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Savitribai Phule Pune University
Syllabus Booklet*

First Year Bachelor of Engineering
(Choice Based Credit System) (2019 Course)
(With Effect from Academic Year 2019-20)

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- Course Materials focused upon

- Quality of Contents
- Ease of Learning
- Excellence in Exam
- Trustworthiness

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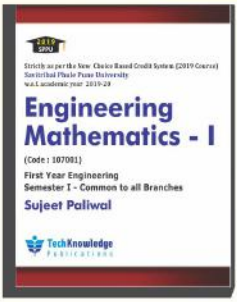
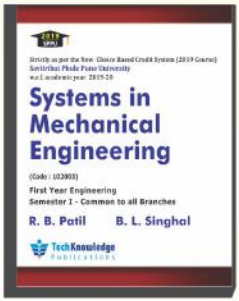
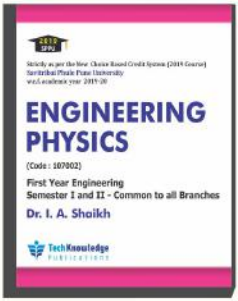
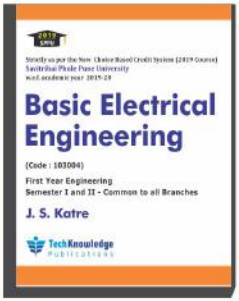
Semester - I

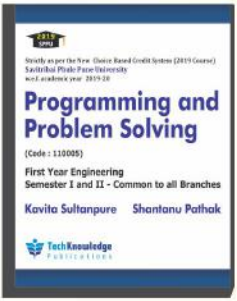


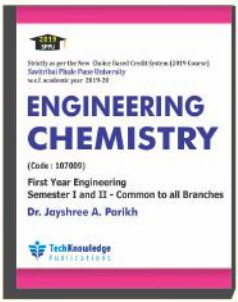


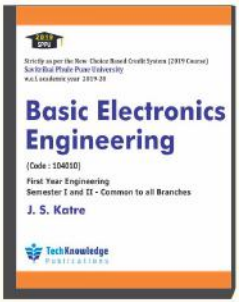
Semester - I / II

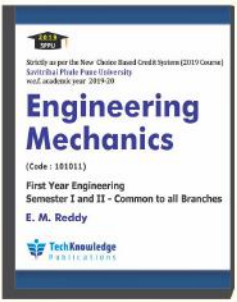












Savitribai Phule Pune University

Faculty of Science & Technology

Curriculum For First Year Bachelor of Engineering
(Choice Based Credit System) (2019 Course)
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Free Syllabus Booklet for Students

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TABLE -1 First Engineering _Structure for Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107001	Engineering Mathematics-I	03	--	01	30	70	25		--	125	03		01	04
107002/ 107009	Engineering Physics / Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
102003	Systems in Mechanical Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
111006	Workshop@	--	02				--	25	--	25	--	01	--	01
Total		16	10	01	150	350	25	125	--	650	16	05	01	22
101007	Audit Course 1&	02	Environmental Studies-I											
Induction Program : 2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II														

TABLE -2 First Engineering_ Structure for Semester-II

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107008	Engineering Mathematics-II	04	--	01	30	70	25	--	--	125	04	--	01	05
107002/ 107009	Engineering Physics/ Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
102012	Engineering Graphics	01	02	01	--	50	25		--	75	01	01		02
110013	Project Based Learning	--	04	--	--	--	25	50	--	75	--	02	--	02
Total		15	12	02	120	330	75	125	--	650	15	05	02	22
101014	Audit Course 2&	02	Environmental Studies-II											
107015		--	Physical Education-Exercise and Field Activities											

107001 - ENGINEERING MATHEMATICS – I

Teaching Scheme:	Credits	Examination Scheme:
TH : 3 Hrs./Week	04	In-Semester Exam :30 Marks
TUT : 1 Hr/Week		End-Semester Exam :70 Marks TW :25 Marks

Prerequisites : Differentiation, Integration, Maxima and Minima, Determinants and Matrices.

Course Objectives :

To make the students familiarize with concepts and techniques in Calculus, Fourier series and Matrices. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcomes (COs) : The students will be able to learn

CO1: Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems.

CO2: The Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems.

CO3: To deal with derivative of functions of several variables that are essential in various branches of Engineering.

CO4: To apply the concept of Jacobian to find partial derivative of implicit function and functional dependence. Use of partial derivatives in estimating error and approximation and finding extreme values of the function.

CO5: The essential tool of matrices and linear algebra in a comprehensive manner for analysis of system of linear equations, finding linear and orthogonal transformations, Eigen values and Eigen vectors applicable to engineering problems

Course Contents

Unit I : Differential Calculus : (08 Hrs.)

Rolle's Theorem, Mean Value Theorems, Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions, Indeterminate Forms, L' Hospital's Rule, Evaluation of Limits and Applications.

Unit II : Fourier Series (08 Hrs.)

Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonicanalysis, Parseval's identity and Applications to problems in Engineering.

Unit III : Partial Differentiation (08Hrs.)

Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous functions, Partial derivative of Composite Function, Total Derivative, Change of Independent variables

Unit IV : Applications of Partial Differentiation (08 Hrs.)

Jacobian and its applications, Errors and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

Unit V : Linear Algebra-Matrices, System of Linear Equations (08 Hrs.)

Rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Application to problems in Engineering.

Unit VI : Linear Algebra-Eigen Values and Eigen Vectors, Diagonaliztion (08 Hrs.)

Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonaliztion of a matrix, Reduction of Quadratic forms to Canonical form by Linear and Orthogonal transformations.

107002: ENGINEERING PHYSICS

Teaching Scheme	Credits	Examination Scheme	
TH: 04 Hr/week	05	In-Semester	:30 Marks
PR: 02 Hr/Week		End-Semester	:70 Marks
		PR	:25 Marks

Prerequisite Courses, if any : Fundamentals of: optics, interference, diffraction polarization, wave-particle duality, semiconductors and magnetism

Companion Course, if any : Laboratory Practical

Course Objectives : To teach students basic concepts and principles of physics, relate them to laboratory experiments and their applications

Course Outcomes : On completion of the course, learner will be able to-

CO1 : Develop understanding of interference, diffraction and polarization; connect it to few engineering applications.

CO2 : Learn basics of lasers and optical fibers and their use in some applications.

CO3 : Understand concepts and principles in quantum mechanics. Relate them to some applications.

CO4 : Understand theory of semiconductors and their applications in some semiconductor devices.

CO5 : Summarize basics of magnetism and superconductivity. Explore few of their technological applications.

CO6 : Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterials and their application.

Course Contents

Unit I Wave Optics (08 Hrs)

Interference :

– Introduction to electromagnetic waves and electromagnetic spectrum

– Interference in thin film of uniform thickness (with derivation)

- Interference in thin film wedge shape (qualitative)
- Applications of interference: testing optical flatness, anti-reflection coating

Diffraction :

- Diffraction of light
- Diffraction at a single slit, conditions for principal maxima and minima, diffraction pattern
- Diffraction grating, conditions for principal maxima and minima starting from resultant amplitude equations, diffraction pattern
- Rayleigh's criterion for resolution, resolving power of telescope and grating

Polarization :

- Polarization of light, Malus law
- Double refraction, Huygen's theory of double refraction
- Applications of polarization: LCD

Unit II Laser and Optic Fibre (08 Hrs)

Laser :

- Basics of laser and its mechanism, characteristics of laser
- Semiconductor laser: Single Hetro-junction laser
- Gas laser: CO_2 laser
- Applications of lasers: Holography, IT, industrial, medical

Optic Fiber :

- Introduction, parameters: Acceptance Angle, Acceptance Cone, Numerical Aperture
- Types of optical fiber- step index and graded index
- Attenuation and reasons for losses in optic fibers (qualitative)
- Communication system: basic building blocks
- Advantages of optical fiber communication over conventional methods.

Unit III Quantum Mechanics (08 Hrs)

- De-Broglie hypothesis
- Concept of phase velocity and group velocity (qualitative)
- Heisenberg Uncertainty Principle
- Wave-function and its physical significance
- Schrodinger's equations: time independent and time dependent
- Application of Schrodinger's time independent wave equation - Particle enclosed in infinitely deep potential well (Particle in RigidBox)

- Particle in Finite potential well (Particle in Non Rigid box) (qualitative)
- Tunneling effect, Tunneling effect examples (principle only): Alpha Decay, Scanning Tunneling Microscope, Tunnel diode
- Introduction to quantum computing

Unit IV Semiconductor Physics (08 Hrs)

- Free electron theory (Qualitative)
- Opening of band gap due to internal electron diffraction due to lattice Band theory of solids
- Effective mass of electron Density of states
- Fermi Dirac distribution function
- Conductivity of conductors and semiconductors
- Position of Fermi level in intrinsic and extrinsic semiconductors (with derivations based on carrier concentration)
- Working of PN junction on the basis of band diagram
- Expression for barrier potential (derivation)
- Ideal diode equation
- Applications of PN junction diode: Solar cell (basic principle with band diagram) IV Characteristics and Parameters, ways of improving efficiency of solar cell
- Hall effect: Derivation for Hall voltage, Hall coefficient, applications of Hall effect

Unit V Magnetism and Superconductivity (8Hrs.)

Magnetism :

- Origin of magnetism
- Classification of magnetism on the basis of permeability (qualitative)
- Applications of magnetic devices: transformer cores, magnetic storage, magneto-optical recording

Superconductivity :

- Introduction to superconductivity; Properties of superconductors: zero electrical resistance, critical magnetic field, persistent current, Meissner effect
- Type I and Type II superconductors
- Low and high temperature superconductors (introduction and qualitative)
- AC/DC Josephson effect; SQUID: basic construction and principle of working; Applications of SQUID
- Applications of superconductors

Unit VI Non Destructive Testing and Nanotechnology (8 Hrs.)

