GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)
Coimbatore - 641 013

II Semester syllabi for

B. E. MECHANICAL ENGINEERING

(Part Time)

2023

Regulations

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GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013
B.E.MECHANICAL ENGINEERING-PART TIME
2023 REGULATIONS
(Candidates admitted during 2023-2024 and onwards)

Second Semester

Sl. No.	Course Code	Course Title	CA Marks	End Sem Marks	Total Marks	Hours/Week			
						L	T	P	C
THEORY									
1	23PTM2Z1	APPLIED MATHEMATICS II	40	60	100	3	0	0	3
2	23PTM202	PYTHON PROGRAMMING	40	60	100	3	0	0	3
3	23PTM203	SOLID MECHANICS	40	60	100	3	0	0	3
4	23PTM204	FLUID MECHANICS AND HYDRAULIC MACHINES	40	60	100	3	0	0	3
5	23PTM205	MATERIALS ENGINEERING AND METALLURGY	40	60	100	3	0	0	3
TOTAL					500				15

23PTM2Z1	APPLIED MATHEMATICS II *(Common to Mech, EEE & ECE)*	SEMESTER II

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To focus on differential equations and Numerical Techniques which is important for comprehending engineering science.	
UNIT – I	**ORDINARY DIFFERENTIAL EQUATIONS**	**9 Periods**
Higher order linear differential equations with constant coefficients -variable coefficients: Cauchy-Euler equation, Cauchy-Legendre equation-Method of variation of parameters.		
UNIT – II	**PARTIAL DIFFERENTIAL EQUATIONS**	**9 Periods**
Formation of partial differential equations – First order partial differential equations – Standard types and Lagrange's linear equation – Homogeneous linear partial differential equations of second and higher order with constant coefficients.		
UNIT – III	**NUMERICAL DIFFERENTIATION AND INTEGRATION**	**9 Periods**
Numerical Differentiation (using Newton's interpolation formula) – Numerical integration: Trapezoidal rule and Simpson's rules (Both single and double integrals.		
UNIT – IV	**NUMERICAL SOLUTION OF FIRST ORDINARY DIFFERENTIAL EQUATIONS**	**9 Periods**
Single Step Methods : Taylor's series method-Euler's and modified Euler's methods-Runge-Kutta method of fourth order Multi Step methods - Milne's and Adam's predicator-corrector methods		
UNIT – V	**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS**	**9 Periods**
Finite difference solution of two dimensional Laplace equation and Poisson equation- Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods)-Finite difference explicit method for one dimensional wave equation.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

1	*Veerarajan.T,* ***"Engineering Mathematics"****, Tata McGraw Hill Education (India) Private Limited, New Delhi, 2018.*
2	*P. Kandasamy, K. Thilagavathy, K. Gunavathi,* ***"Numerical Methods"****, S. Chand & Company, 3nd Edition, Reprint 2013.*

REFERENCES

1	*B.S.Grewal,* ***"Higher Engineering Mathematics"****, Khanna Publishers, New Delhi, 44thEdition, 2018.*
2	*SrimantaPal,* ***"Numerical Methods Principles, Analyses and Algorithms"****, Oxford University Press, New Delhi, IstEdition 2009.*
3	*Raisinghania.M..D,* ***"Ordinary And Partial Differential Equations"****, 20th Edition, S. ChandPublishing,2020*
4	*S.S. Sastry,* ***"Introductory methods of numerical analysis"****, PHI, New Delhi, 5th Edition, 2015.*
5	*S.Larsson and V.Thomee,* ***"Partial Differential Equations with Numerical Methods"****, Springer, 2003.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Obtain the knowledge for solving higher order linear differential equation with constant and variable coefficient techniques and simultaneous differential equation.	K3
CO2	Understand the knowledge of partial differential equations (PDEs), modeling; demonstrate accurate and efficient use of Lagrange's techniques.	K3
CO3	Demonstrate and understanding of common numerical methods and how they are used to obtain approximate solutions to polynomial and transcendental equations.	K3
CO4	Construct one-step and linear multistep methods for the numerical solution of initial-value problems for ordinary differential equations.	K3
CO5	Acquire the knowledge of principles for designing numerical schemes for PDEs in particular finite difference schemes.	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	-	1
CO2	3	3	2	2	-	-	-	-	-	-	-	2	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	2	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	2	-	1
CO5	3	3	2	2	-	-	-	-	-	-	-	2	-	1
23PTM2Z1	3	3	2	2	-	-	-	-	-	-	-	2	-	1
1 – Slight, 2 – Moderate, 3 – Substantial														

