SCHEME OF INSTRUCTION & EXAMINATION
B.E. III - SEMESTER (**MECHANICAL ENGINEERING**)
(Proposed for the Academic Year 2025-2026)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs./Week	CIE	SEE	Duration in Hours	
		Theory Courses								
1	BS301MT	Partial Differential Equations and Statistics	3	1	-	4	30	70	4	4
2	ES303EC	Microcontroller with Interfacing	3	-	-	3	30	70	3	3
3	PC301ME	Engineering Mechanics	3	-	-	3	30	70	3	3
4	PC302ME	Strength of Materials	3	-	-	3	30	70	3	3
5	PC303ME	Material Science and Engineering	3	-	-	3	30	70	3	3
6	PC304ME	Engineering Thermodynamics	3	-	-	3	30	70	3	3
		Practical/Laboratory Courses								
7	PC351ME	Material Science and Testing Lab	-	-	2	2	25	50	3	1
8	PC352ME	Engineering Thermodynamics Lab	-	-	2	2	25	50	3	1
9	PC353ME	CAD Lab	-	-	2	2	25	50	3	1
Total			**18**	**01**	**06**	**25**	**255**	**570**	28	**22**

SCHEME OF INSTRUCTION & EXAMINATION
Service Courses Offered to Other Departments
B.E III Semester (Computer Science and allied branches)

S.No	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	ES 301ME	Applied Operations Research	3	-	-	3	30	70	3

New/Revised code →

BS205MT Partial Differential equations, Probability & Statistics 3 1 - 4 30 70 4

PARTIAL DIFFERENTIAL EQUATIONS AND STATISTICS

BS301MT

Instruction: 4 periods per week
CIE: 30 marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 marks

Course Objectives:

1. To introduce the solution methodologies for first and second order Partial Differential Equations
2. Exploring random variables and probability distributions
3. Exploring regression analysis and correlation and applying statistical methods to real-world problems

Revised

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Solve field problems in engineering involving PDEs
2. Solution of boundary value problems involving PDEs
3. Evaluate statistical parameters of discrete and continuous probability distribution
4. Perform regression analysis to compute the coefficient of correlation to interpret data
5. Testing of hypothesis of few unknown statistical parameters using types of sampling, Sampling distribution of means, Sampling distribution of variance, Estimations of statistical parameters

UNIT-I:

Formation of Partial Differential Equations, First order Partial Differential Equations, solutions of first order linear Partial Differential Equations, Lagrange's equation, Non-linear First Order equations, Charpit's method.

UNIT-II:

Second-order linear equations and their classification, Method of separation of variables, vibration of stretched string wave equation, one dimensional heat equation, solution of Laplace's equation in Cartesian coordinates.

UNIT-II:

Probability distributions: Uniform, Poisson and Normal distributions, Mean, variance, moment generating function, and evaluation of statistical parameters for these distributions, Moments.

Unit-IV:

Curve fitting by the method of least squares- Fitting of straight lines, second degree parabolas and more general curves, Correlation, regression and rank correlation. Test of significance- Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Unit-V:

Test for single mean, difference of means, and correlation coefficients, test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.

Note: Course Code, Course Name & Syllabus for "BS301MT – Partial differential equations & Statistics" is revised by Osmania University as "BS205MT – Partial Differential Equations, Probability & Statistics". The New syllabus is attached at the end of Sem-III syllabus in this file.

(Head, MSD, MJCET)

Suggested Readings:

1. R.K Jain S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publication. 4h Edition, 2014.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication 4rd Edition, 2014.
3. S.C Gupta and V.K Kapoor, Fundamental of Mathematical Statistics, Sultand Chand & Sons , New Delhi 2014.

MICROCONTROLLER WITH INTERFACING

ES303EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To learn the architecture and programming of typical microcontroller.
2. To introduce the basic concepts of small and medium scale embedded system design using microcontroller
3. To get familiarity of assembly as well as embedded C programming environment to control peripheral devices
4. To develop assembly and C language programming skills for real time applications of Microcontroller
5. To gives hands-on training of interfacing external sensors and actuators with microcontroller

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Explain the architecture of 8085 microprocessor and AVR 8-bit Microcontroller
2. Differentiate microprocessor and microcontroller and describe the importance and function of each pin of AVR ATmega32 Microcontroller.
3. Interface different peripherals to 8086 microprocessor.
4. Explain the architecture of 8051 microcontroller and write assembly/C language programming using 8051 microcontroller.
5. Interface I/O peripheral devices different peripheral modules to 8051 microcontroller.