Non Destructive Testing

- Classification of Non-destructive testing methods

- Principles of physics in Non-destructive Testing
- Advantages of Non-destructive testing methods
- Acoustic Emission Testing
- Ultrasonic (thickness measurement, flaw detection)
- Radiography testing

Nanotechnology :

- Introduction to nanotechnology
- Quantum confinement and surface to volume ratio
- Properties of nanoparticles : optical, electrical, mechanical
- Applications of nanoparticles : Medical (targeted drug delivery), electronics, space and defense, automobile

102003 - SYSTEMS IN MECHANICAL ENGINEERING

Teaching Scheme:	Credits	Examination Scheme :
TH : 3 Hrs./week PR : 2 Hrs./Week	04	In-Semester : 30 Marks End-Semester :70 Marks PR :25 Marks

Course Objectives :

1. To identify the sources of energy and their conversions
2. To explain the basic concept of engineering thermodynamics and its application
3. To understanding the specifications of vehicles
4. To get acquainted with vehicle systems
5. To introduce manufacturing processes applying proper method to produce components
6. To be able to select and compare domestic appliances

Course Outcomes :

On completion of the course, learner will be able to

CO1 : Describe and compare the conversion of energy from renewable and non-renewable energy sources

CO2 : Explain basic laws of thermodynamics, heat transfer and their applications

CO3 : List down the types of road vehicles and their specifications

CO4 : Illustrate various basic parts and transmission system of a road vehicle

CO5 : Discuss several manufacturing processes and identify the suitable process

CO6 : Explain various types of mechanism and its application

Course Contents

Unit I : Introduction of energy sources & its conversion (06 Hrs)

Energy sources : Thermal energy, Hydropower energy, Nuclear energy, Solar energy, Geothermal energy, Wind energy, Hydrogen energy, Biomass energy and Tidal energy. Grades of Energy. (Numerical on efficiency calculation of thermal power plant)

Energy conversion devices : Introduction of pump, compressor, turbines, wind mills etc (Simple numerical on power and efficiency calculations)

Unit II : Introduction to Thermal Engineering (06Hrs)

Laws of thermodynamics, heat engine, heat pump, refrigerator (simple numerical) Modes of heat transfer: conduction, convection and radiation, Fourier's law, Newton's law of cooling, Stefan Boltzmann's law. (Simple numerical) Two stroke and Four stroke engines (Petrol, Diesel and CNG engines). Steam generators.

Unit III : Vehicles and their Specifications (04 Hrs)

Classification of automobile. Vehicle specifications of two/three wheeler, light motor vehicles, trucks, buses and multi-axle vehicles. Engine components (Introduction). Study of engine specifications, comparison of specifications of vehicles. Introduction of Electric and Hybrid Vehicles. Cost analysis of the Vehicle.

Unit IV Vehicle systems (08 Hrs)

Introduction of chassis layouts, steering system, suspension system, braking system, cooling system and fuel injection system and fuel supply system. Study of Electric and Hybrid Vehicle systems. Study of power transmission system, clutch, gear box (Simple Numerical), propeller shaft, universal joint, differential gearbox and axles. Vehicle active and passive safety arrangements: seat, seat belts, airbags and antilock brake system.

Unit V : Introduction to Manufacturing (06 Hrs)

Conventional Manufacturing Processes : Casting, Forging, Metal forming (Drawing, Extrusion, etc.), Sheet metal working, Metal joining, etc. Metal cutting processes and machining operations- Turning, Milling and Drilling, etc.

Micromachining. Additive manufacturing and 3D Printing. Reconfigurable manufacturing system and IOT, Basic CNC programming: Concept of Computer Numerical Controlled machines.

Unit VI : Engineering Mechanisms and their application in Domestic Appliances (6Hrs.)

Introduction to Basic mechanisms and equipment: Pumps, blowers, compressors, springs, gears, Belt-Pulley, Chain-Sprocket, valves, levers, etc. Introduction to terms : Specifications, Input, output, efficiency, etc.

Applications of : Compressors - Refrigerator, Water cooler, Split AC unit; Pumps - Water pump for overhead tanks, Water filter/Purifier units; Blower - Vacuum cleaner, Kitchen Chimney; Motor - Fans, Exhaust fans, Washing machines; Springs - Door closure, door locks, etc.; Gears - Wall clocks, watches, Printers, etc.; Application of Belt-Pulley/Chain-Sprocket - Photocopier, bicycle, etc.; Valves - Water tap, etc.; Application of levers - Door latch, Brake pedals, etc.; Electric/Solar energy - Geyser, Water heater, Electric iron, etc. (simple numerical on efficiency calculation)

103004: BASIC ELECTRICAL ENGINEERING

Teaching Scheme :	Credits	Examination Scheme :
TH : 03 Hr/week	04	In-Semester : 30 Marks
PR : 02 Hr/Week		End-Semester : 70 Marks
		PR : 25 Marks

Prerequisite Courses, if any : Engineering physics, electron theory, electricity, potential and kinetic energy

Course Overview : This course aims at enabling students of all Engineering Branches to understand the basic concepts of electrical engineering. This course is designed to provide knowledge of fundamentals and various laws in electromagnetic and magnetic circuits, electrostatics. The steady state analysis of AC and DC circuits, and its applications transformer, batteries and different energy conversion techniques are also included in this course.

Course Objectives :

1. To introduce fundamental concepts, various laws-principles and theorems associated with electrical systems.
2. To impart basic knowledge of all electrical quantities such as current, voltage, power, energy, frequency along with different types of fields.
3. To provide knowledge about fundamental parameters such as resistance, inductance and capacitance and magnetic circuits, AC and DC circuits.
4. To provide knowledge of the concepts of transformer, different energy conversions techniques.

Course Outcomes : At the end of course students will be able to

CO1: Differentiate between electrical and magnetic circuits and derive mathematical relation for self and mutual inductance along with coupling effect.