23PTM202	PYTHON PROGRAMMING	SEMESTER II

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	1. To solve problems using Python conditionals and loops statements. 2. To define Python functions and use function calls to modularize the program. 3. To use Python data structures, simple data – lists, tuples, complex data - dictionaries. 4. To do input/output operations with files in Python.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Fundamentals of Computing – Identification of Computational Problems - Algorithms, building blocks of algorithms - statements, control flow, notation - pseudo code, flowchart, programming language – Data, Expressions, variables and keywords, precedence of operators, comments. Python Interactive and script mode.		
UNIT – II	**CONDITIONAL AND LOOPING STATEMENTS**	**9 Periods**
Conditional Statements: Boolean values and operators, simple (if), alternative (if-else), chained conditional (if-elif-else) and Nested. Iteration: while, for, break, continue, pass; nested loops.		
UNIT – III	**FUNCTION AND STRING**	**9 Periods**
Function: structure of a function, return values, parameters, local and global scope, recursion. String – operations, functions, methods and slicing.		
UNIT – IV	**LIST, TUPLE AND DICTIONARY**	**9 Periods**
List – creation, operations, functions, methods and slicing; tuple creation and methods, Multiple assignment statements. Dictionaries: operations and methods; advanced list processing – list comprehension.		
UNIT – V	**FILES AND EXCEPTIONS**	**9 Periods**
Files and exceptions: Types of files, reading and writing files, Different file modes, copying a file; command line arguments, Exceptions: handling exceptions, modules, packages.		
Contact Periods: **Lecture:45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods**		

TEXT BOOK:

1	*Kenneth Leroy Busbee and Dave Braunschweig, **"Programming Fundamentals, A Modular Structured Approach"**, Creative Commons Attribution-Share A like 4.0 International License, 2nd Edition, 2018.*
2	*Yashavant Kanetkar and Aditya Kanetkar, **"Let us Python"**, BPB Publications, 1stEdition, 2019.*

REFERENCES:

1	*Allen B. Downey, **"Think Python: How to Think like a Computer Scientist"**, O'Reilly Publishers, 2nd Edition, 2016.*
2	*Venkatesh and Madhavan Mukund, **"Computational Thinking: A Primer for Programmers and Data Scientists"**, Notion Press, 1st Edition, 2021.*
3	*John V Guttag, **"Introduction to Computation and Programming Using Python: With Applicationsto Computational Modeling and Understanding Data"**, The MIT Press, 3rd Edition, 2021.*
4	*Paul Deitel and Harvey Deitel, **"Python for Programmers"**, Pearson Education, 1st Edition, 2021.*
5	*Eric Matthes, **"Python Crash Course, A Hands – on Project Based Introduction to Programming"**, No Starch Press, 2nd Edition, 2019.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Develop algorithms to simple computational problems.	K3
CO2	Write simple conditional Python programs.	K3
CO3	Write simple Python programs using loops and functions.	K3
CO4	Create Python lists, tuples and dictionaries.	K3
CO5	Read from a file and write into a file using Python.	K3

23PTM203	SOLID MECHANICS	SEMESTER II

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To learn the basics techniques to evaluate stresses, strain, bending moment and shear force distribution in engineering structures.	
UNIT – I	**STRESS AND STRAIN**	**9 Periods**
Stress and strain at a point - Tension, compression, shear stresses - Hooke's law - Compound bars – lateral strain - Poisson's ratio - Volumetric strain - Bulk modulus - Relationship among elastic constants – stress strain diagrams for mild steel, cast iron - Ultimate stress - Yield stress - Factor of safety - Thermal stresses - Thin cylinders - Strain energy due to axial force - Resilience - Stress due to gradual load, suddenly applied load and Impact load.		
UNIT – II	**SHEAR FORCE AND BENDING MOMENT**	**9 Periods**
Beams – Types of Beams - Types of loads, supports - Shear force – Bending moment – shear force and bending moment diagrams for cantilever, simply supported and over hanging beams with concentrated , uniformly distributed, uniformly varying load and couple - Relationship among rate of loading, shear force, bending moment- Point of contraflexure.		
UNIT – III	**THEORY OF BENDING AND COMPLEX STRESSES**	**9 Periods**
Theory of bending - Bending equation - Section Modulus - Stress distribution at a cross section due to bending moment and shear force for cantilever, simply supported beams with point, UDL loads (Rectangular, circular, I & T sections only) - combined direct and bending stresses, Kernel of section (Rectangular, Circular Sections only). 2D State of stress - 2D Normal and shear stresses on any plane-Principal stresses and Principal planes - Introduction to principal strains and direction - Mohr's circle of stress (Two dimension only).		
UNIT – IV	**DEFLECTION OF BEAMS AND THEORY OF LONG COLUMNS**	**9 Periods**
Determinations of deflection curve – Relation between slope, deflection and radius of curvature – Slope and deflection of beam at any section by Macaulay's method - Concept of Conjugate beam method (Theory only) - Euler's theory of long columns - Expression of crippling load for various end conditions - Effective length - Slenderness ratio - limitations of Euler equation - Rankine formula for columns.		
UNIT – V	**THEORY OF TORSION**	**9 Periods**
Torsion of shafts - Torsion equation - Polar modulus - Stresses in solid and hollow circular shafts – Torsional rigidity - Power transmitted by the shaft – Importance of angle of twist - Strain energy due to torsion - Modulus of rupture – Torsional resilience – Combined bending and torsion - Stresses in helical springs - Deflection of helical spring - Introduction to torsion of non - circular sections.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Sadhu Singh, **"Strength of Materials"**, Khana Publishers, 11th Edition, 2014.*
2	*R.K.Rajput, **"Strength of Materials"**, S. Chand & Company Ltd., 6th Edition, 2018.*

