with conditionals and loops. **CO2:** Apply the use of Numpy Library for performing various data processing activities. **CO3:** Apply the use of Pandas library for data handling activities and Matplotlib for data visualization activities **CO4:** Solve problems based on engineering applications using Python **CO5:** Solve problems based on engineering mechanics using Python

Unit – I **CO1**

Introduction: Key Concepts: Python Identifiers, Keywords, Indentations, Comments in Python, Operators, Membership operator, String, Tuple, List, Set, Dictionary, File input/output. Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and Elif statement in Python. Loops: Purpose and working of loops, while loop including its working, For Loop, Nested Loops, Break and Continue. Parts of A Function, Execution of A Function, Scope Rules. Strings: Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings. Python Data Structure: Tuples, Unpacking Sequences, Lists, Mutable Sequences, List Comprehension, Sets, Dictionaries Higher Order Functions: Treat functions as first-class Objects, Lambda Expressions **[8 Hrs]**

Unit – II **CO2**

The NumPy Library: Ndarray, Basic Operations, Indexing, Slicing, and Iterating, Conditions and Boolean Arrays, Shape Manipulation, Array Manipulation, Vectorization, Broadcasting, Structured Arrays, Reading and Writing Array Data on Files. Iterators & Recursion: Recursive Fibonacci, Tower of Hanoi Search: Simple Search and Estimating Search Time, Binary Search and Estimating Binary Search Time Sorting & Merging: Selection Sort, Merge List, Merge Sort, Higher Order Sort **[7Hrs]**

Unit – III **CO3**

The Pandas Library: The Series, The Data-Frame, The Index Objects, Reindexing, Dropping, Arithmetic and Data Alignment, Operations between Data-Frame and Series, Functions by Element, Functions by Row or Column, Statistics Functions, Sorting and Ranking, Correlation and Covariance, “Not a Number” Data. Reading and Writing Data: CSV and Textual Files, HTML Files, XML, Microsoft Excel Files.

Data Visualization with Matplotlib: A Simple Interactive Chart, Set the Properties of the Plot, matplotlib and NumPy, Working with Multiple Figures and Axes, Adding Text, Adding a Grid, Adding a Legend, Saving the Charts. Line Chart, Histogram, Bar Chart, Pie Charts. **[7Hrs]**

Unit – IV **CO4**

Problem based on Engineering applications: Thermodynamics from first Law, second law, Efficiency of Heat Engine, Entropy, Availability of systems, Applied Thermo-dynamics. Problem based on Fluid Mechanics. **[7Hrs]**

Unit – V **CO5**

Problem based on Engineering Mechanics: Strength of material and Theory of Machine, Machine Design. Programs for a robotic arm with 2 degrees of freedom and simulating the motion of a pendulum. Solving Dynamic Equations, Curve Fitting and Regression and Iterative Solver. **[7Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Python Data Analytics: With Pandas, NumPy, and Matplotlib	Fabio Nelli	Apress
2	Python for Data Analysis	Wes McKinney	O'Reilly Media, Inc

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Mastering Machine Learning with Python in Six Steps	Manohar Swamynathan	Apress
2	Data Structures and Algorithms Using Python	Rance D. Necaise	WILEY

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code AC100492	BIOLOGY FOR ENGINEERS	L = 0	T = 0	P = 0	Credits = 0
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	Workshop ,Quiz, Seminar and by Organize Guest Lecture	--	25	25	---

Course Objectives	Course Outcomes
The objective of this course is to impart an understanding of fundamentals of biological systems and its applications towards industries to solve the problems in the real life. • To convey that Biology is as important scientific discipline as Mathematics, Physics, Chemistry, and Engineering and technology. • To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Discuss the concept human genetics. • To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. The molecular basis of coding and decoding genetic information is universal • How to analyses biological processes at the reductionist level. Concept of Energy change. • The fundamental concept and principles of Microbiology	**On successful completion of the course, the student will be able to:** **CO1:** Describe how biological observations of 18th Century that lead to major discoveries. **CO2:** Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological. Highlight the concepts of genetic material and its segregation and independent assortment. **CO3:** Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine. Classify enzymes and distinguish between different mechanisms of enzyme action. Concept of genetic code. Universality and degeneracy of genetic code **CO4:** Identify DNA as a genetic material in the molecular basis of information transfer. The fundamental principles of energy transactions in physical and biological world. Thermodynamics properties of different biological systems. **CO5:** Apply thermodynamic principles to biological systems. Identify and classify microorganisms. A Brief Account of Evolution