CO2: Calculate series, parallel and composite capacitor as well as characteristics parameters of alternating quantity and phasor arithmetic

CO3: Derive expression for impedance, current, power in series and parallel RLC circuit with AC supply along with phasor diagram.

CO4: Relate phase and line electrical quantities in polyphase networks, demonstrate the operation of single phase transformer and calculate efficiency and regulation at different loading conditions

CO5: Apply and analyze the resistive circuits using star-delta conversion KVL, KCL and different network theorems under DC supply.

CO6: Evaluate work, power, energy relations and suggest various batteries for different applications, concept of charging and discharging and depth of charge.

Course Contents

Unit I Electromagnetism : (6Hrs)

Review : resistance, emf, current, potential, potential difference and Ohm's law

Electromagnetism : Magnetic effect of an electric current, cross and dot conventions, right hand thumb rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of mmf, flux, flux density, reluctance, permeability and field

strength, their units and relationships. Simple series magnetic circuit, Introduction to parallel magnetic circuit(Only theoretical treatment), comparison of electric and magnetic circuit, force on current carrying conductor placed in magnetic field, Fleming's left hand rule. Faradays laws of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced e.m.f., self and mutual inductance, coefficient of couplings. Energy stored in magnetic field.

Unit II Electrostatics and AC Fundamentals (6 Hrs)

A) Electrostatics : Electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance. Capacitor, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors (no derivation) and time constant. **(2Hrs)**

B) AC Fundamentals : Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, Period, frequency, instantaneous, peak(maximum), average and r.m.s. values, peak factor and form factor. Phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasor. **(4Hrs)**

Unit III Single Phase AC Circuits (06 Hrs)

Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance, series R-L, R-C and R-L-C circuits, phasor diagrams, voltage, current and power waveforms, resonance in series RLC circuits, concept of impedance, concept of active, reactive, apparent, complex power and power factor, Parallel AC circuits (No numericals), concept of admittance

Unit IV Polyphase A.C. Circuits and Single Phase Transformers (06 Hrs)

A) Polyphase A.C. Circuits : Concept of three-phase supply and phase sequence. Balanced and unbalanced load, Voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams. **(3Hrs)**

B) Single phase transformers : principle of working, construction and types, emf equation, voltage and current ratios. Losses, definition of regulation and efficiency, determination of these by direct loading method. Descriptive treatment of autotransformers. **(3Hrs)**

Unit V DC Circuits : (06 Hrs)

Classification of electrical networks, Energy sources - ideal and practical voltage and current sources, Simplifications of networks using series and parallel combinations and star-delta conversions, Kirchhoffs laws and their applications for network solutions using loop analysis, Superposition theorem, Thevenin's theorem.

Unit VI Work, Power, Energy and Batteries (06 Hrs)

A) Work, Power, Energy : Effect of temperature on resistance, resistance temperature coefficient, insulation resistance, conversion of energy from one form to another in electrical, mechanical and thermal systems. **(4Hrs)**

B) Batteries : Different types of batteries (Lead Acid and Lithium Ion), construction, working principle, applications, ratings, charging and discharging, concept of depth of charging, maintenance of batteries, series -parallel connection of batteries **(2Hrs)**

110005: PROGRAMMING AND PROBLEM SOLVING

Teaching Scheme :	Credits	Examination Scheme :
TH: 03 Hrs/Week	04	In-Semester : 30 Marks
PR : 02 Hrs/Week		End-Semester : 70 Marks
		PR : 25 Marks

Prerequisite Courses, if any :

Students are expected to have a good understanding of basic computer principles.

Companion Course, if any:

Programming and Problem Solving Laboratory (110005)

Course Objectives :

Prime objective is to give students a basic introduction to programming and problem solving with computer language Python. And to introduce students not merely to the coding of computer programs, but to computational thinking, the methodology of computer programming, and the principles of good program design including modularity and encapsulation.

1. To understand problem solving, problem solving aspects, programming and to know about various program design tools.
2. To learn problem solving with computers
3. To learn basics, features and future of Python programming.
4. To acquaint with data types, input output statements, decision making, looping and functions in Python
5. To learn features of Object Oriented Programming using Python
6. To acquaint with the use and benefits of files handling in Python

Following Fields are applicable for courses with companion Laboratory course

Course Outcomes : On completion of the course, learner will be able to-

CO1: Inculcate and apply various skills in problem solving.

CO2 : Choose most appropriate programming constructs and features to solve the problems in diversified domains.

CO3 : Exhibit the programming skills for the problems those require the writing of well- documented programs including use of the logical constructs of language, Python.

CO4 : Demonstrate significant experience with the Python program development environment.

Course Contents

Unit I Problem Solving, Programming and Python Programming (07 Hrs)

General Problem Solving Concepts: Problem solving in everyday life, types of problems, problem solving with computers, difficulties with problem solving, problem solving aspects, top down design. Problem Solving Strategies,

Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms.

Basics of Python Programming: Features of Python, History and Future of Python, Writing and executing Python program, Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.

Unit II : Decision Control Statements (08 Hrs)

Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements.

Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops, The break, continue, pass, else statement used with loops. Other data types- Tuples, Lists and Dictionary.

Unit III : Functions and Modules (08 Hrs)

Need for functions, **Function:** definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices. Introduction to modules, Introduction to packages in Python, Introduction to standard library modules.

Unit IV : Strings (07 Hrs)

Strings and Operations: concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module.