REFERENCES:

1	*S.S. Bhavikatti, **"Strength of Materials"**, Vikas Publishing House, 5th Edition, 2022.*
2	*James M.Gere and Barry J.Goodno, **"Mechanics of Materials"**, Cengage Learning India Pvt. Ltd., 9th Edition, 2022.*

3	*Srinath L., **"Advanced Mechanics of Solids"**, McGraw Hill Education, 3rd Edition, 2017.*
4	*Kazimi, **"Solid Mechanics"**, McGraw Hill Education, 2nd Edition, 2017.*
5	*Jacob Lubliner and Panayiotis Papadopoulos, **"Introduction to Solid Mechanics - An Integrated Approach"**, Springer, 2014th Edition, 2013.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Evaluate stresses and strains for various types of loading.	K2
CO2	Estimate the Shear force and Bending moment and find the point of contraflexure.	K2
CO3	Create shear stress distribution drawings for simple sections and evaluate principal stresses and strains.	K3
CO4	Use theory of beams and long columns to find slope, deflection, radius of curvature of beams and crippling load of long columns.	K3
CO5	Apply theory of torsion for problems involving torsion of circular shafts and leaf spring.	K3

23PTM204	FLUID MECHANICS AND HYDRAULIC MACHINES	SEMESTER II

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To understand the Fluid properties, types of fluid flow, dimensional analysis and performance of pumps and turbines.	
UNIT – I	**FLUID PROPERTIES**	**9 Periods**
Units and dimensions – fluid properties – density, specific gravity, viscosity, surface tension, capillarity, compressibility and bulk modulus – Pascal's law – pressure measurements – manometers - fluid statics – total pressure and centre of pressure on submerged surfaces.		
UNIT – II	**FLUID KINEMATICS AND DYNAMICS**	**9 Periods**
Types of fluid flow and flow lines – control volume – continuity equation in one dimension and three dimension – velocity potential and stream function - energy equation – Euler and Bernoulli's equations – applications of energy equations - flow meters - laminar and turbulent flow through pipes – Hagen Poisullie equation – Darcy Weisbach formula – applications.		
UNIT – III	**DIMENSIONAL ANALYSIS**	**9 Periods**
Need for dimensional analysis – dimensional homogeneity – Rayleigh's and Buckingham methods of dimensional analysis – problems. Model study and similitude – scale effects and distorted model.		
UNIT – IV	**TURBINES**	**9 Periods**
Classification – construction, working principles and design of Pelton wheel, Francis and Kaplan turbines - work done and efficiency - specific speed - operating characteristics - governing of turbines – problems.		
UNIT – V	**PUMPS**	**9 Periods**
Classification of pumps - centrifugal pump - working principle - work done and efficiency – multistage pumps - reciprocating pumps - work done and efficiency - negative slip - air vessels - indicator diagram – problems.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*P.N.Modi and S.N.Seth, **"Hydraulics and Fluid Mechanics, Including Hydraulic Machines"**, Standard Book House, 15th Edition, 2015.*
2	*R.K.Bansal, **"Fluid Mechanics and Hydraulic Machines"**, Laxmi Publications (P) Ltd., 9th Edition, 2018.*

REFERENCES:

1	*K.Subramanya, **"Flow in Open channels"**, McGraw-Hill, 5th Edition, 2019.*
2	*S.Ramamrutham and R.Narayan, **"Hydraulics, Fluid Mechanics and Fluid Machines"**, Dhanpat Rai Publishing Company, 9th Edition, 2014.*
3	*R.K.Rajput, **"A Text Book of Fluid Mechanics and Hydraulic Machines"**, S.Chand and Company, 9th Edition, 2015.*