Unit – I **CO1**

Introduction: Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.**[2Hrs]**

Unit – II **CO2**

Classification & Genetics: Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy.Classification. Discuss based on (a) cellularity- Unicellular or multicellular (b) ultrastructure-prokaryotes or eucaryotes. (c) Energy and Carbon utilization -Autotrophs,Heterotrophs, Lithotropes (d) Ammonia excretion – Aminotelic, Uricotelic, Ureotelic (e) Habitataacquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M.musculus, Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. **[3Hrs]**

Unit – III **CO3**

Biomolecules & Information Transfer: Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids, Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. **[4Hrs]**

Unit – IV **CO4**

Macromolecular Analysis & Its Metabolism: Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and Energy consuming reactions. Concept of Energy change. **[3Hrs]**

Unit – V **CO5**

Microbiology Evolution: Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics. Origin of Universe, Origin of Life, Evolution of Life Forms, Evidences of Evolution, Adaptive Radiation, Theories of Evolution Biological Evolution, Hardy–Weinberg Principle, **[3Hrs]**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Biology: A global approach	Campbell, N. A, Reece, J. B., Urry, Lisa, Cain, M, L., Wasserman, S. A., Miniorsky, P. V., Jackson, R. B.	Pearson Education Ltd
2	Outlines of Biochemistry	Conn, E.E, Stumpf, P.K., Bruening G., Doi R.H.	John Wiley and Sons
3	Principles of Biochemistry	Nelson D. L. and Cox M.M.W.H.	Freeman and Company
4	Molecular Genetics	Stent, G. S.; and Calendar, R.W.H.	Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5	Microbiology	Prescott, L.M J.P. Harley and C.A. Klein	W.M.C. Brown Publishers
6	Biology for engineers and other non-biologist.	Prof. Suraishkumar &Prof Madhulika Dixit	IIT, Madras

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Biology For Engineers	Dr Tanu Allen, Dr Sohini Singh	Vayu Education Of India ,New Delhi
2	Biology For Engineers	Arthur T.Johnsion	Taylor &Francis Group
3	Molecular. Cellular and tissue Engineering	Joseph D .Bronzino,Donal R .Peterson	CRC Press
4	Biology For Engineers	Rajiv Singal,Gaurav Agrawal,Ritu Bir	CBS Publisher & distributors
5	Biology For Engineers	G,K,Suraish Kumar	OUP India

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code ME107491	KINEMATICS OF MACHINES LAB	L = 0	T = 0	P = 2	Credits = 1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	--	25	50	-----

Course Objectives	Course Outcomes
• To synthesis, both graphically and analytically, multilink mechanisms. • To perform mechanism analyses to find the position, velocity, acceleration, and dynamics of multi-bar mechanisms. • To synthesis mechanism to perform certain prescribed task/motion • To analyze gear trains. • To analyze thrust bearings, Brakes and dynamometers	At the end of this course, the students are expected to be able to: **CO1:** Apply knowledge of Kinematics of machine for understanding, formulating and solving engineering problems base on market demand. **CO2:** Acquire knowledge and hands-on competence in applying the concepts kinematics of machine in the design and development of mechanical systems. **CO3:** Demonstrate creativeness in designing new systems components and processes in the field of engineering **CO4:** Identify, analysis, and solve mechanical engineering problems useful to the society. **CO5:** Demonstrate creativeness in designing components gear system.

List of Experiments (At least Ten experiments are to be performed by each student):

1. To determine the jump phenomena of cam follower apparatus.
2. To draw displacement, velocity and acceleration curve of cam motion.
3. To find out the load carrying capacity of bearing.
4. To find out the Coefficient of friction of bearing.
5. To find out the frictional horse power of bearing.
6. To find out the Pressure around the bearing by journal bearing apparatus.
7. To measure co-efficient of friction, power transmitted with varied belt tension by slip & creep apparatus.
8. To find out the percentage slip at fixed belt tension by varying load with slip & creep apparatus.
9. To find out belt slip and creep by slip and creep measurement apparatus.
10. To verify the coriolli's component of acceleration with theoretical and practical results.
11. To find the speed and torque of different gear in an epicyclic gear train.
12. To find the speed and torque of different gear in a simple, compound and reverted gear train.
13. To Study and analysis of Pantograph.
14. To study Four-bar mechanism and its inversions.
15. To study internal expanding and external contracting shoe brakes.
16. To study rope brake dynamometer and calculation of torque and power.