Unit V : Object Oriented Programming (08 Hrs)

Programming Paradigms-monolithic, procedural, structured and object oriented, **Features of Object oriented programming :** classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation.

Classes and Objects : classes and objects, class method and self object, class variables and object variables, public and private members, class methods.

Unit VI File Handling and Dictionaries (07 Hrs)

Files : Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files. Dictionary method. Dictionaries- creating, assessing, adding and updating values.

Case Study : Study design, features, and use of any recent, popular and efficient system developed using Python. (This topic is to be excluded for theory examination).

101007: ENVIRONMENTAL STUDIES-I

TH : 02 Hrs./week (Mandatory Non-Credit Course)

Course Objectives :

1. To explain the concepts and strategies related to sustainable development and various components of environment.
2. To examine biotic and abiotic factors within an ecosystem, to identify food chains, webs, as well as energy flow and relationships.
3. To identify and analyze various conservation methods and their effectiveness in relation to renewable and nonrenewable natural resources.
4. To gain an understanding of the value of biodiversity and current efforts to conserve biodiversity on national and local scale.

Course Outcomes : On completion of the course, learner will be able to-

CO1 : Demonstrate an integrative approach to environmental issues with a focus on sustainability.

CO2: Explain and identify the role of the organism in energy transfers in different ecosystems.

CO3: Distinguish between and provide examples of renewable and nonrenewable resources & analyze personal consumption of resources.

CO4: Identify key threats to biodiversity and develop appropriate policy options for conserving biodiversity in different settings.

Course Contents

Unit I Introduction to environmental studies (02 Hrs)

Multidisciplinary nature of environmental studies; components of environment - atmosphere, hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development.

Unit II Ecosystems (06 Hrs)

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems :

a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III Natural Resources: Renewable and Non-renewable Resources (08 Hrs)

Land Resources and land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water : Use and over-exploitation of surface and ground water, floods droughts, conflicts over water (international & inter-state).

Heating of earth and circulation of air; air mass formation and precipitation.

Energy resources : Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit IV Biodiversity and Conservation (08 Hrs)

Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. **Threats to biodiversity :** habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity; In-situ and Ex- situ conservation of biodiversity.

Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

107008 - ENGINEERING MATHEMATICS - II

Teaching Scheme:	Credits	Examination Scheme :
TH : 4 Hrs./Week	05	In-Semester : 30 Marks
TUT : 1 Hr./Week		End-Semester : 70 Marks
		TW : 25 Marks

Prerequisites : Integration, Differential Equation, Three-dimensional coordinate systems

Course Objectives :

To make the students familiarize with Mathematical Modeling of physical systems using differential equations advanced techniques of integration, tracing of curve, multiple integrals and their applications. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

Course Outcomes (COs): The students will be able to learn

CO1: The effective mathematical tools for solutions of first order differential equations that model physical processes such as Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc.

CO2 : Advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign and Error functions needed in evaluating multiple integrals and their applications.

CO3: To trace the curve for a given equation and measure arc length of various curves.

CO4 : The concepts of solid geometry using equations of sphere, cone and cylinder in a comprehensive manner.

CO5: Evaluation of multiple integrals and its application to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia.

Course Contents

Unit I : First Order Ordinary differential Equations (09 Hrs.)

Exact differential equations, Equations reducible to exact form. Linear differential equations, Equations reducible to linear form, Bernoulli's equation.

Unit II : Applications of Differential Equations (09 Hrs.)

Applications of Differential Equations to Orthogonal Trajectories, Newton's Law of Cooling, Kirchhoffs Law of Electrical Circuits, Rectilinear Motion, Simple Harmonic Motion, One dimensional Conduction of Heat.

Unit III : Integral Calculus (09 Hrs.)

Reduction Formulae, Beta and Gamma functions, Differentiation Under Integral Sign and Error functions.

Unit IV : Curve Tracing (09 Hrs.)

Tracing of Curves - Cartesian, Polar and Parametric curves, Rectification of curves.

Unit V : Solid Geometry (09 Hrs.)

Cartesian, Spherical polar and Cylindrical coordinate systems, Sphere, Cone and Cylinder.

Unit VI : Multiple Integrals and their Applications (09 Hrs.)

Double and Triple integrations, Change of order of integration, Applications to find Area, Volume, Mass, Centre of Gravity and Moment of Inertia.

107009 : ENGINEERING CHEMISTRY

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 04 Hrs/week	05	In Semester : 30 Marks
PR : 02 Hrs/Week		End Semester: 70 Marks
		PR : 25 Marks

Prerequisite Courses, if any:

Types of titrations, volumetric analysis, structure property relationship, types of crystals, periodic table, classification and properties of polymers, electromagnetic radiation, electrochemical series

Companion Course, if any : Laboratory Practical

Course Objectives :

1. To understand technology involved in analysis and improving quality of water as commodity.
2. To acquire the knowledge of electro-analytical techniques that facilitates rapid and precise understanding of materials.
3. To understand structure, properties and applications of speciality polymers and nano material.
4. To study conventional and alternative fuels with respect to their properties and applications.

5. To study spectroscopic techniques for chemical analysis.
6. To understand corrosion mechanisms and preventive methods for corrosion control.

Course Outcomes : On completion of the course, learner will be able to-

CO1 : Apply the different methodologies for analysis of water and techniques involved in softening of water as commodity.