UNIT I

Introduction to Microcontrollers: History of microprocessor and microcontrollers, Difference between microprocessors and microcontrollers and Applications of microcontrollers, Architectural of 8-bit 8085 microprocessor, Pin details and functional operation of 8085, Memory and I/O interfacing. Role of microcontrollers in embedded Systems. Overview of the AVR family

UNIT II

Architecture and instruction set of 8-bit AVR Microcontroller: AVR Microcontroller architecture: Registers, AVR status register, Memory Space, ATmega32 pin-configuration & function of each pin, Addressing mode and instruction set of AVR microcontroller, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, Bit manipulation instructions.

UNIT III

8051 Microcontroller: Internal architecture and pin configuration, 8051 addressing modes, instruction set, bit addressable features. I/O port structures, assembly language programming using data transfer, arithmetic, logical and branch instructions.

UNIT IV

8051 Timers, Serial Port and Interrupts: 8051 Timers/Counters and its programming, Serial data communication Serial port and its programming, 8051 interrupts, Interrupt vector table, Interrupts programming.

UNIT V

8051 Interfacing: Interfacing of 8051 with LCD, ADC, DAC, external memory, stepper motor interfacing.

Suggested Readings:

1. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi,"The AVR Microcontroller and Embedded Systems", Using Assembly and C, Pearson Education, 1st Edition, 2012.
2. Dhananjay Gadre, "Programming and Customizing the AVR Microcontroller", TMH, 1st Edition, 2001.
3. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996.
4. Douglas V. Hall, "Microprocessors and Interfacing Programming and Hardware", 2nd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 2008.
5. Scott Mackenzie and Raphael C. W. Phan. "The 8051 Microcontroller", 4th Edition, Pearson Education, 2008.

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ENGINEERING MECHANICS

PC301ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Resolution of forces, equilibrium, and static load analysis.
2. Computation of centroids and moments of inertia for composite sections.
3. Friction laws and applications in engineering systems.
4. Various forces in the axial force members, and to analyze the trusses.
5. Basic concepts of dynamics, their behavior, analysis and motion bodies, Apply dynamics principles (work-energy, impulse-momentum).

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Analyze force systems and equilibrium using free-body diagrams.
2. Determine geometric properties (centroids, inertia) for complex shapes.
3. Solve friction/truss problems for engineering applications.
4. Evaluate motion of particles/rigid bodies kinematically and kinetically.
5. Solve dynamics problems using energy/momentum methods.

UNIT – I

System of Forces: Scope of Mechanics, Fundamental Concepts and Axioms, System of Forces, Introduction to Free-Body Diagrams, Parallelogram Law, Triangle Law, Forces and Components, Resultant of Coplanar Concurrent Forces, Moment of force Principle of Moments, Varignon's Theorem, Coplanar Applications, Couples, Resolution of a Force and Couple, Resultant of Non-Concurrent Force System.

Equilibrium of Systems of Forces: Definition, Free Body Diagrams, Equations of Equilibrium, Equilibrium of Planar Systems.

UNIT – II

Analysis of Structures*:* Introduction, Construction and Assumptions in simple Trusses, Method of joints, Method of Sections.

Friction: Theory of friction, Angle of Friction, Laws of Friction, Related problems.

UNIT – III

Centroid and Centre of Gravity: Introduction, Centroid of Areas, Centroids determined by Integration, Centroids of Composite, Pappu's Theorem, Centre of gravity of Bodies, Centroids of Volumes.

Area Moment of Inertia*:* Definition of Moment of Inertia, Polar Moment of Inertia, Radius of Gyration, Transfer Formula for Moment of Inertia, Moment of Inertia by Integration, Moment of Inertia for Composite Areas, Product of Inertia.

Mass Moment of Inertia: Basic principles of mass moment of inertia of simple bodies, Integration.

UNIT – IV

Kinematics: Motion of a Particle, Rectilinear motion, Motion curves, Rectangular components of Curvilinear Motion, Normal and Tangential Components of Acceleration, Newton's Laws of Motion for

a Particle, D'Alembert's Principle, Types of Rigid Body Motion, Angular Motion-Fixed Axis Rotation, and its Analysis of Plane Motion.

Kinetics: Fundamental Equation of Kinetics for a Particle, Translation-Analysis for a Particle, Kinetics and Rigid Body. Equations of Plane Motion, Fixed Axis Rotation, Rolling Bodies and General Plane Motion.