List of Equipment/Instruments/Machines/Software Required:

- Cam analysis apparatus
- Journal bearing apparatus.
- Coriolli's component of acceleration apparatus
- Slip & Creep Measurement Apparatus in Belt Drive Simple, compound, reverted and epicyclic gear train apparatus.
- Pantograph apparatus (with all accessories)
- Internal / external shoe brake (complete set with accessories)
- Four bar mechanism and its inversions.
- Rope brake dynamometer apparatus (with all accessories)
- Mechanoset.

SHRI SHANKARACHARYA TECHNICAL CAMPUS, BHILAI

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code ME107492	FLUID MECHANICS AND MACHINES LAB	L = 0	T = 0	P = 2	Credits = 1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	--	25	50	-----

Course Objectives	Course Outcomes
The Fluid mechanics lab runs closely with the lectures in such a way that experiments support the text covered in the class room. The objective of this course is to compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows	At the end of this course, the students are expected to be able to: **CO1:** Demonstrate practical understanding of principles of buoyancy and flotation and determine meta-centric height. **CO2:** Verify impulse momentum principle. **CO3:** Demonstrate practical understanding of the various terms in Bernoulli's equation and verify Bernoulli's theorem. **CO4:** Calibrate flow measurement devices. **CO5:** Demonstrate practical understanding of Major and Minor Losses in pipe flow

List of Experiments (At least Ten experiments are to be performed by each student):

1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli's Theorem.
3. To calibrate a Venturimeter and study the variation of coefficient of discharge.
4. To calibrate an orifice-meter.
5. To study the transition from laminar to turbulent flow and to determine the lower critical Reynold's number
6. To determine the hydraulic coefficients (Cc, Cd and Cv) of an orifice.
7. Performance characteristics of Pelton wheel turbine.
8. Performance characteristics of Francis turbine
9. Performance characteristics of Kaplan turbine
10. To study the Hydraulic Accumulator
11. To study the Hydraulic Intensifier
12. To study the Hydraulic Crane
13. To study the Hydraulic Ram

List of Equipment/Instruments/Machines/Software Required:

- Apparatus for determination of metacentric height
- Bernoulli's apparatus
- Venturimeter
- Orifice meter
- Orifice apparatus
- Mouth Piece apparatus with the provision for determination of hydraulic coefficient Cc, Cd & Cv
- Reynold's apparatus
- Pelton Wheel Turbine
- Francis Turbine Test Rig
- Kaplan Turbine Test Rig

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SYLLABUS

B.Tech. (Mechanical Engineering) Fourth Semester

Subject Code ME107493	PROGRAMMING WITH PYTHON LAB	L = 0	T = 0	P = 2	Credits = 1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	--	25	50	-----

Course Objectives	Course Outcomes
• To master the fundamentals of writing Python scripts. • To learn core Python scripting elements such as variables and flow control structures. • To discover how to work with lists and sequence data. • To write Python functions to facilitate code reuse. • To use Python to read and write files.	At the end of this course, the students are expected to be able to: **CO1:** Student should be able to understand the basic concepts scripting and the contributions of scripting language **CO2:** Ability to explore python especially the object oriented concepts, and the built in• objects of Python. **CO3:** Student should be able to understand the basic concepts to draw Pie Charts. **CO4:** Student should be able to understand the basic concepts to analyze diesel cycle with python program. **CO5:** Student should be able to understand the basic concepts to analyze strength of material and theory of machine, machine design.

List of Experiments (At least Ten experiments are to be performed by each student):

1. To write a program to perform different arithmetic operations on numbers in python
2. To write a program to perform String, Tuple, List, Set, Dictionary, File input/output operations.
3. To write a program to add natural number.
4. Write a nested for loop program to print multiplication table in Python.
5. To write a python program for binary search.
6. To write a python program to multiply matrices in Numpy.
7. To write a Python Program to Display Fibonacci Sequence Using Recursion.
8. To write python program to surface plot.
9. To write python program to surface plot.
10. To write python program to polar plot.
11. To write python program Analyze the Diesel cycle with python program.
12. To write python program to Analysis of Beam: - Shear force and bending moment Diagram.
13. To write python program for projectile motion.
14. Animating the kinematic Mechanism Pendulum Animation.

List of Equipment/Instruments/Machines/Software Required:

- Python 3, Anaconda
- Memory: 8 GB RAM
- Storage: 500 GB internal storage drive
- Monitor/Display: 15" LCD monitor
- Other: 802.11ac 2.4/5 GHz wireless adapter