CO2 : Select appropriate electro-technique and method of material analysis.

CO3 : Demonstrate the knowledge of advanced engineering materials for various engineering applications.

CO4 : Analyze fuel and suggest use of alternative fuels.

CO5 : Identify chemical compounds based on their structure.

CO6 : Explain causes of corrosion and methods for minimizing corrosion.

Course Contents

Unit I : Water Technology (08Hrs)

Impurities in water, hardness of water: Types, Units and Numericals. Determination of hardness (by EDTA method using molarity concept) and alkalinity, numericals. Ill effects of hard water in boiler - priming and foaming, boiler corrosion, caustic embrittlement, scale and sludge.

Water treatment: i) Zeolite method and numerical ii) Demineralization method. Purification of water: Reverse osmosis and Electrodialysis.

Unit II : Instrumental Methods of Analysis (08Hrs)

Introduction: Types of reference electrode (calomel electrode), indicator electrode (glass electrode), ion selective electrode: ion selective membranes such as solid membrane, enzyme based membrane and gas sensing membrane.

[A] Conductometry : Introduction, conductivity cell, conductometric titrations of acid versus base with titration curve.

[B] pHmetry : Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve.

Unit III Engineering Materials (08Hrs)

A] Speciality polymers: Introduction, preparation, properties and applications of the following polymers :

1. Engineering Thermoplastic: Polycarbonate,
2. Bio-degradable polymers: Poly (hydroxybutyrate-hydroxyvalanate),
3. Conducting Polymer: Polyacetylene,
4. Electroluminescent polymer: Polyphenylenevinylene,
5. Polymer composites: Fiber reinforced plastic (FRP)- Glass reinforced and Carbon reinforced polymer composite

[B] **Nanomaterials :** Introduction, classification of nanomaterials based on dimensions (zero dimensional, one-dimensional, two-dimensional and three-dimensional), structure, properties and applications of graphene and carbon nanotubes, quantum dots (semiconductor nanoparticles).

Unit IV Fuels (08Hrs)

Introduction (definition, classification of fuel based on chemical reactions and characteristics of an ideal fuel),

Calorific value (CV): Higher calorific value (HCV) and Lower calorific value (LCV), Determination of Calorific value: Principle, construction and working of Bomb calorimeter and Boy's gas calorimeter and numericals,

Solid fuel: Coal: Analysis of Coal-Proximate and Ultimate analysis, numericals,

Liquid fuel: Petroleum: Refining of petroleum /crude oil and composition, boiling range and uses of various fractions,

Gaseous fuel: Composition, properties and applications of CNG. Hydrogen gas as a future fuel

Alternative fuels : Power alcohol and biodiesel.

Unit V Spectroscopic Techniques (08Hrs)

[A] UV-Visible Spectroscopy :

Introduction, interaction of electromagnetic radiation with matter, statement of Beer's law and Lambert's law, absorption of UV radiation by organic molecule leading to different electronic transitions, terms involved in UV-visible Spectroscopy-chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift, Instrumentation and basic principle of single beam spectrophotometer, applications of UV-visible spectroscopy.

[B] Infra red Spectroscopy:

Introduction, Principle of IR Spectroscopy, types of vibrations: Stretching (symmetric and asymmetric) and bending (scissoring, rocking, wagging and twisting), conditions of absorption of IR radiations, vibration of diatomic and polyatomic molecules. Instrumentation with block diagram. Parts of IR spectrum, fundamental group region, fingerprint region, applications of IR spectroscopy.

Unit VI Corrosion Science (08Hrs)

Introduction, Types of corrosion - Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion - mechanism: hydrogen evolution and oxygen absorption, galvanic cell corrosion, concentration cell corrosion, Factors influencing rate of corrosion. Methods of corrosion control and prevention: cathodic and anodic protection, metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot dipping, cladding, electroplating, cementation.

104010 : BASIC ELECTRONICS ENGINEERING

Teaching Scheme :	Credits	Examination Scheme :
TH : 03 Hrs./week PR : 02 Hrs./week	04	In - Semester : 30 Marks End - Semester : 70 Marks PR : 25 Marks

Course Objectives :

1. The principle of electronics and working principle of PN junction diode and special purpose diodes.
2. The functioning of transistors like BJT, MOSFETs and OPAMP.
3. Basics of various logic gates, digital circuits and their applications.
4. Working and functions of various electronic instruments.
5. The operating principles and applications of various active and passive sensors.
6. Basic principles of communication systems.

Course Outcomes : On completion of the course, learner will be able to-

CO1: Explain the working of P-N junction diode and its circuits.

CO2: Identify types of diodes and plot their characteristics and also can compare BJT with MOSFET.

CO3: Build and test analog circuits using OPAMP and digital circuits using universal/basic gates and flip flops.

CO4: Use different electronics measuring instruments to measure various electrical parameters. CO5: Select sensors for specific applications.

CO6: Describe basic principles of communication systems.

Course Contents

Unit I : Introduction to Electronics (08Hrs)

Evolution of Electronics, Impact of Electronics in industry and in society. Introduction to active and passive components, P-type Semiconductor, N-type Semiconductor. Current in semiconductors(Diffusion and Drift Current)

P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias condition, V-I characteristics of P-N junction Diode, Diode as a switch, Half Wave Rectifier, Full wave and Bridge Rectifier.