UNIT – V

Work -Energy: Work-Energy Equation for Translation, Work-Energy Applied to Particle Motion, Connected Systems, Fixed Axis Rotation and Plane Motion.

Impulse momentum: Linear Impulse Momentum, Conservation of Linear Momentum, Elastic Impact and Impulse Momentum in Plane Motion.

Suggested Readings:

1. Ferdinand L. Singer, Engineering Mechanics, Collins, Singapore, 1994.
2. Reddy Vijay Kumar K. and K. Suresh Kumar, Singer s Engineering Mechanics, 2010.
3. S.S Bhavakatti, Engineering Mechanics, New age International publishers.
4. Rajeshakharam, S. and Sankarasubrahmanyam, G., Mechanics, Vikas Publications, 2002.
5. Junarkar, S.B. and H.J. Shah., Applied Mechanics, Publishers, 2001.
6. Shah., Applied Mechanics, Publishers, 2001.

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STRENGTH OF MATERIALS

PC302ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To understand the basic concept of stresses and strains for different materials.
2. To know the procedure for the development of shear force and bending moment in beams and the stresses in thin cylinders & spheres.
3. To know the theory of simple bending, direct & bending stress and distribution of shear stress.
4. To analyse and understand torsional shear stress and buckling of columns
5. To study the methods to determine deflections in beams.

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. To understand the theory of elasticity and Hooke‘s law
2. To analyse beams to determine shear force and bending moments
3. Analyse shear stress distribution in different sections of beams.
4. To analyse and design structural members subjected to combined stresses
5. To solve problems on bars and to determine deflections at any point of the beams

Unit-I

Simple Stresses & Strains: Types of stresses & strains, Stress-Strain relations (Hooke‘s law), Relation between elastic constants, Volumetric strain, Composite bars, Thermal stresses. ***Strain energy****:* Gradual, Sudden and Impact loading. ***Compound Stresses:*** Stresses on oblique planes, Principal stresses and Principal planes. Mohr‘s circle and ellipse of stresses & strains.

Unit-II:

Shear Force and Bending Moment: Construction of S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads, Point of contra flexure and Relation between S.F & B.M. ***Thin Cylinders & Spheres****:* Derivation of formulae for longitudinal stress, Circumferential (hoop) stress, Volumetric strains, Changes in dimensions and volume.

Unit-III

Bending stresses in Beams*:* Assumptions made in pure bending, Derivation of bending moment equation, Modulus of section, Moment of resistance, Determination of bending stresses. ***Distribution of shear stress:*** Equation of shear stress, Distribution across rectangular section. Circular, triangular cross sections.

Unit-IV

Torsion of Circular Shafts*:* Theory of pure torsion, Assumptions made, Derivation of basic torsion equation, Torsional moment of resistance, Polar section modulus, Power transmitted by shafts, combined bending and torsion. ***Columns and Struts****:* Introduction to columns and struts, Buckling and Stability, types of supports, critical load, Euler‘s formulae and Rankine formulae, Equivalent length of the column, eccentric axial loads on column, core or kernel of section.

Unit-V

Deflection of Beams: Deflections of cantilever and simply supported beams including overhanging beams for point loads and uniformly distributed loads by Double integration method, Macaulay's method, Strain energy method, Moment area method.

Suggested Reading:

1. S. Ramamrutham, ―Strength of Materials", Dhanpat Rai & Sons, 1993.
2. B.C. Punmia, Strength of Materials and Theory of Structures, Laxmi Publishers, Delhi, 2000.
3. R.K. Rajput, ―Strength of Materials", S. Chand & Co., 2003.
4. EgorP.Popov, ―Engineering Mechanics of Solids", Prentice Hall of India, NewDelhi, 2001.
5. Gere & Timoshenko, ―Mechanics of Materials", 2nd Edition, CBS Publishers and Distributors Pvt. Ltd.
6. Ferdinand P. Beer et.al., ―Mechanics of Materials", Tata McGraw-Hill Publishing Co. Ltd., New Delhi,2005

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MATERIAL SCIENCE AND ENGINEERING

PC303ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To understand structure property relations, analyze the failures of metals and their prevention.
2. To broaden the understanding of phase diagrams.
3. To acquire basic knowledge in various heat treatment operations, their purpose and applications.
4. Expose to the various methods of extractive metallurgy techniques.
5. Understand various modes of failure and suggest mechanisms for preventions of failures.
6. Understand applications of conventional metals and alloys.