4	*D.S.Kumar, **"Fluid Mechanics and Fluid Power Engineering"**, S.K.Kataria & Sons, 9th Edition, 2018.*
5	*G.K.Batchelor, **"An Introduction to Fluid dynamics"**, Cambridge University Press, 2nd Edition, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain fluid properties and its applications.	K4
CO2	Gain knowledge on fluid flows and to solve practical problems.	K4
CO3	Apply the concepts of dimensional analysis for fluid flow problems.	K4
CO4	Analyze the performance of turbines and design of turbines.	K4
CO5	Analyze the performance of pumps and design of pumps.	K4

23PTM205	MATERIALS ENGINEERING AND METALLURGY	SEMESTER II

PREREQUISITES	L	T	P	C
MATERIAL SCIENCE	3	0	0	3

Course Objectives	To study the crystal structure, phase diagrams, phase transformations and heat treatment of alloys and to acquire knowledge on various testing methods of engineering materials.	
UNIT – I	**BASICS OF CRYSTALS STRUCTURES**	**9 Periods**
Classification of engineering materials, ABAB stacking of HCP structure, ABCABC Stacking of CCP structure, Voids in closed packed structure, Dislocations, Slip systems, Deformation by twining, Twin-Tilt Boundary, Burger circuit, Stacking fault, Types of solid solutions, Hume Rotherys rules, Intermediate alloy phases and electron compounds, Solid solutions - Substitutional and interstitial.		
UNIT – II	**PHASE DIAGRAMS OF ALLOYS AND STRENGTHENING MECHANISMS**	**9 Periods**
Unary phase diagram, Binary isomorphous and eutectic system, Iron-carbon equilibrium diagram - Experimental methods of construction of equilibrium diagrams, Invariant reactions - Eutectic, Peritectic, Eutectoid and peritectoid reactions, Strengthening mechanisms: Strengthening by grain size reduction solute hardening, chemical hardening, dispersion hardening, cold working, strain hardening, Recovery recrystallization and grain growth.		
UNIT – III	**PHASE TRANSFORMATIONS AND HEAT TREATMENT OF ALLOYS**	**9 Periods**
Heat treatment of steel - TTT diagram - annealing process, normalizing, hardening and tempering of steels - Age hardening, austempering, martempering, Isothermal transformation diagrams – Cooling curves superimposed on I.T diagram - Effect of alloying elements on Fe-Fe_3C system - hardenability, Jominy-end-quench test, Case hardening – Carburizing - Types, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening.		
UNIT – IV	**FERROUS AND NON FERROUS METALS**	**9 Periods**
Plain carbon steels – alloy steels - stainless and tool steels – Cast iron - Gray, White, Malleable, Spheroidal graphite - alloy cast irons – Heat resistant steels and Die steels. Alloys of Copper, Aluminum, Nickel, Magnesium, Titanium, Lead, Tin, Composite material, Types - PMCs, MMCs, CMCs, CAMCs, Material specification and standards.		
UNIT – V	**TESTING OF MATERIALS**	**9 Periods**
Grain size determination by Microscopic techniques, Mechanical tests - tension, compression, impact, hardness, Fracture toughness test, Low and high cycle fatigue test, Crack growth studies – Creep tests. Non destructive testing basic principles and testing method for radiographic testing, Ultrasonic testing, Magnetic particle inspection and Liquid penetrant inspection test, Eddy current testing. Basics of X Ray diffraction test - Bragg's law, Secondary Ion Mass Spectroscopy, Fourier Transform Infra - Red Spectroscopy (FTIR).		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*William D. Callister, Jr. and David G. Rethwisch,* ***"Materials Science and Engineering: An***

	***Introduction"**, Wiley, 10th Edition, 2018.*
2	*O.P. Khanna, **"Material Science and Metallurgy"**, Dhanpat Rai Publications, 2nd Edition, 2014.*

REFERENCES:

1	*George E. Dieter, **"Mechanical metallurgy"**, McGraw-Hill, 3rd Edition, 2017.*
2	*Sydney H.Avner, **"Introduction to Physical Metallurgy"**, McGraw-Hill, 2nd Edition, 2017.*
3	*Kenneth G.Budinski and Michael K.Budinski, **"Engineering Materials: Properties and Selection"**, Pearson Education, 9thEdition, 2016.*
4	*Raghavan V., **"Materials Science and Engineering"**, Prentice Hall India Learning Private Ltd., 6th Edition, 2015.*
5	*U.C.Jindal, **"Engineering Materials and Metallurgy"**, Pearson Education, 1st Edition, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Acquire knowledge in the crystal structure and deformation of pure metals and alloys.	K3
CO2	Understand the alloy phase diagrams basics and their strengthening mechanisms.	K4
CO3	Select suitable and heat treatment methods for various metals and alloys.	K4
CO4	Understand the ferrous and nonferrous materials and their application.	K2
CO5	Gain knowledge about materials testing methods.	K4