Special purpose diodes: Zener diode, Light Emitting Diode (LED) and photo diode along with VI characteristics and their applications.

Unit II : Transistor and OPAMP (07Hrs)

Bipolar Junction Transistor : Construction, type, Operation, V-I Characteristics, region of operation, BJT as switch and CE amplifier

Metal Oxide Semiconductor Field Effect Transistors (MOSFET) : Construction, Types, Operation, V-I characteristics, Regions of operation, MOSFET as switch & amplifier.

Operational amplifier: Functional block diagram of operational amplifier, ideal operational amplifier, Op-amp as Inverting and Non inverting amplifier

Unit III Number System and Logic Gates (07Hrs)

Number System: Binary, BCD, Octal, Decimal, Hexadecimal their conversion and arithmetic, De-Morgan's theorem.

Basic Gates: AND, OR, NOT, Universal Gate- XOR, XNOR, Half adder, Full adder Flip Flop's SR, JK, T and D Introduction to Microprocessor and Microcontroller (Only block diagram and explanation)

Unit IV : Electronic Instrumentation (06Hrs)

Electronic Instruments: Principles and block diagram of digital multimeter, Function Generator, Digital Storage Oscilloscope (DSO) Power scope, AC/DC power supply, Auto transformer, Analog ammeter and voltmeter.

Unit V : Sensors (07Hrs)

Classification of a sensors, Active /Passive Sensors, Analog/Digital Sensors, Motion Sensors (LVDT, Accelerometer), Temperature Sensors (Thermocouple, Thermistor, RTD), Semiconductor Sensors(Gas Sensors), Optical Sensors (LDR), Mechanical Sensors (Strain Guage, Load Cell, Pressure sensors), Biosensors. (Working Principle and one application).

Unit VI : Communication Systems (07Hrs)

Basic Communication System: Block Diagram, Modes of Transmission, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Allotment of frequency band for different applications, Block Diagram of AM and FM Transmitter and receiver,

Mobile Communication System: Cellular concept, Simple block diagram of GSM system.

101011 : ENGINEERING MECHANICS

Teaching Scheme:	Credits	Examination Scheme:
TH : 3 Hrs./week	04	In-Semester : 30 Marks
PR : 2 Hrs./Week		End-Semester : 70 Marks
		PR : 25 Marks

Course Objectives :

1. To impart knowledge about force systems and methods to determine resultant centroid and moment of inertia
2. To teach methods to calculate force of friction
3. To impart knowledge to determine reaction of beams, calculate member forces in trusses, cables and frames using principles of equilibrium
4. To teach space force systems
5. To train students to solve problems related to particle mechanics using principles of kinematics, kinetics and work power energy

Course Outcomes : On completion of the course, learner will be able to-

CO1: Determine resultant of various force systems

CO2: Determine centroid, moment of inertia and solve problems related to friction

CO3: Determine reactions of beams, calculate forces in cables using principles of equilibrium

CO4: Solve trusses, frames for finding member forces and apply principles of equilibrium to forces in space

CO5: Calculate position, velocity and acceleration of particle using principles of kinematics

CO6: Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy

Course Contents

Unit I Resolution and Composition of Forces (07Hrs)

Principle of statics, Force system, Resolution and composition of forces, Resultant of concurrent forces. Moment of a force, Varignon's theorem, resultant of parallel force system, Couple, Equivalent force couple system, Resultant of parallel general force system

Unit II Distributed Forces and Friction (06Hrs)

Moment of area, Centroid of plane lamina and wire bends, Moment of Inertia. **Friction:** Laws of friction, application of friction on inclined planes Wedges and ladders friction Application to flat belt

Unit III Equilibrium (06Hrs)

Free body diagram Equilibrium of concurrent, parallel forces in a plane Equilibrium of general forces in a plane Equilibrium of three forces in a plane, Types of beams, simple and compound beams, Type of supports and reaction, Forces in space, Resultant of concurrent and parallel forces in a space, Equilibrium of concurrent and parallel forces in a space.

Unit IV Analysis of Structures (06 Hrs)

Two force member, Analysis of plane trusses by Method of joints Analysis of plane trusses by method of section, Analysis of plane frames, Cables subjected to point load multi force member.

Unit V Kinematics of Particle (06 Hrs)

Kinematics of linear motion: Basic concepts Equation of motion for constant acceleration Motion under gravity, Variable acceleration motion curves.

Kinematics of curvilinear motion: Basic Concepts Equation of motion in Cartesian coordinates Equation of motion in path coordinates Equation of motion in polar coordinates Motion of projectile.

Unit VI Kinetics of Particle (06Hrs)

Kinetics- Newton's Second Law of motion Application of Newton's Second Law. Work, power, energy, conservative and non-conservative forces Conservation of energy for motion of particle, Impulse, Momentum, Direct central impact. Coefficient of restitution, Impulse Momentum principle of particle.

102012: ENGINEERING GRAPHICS

Teaching Scheme:	Credits	Examination Scheme:
TH : 01 Hr/week	02	End-Semester : 50 Marks
PR : 02 Hrs/Week		TW : 25 Marks
TUT : 01 Hr/Week		

Course Objectives

1. To acquire basic knowledge about engineering drawing language, line types, dimension methods, and simple geometrical construction.
2. To draw conic sections by various methods, involutes, cycloid and spiral.
3. To acquire basic knowledge about physical realization of engineering objects and shall be able to draw its different views.
4. To visualize three dimensional engineering objects and shall be able to draw their isometric views.
5. To imagine visualization of lateral development of solids.
6. To acquire basic knowledge about the various CAD drafting software's and its basic commands required to construct the simple engineering objects.

Course Outcomes : On completion of the course, learner will be able to

CO1: Draw the fundamental engineering objects using basic rules and able to construct the simple geometries.

CO2: Construct the various engineering curves using the drawing instruments.

CO3: Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object.

CO4: Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment.

CO5: Draw the development of lateral surfaces for cut section of geometrical solids.

CO6: Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools.

Course Contents

Unit I Fundamentals of Engineering Drawing (01 Hrs)

Need of Engineering Drawing and design, Sheet layout, Line types and dimensioning and simple geometrical constructions

Unit II Introduction to 2D and 3D computer aided drafting packages (02 Hrs)

Evolution of CAD, Importance of CAD, Basic Commands - Edit, View, Insert, Modify, Dimensioning Commands, setting and tools etc. and its applications to construct the 2D and 3D drawings

Unit III Engineering Curves (01 Hr)

Introduction to conic sections and its significance, various methods to construct the conic sections. Helix for cone and cylinder , rolling curves (Involutes , Cycloid) and Spiral

Unit IV Orthographic Projection (02 Hrs)

Principle of projections, Introduction to First and Third angle Projection methods, Orthographic projection of point, line, plane, solid and machine elements/parts

Unit V Isometric Projection (03 Hrs)

Introduction to isometric projection, oblique projection and perspective projection. Draw the isometric projection from the given orthographic views

Unit VI Development of Lateral Surfaces (03 Hrs)

Introduction to development of lateral surfaces and its industrial applications. Draw the development of lateral surfaces for cut section of cone, pyramid, prism etc.

101014: ENVIRONMENTAL STUDIES-II

TH: 02 Hr/week (Mandatory Non-Credit Course)

Course Objectives :

1. To provide a comprehensive overview of environmental pollution and the science and technology associated with the monitoring and control.
2. To understand the evolution of environmental policies and laws.
3. To explain the concepts behind the interrelations between environment and the development.
4. To examine a range of environmental issues in the field, and relate these to scientific theory.

Course Outcomes : On completion of the course, learner will be able to-

CO1: Have an understanding of environmental pollution and the science behind those problems and potential solutions.

CO2: Have knowledge of various acts and laws and will be able to identify the industries that are violating these rules.

CO3: Assess the impact of ever increasing human population on the biosphere: social, economic issues and role of humans in conservation of natural resources.

CO4: Learn skills required to research and analyze environmental issues scientifically and learn how to use those skills in applied situations such as careers that may involve environmental problems and/or issues.

Course Contents

Unit V Environmental Pollution (08 Hrs)

Environmental pollution : types, causes, effects and controls; Air, water, soil, chemical and noise pollution Nuclear hazards and human health risks

Solid waste management: Control measures of urban and industrial waste Pollution case studies.

Unit VI Environmental Pollution (07 Hrs)

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto Protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC).Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context

Unit VII Human Communities and the Environment (06 Hrs)

Human population and growth; Impacts on environment, human health and welfares. Carbon foot-print. Resettlement and rehabilitation of project affected persons; case studies.

Disaster management: floods earthquakes, cyclones and landslides.

Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan.

Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit VIII : Field work (05 Hrs)

– Visit to an area to document environmental assets; river/forest/flora/fauna, etc.

– Visit to a local polluted site - Urban/Rural/Industrial/Agricultural.

– Study of common plants, insects, birds and basic principles of identification.

– Study of simple ecosystems-pond, river Delhi Ridge, etc

Subject Code	Subject Name	Our Authors
107001	Engineering Mathematics	**Sujeet Paliwal**
107002	Engineering Physics	**Dr. I.A. Shaikh**
102003	Systems in Mechanical Engineering	**R.B. Patil, B.L. Singhal**
103004	Basic Electrical Engineering	**J.S. Katre**
110005	Programming and Problem Solving	**Kavita Sultanpure, Shantanu Pathak**
107008	Engineering Mathematics – II	**Sujeet Paliwal**
107009	Engineering Chemistry	**Dr. Jayshree A. Parikh**
104010	Basic Electronics Engineering	**J. S. Katre**
101011	Engineering Mechanics	**E.M. Reddy**
102012	Engineering Graphics	**Arunoday Kumar**

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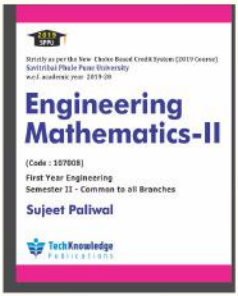
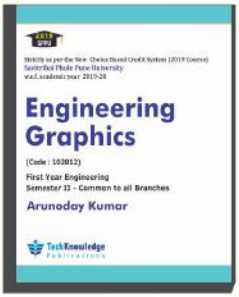
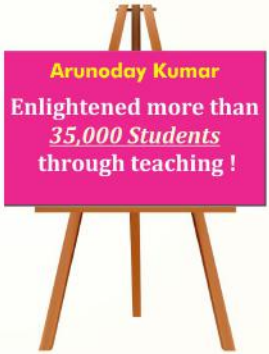
Semester - II







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