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Understand and explain the fundamental concepts of crystal structures, crystal defects, mechanical properties, and plastic deformation mechanisms in materials.
2. Analyze different failure modes such as fracture, fatigue, and creep, and assess their influence on material performance in engineering applications.
3. Construct and interpret binary phase diagrams including isomorphous, eutectic, and peritectic systems, and apply the phase rule to predict phase transformations.
4. Evaluate the influence of alloying elements and various heat treatment processes on the mechanical properties and microstructures of ferrous and non-ferrous alloys.
5. Compare the properties, structures, and applications of non-ferrous metals, ceramics, polymers, and composites, and explain their engineering significance.

Unit-I

Introduction to Materials engineering, Space lattice, unit cell, crystal structure, crystal directions and planes, crystal imperfections- point defects, line defects, surface defects, volume defects. Effect of slip and twinning on the plastic deformation, Jogs and its effect on yield phenomenon, Hall-Petch equation, Orange peel effect, cold and hot working, strain hardening and Bauchinger effect. Recovery, Recrystallization, Grain growth and its effect on mechanical properties of metals. Mechanical properties of materials- Tensile properties, stress-strain diagrams, elasticity, plasticity, ductility, toughness, modulus of elasticity, resolved shear stress, tensile and compression test, hardness and its measurement

Unit-II:

Fracture: Ductile and Brittle fracture, modes of fracture, ductile to brittle transition, crack initiation and propagation. ***Fatigue:*** S-N curve, Structure of fatigue fracture specimen, Fatigue crack propagation, Effect of metallurgical variables on fatigue of metal, Experimental determination of fatigue strength (RR-Moore Test). **Creep:** Creep strength, Creep curve, Creep deformation mechanisms, Creep Test, Differences between creep curve and stress rupture curve.

Unit-III

Structure of Metals & Alloys: Types of solid solution, Substitutional and Hume Rothary‘s rules for solid solution, Construction and interpretation of Binary equilibrium diagram, Isomorphous,
Eutectic and Peritectic diagrams, Intermediate phases and phase rule, Iron-Iron Carbide equilibrium diagram, construction and interpretation. Types of Plain Carbon Steels, Cast Iron and their properties and Characteristics.

Unit-IV

Alloy Steels: Effects of alloying elements like Nickel, Chromium, Manganese, Silicon and Tungsten. Titanium. Study about Stainless steels, HSS, Maraging steels, Brass, their composition and Properties. ***Heat Treatment:*** Annealing, Normalising, Hardening, Tempering, Construction and interpretation of T.T.T Curve. Austempering and Martempering. Case Hardening: Carburising, Nitriding, Carbo-nitriding, Flame Hardening, Induction Hardening. Brief introduction of Age Hardening.

Unit-V

Non-ferrous metals and alloys: Properties and applications of –Cu and its alloys, Al and its alloys, Age hardening, Ti and its alloys, Ni- based alloys. Bronze, Muntz Metal, Invar, Duralumin and Ti Alloy (Ti-6Al-4V)-their composition properties. **Ceramics, Polymers and Composites:** Ceramics, crystalline ceramics, glasses, properties and applications of ceramics, polymers-polymerization, thermoplastics and thermosetting plastics, properties and applications of polymers. Composites: concept of composites, matrix and reinforcement, rule of mixtures, classification of composites, applications of composites.

Suggested Reading:

1. V. Raghavan, Material Science and Engineering, Prentice Hall of India Ltd., 4th Edition, 1994.
2. S.H. Avner, Introduction to Physical Metallurgy, Tata McGraw Hill, 2nd Edn.1997.
3. S.P. Nayak, Engineering Metallurgy and Material Science, Charotar Publishing House, 6th Edition, 1995.
4. E. Dieter, Mechanical Metallurgy, Metric Editions, Tata McGraw Hill, 3rd Edn, 1997.
5. Robert M Jones, Mechanics of Composite Materials, Taylor and Francis.

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ENGINEERING THERMODYNAMICS

PC304ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Basic definitions of thermodynamics and significance of Zeroth law of thermodynamics.
2. The importance and application of first law of thermodynamics.
3. The various laws associated with second law of thermodynamics.
4. Properties of pure substances and use of Mollier diagram.
5. Various air standard cycles, their importance and their comparison.
6. Calculation procedures of the air-fuel ratio.

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Correlate the study of thermodynamics with the fundamental conceptual terminologies and distinguish the different forms of energy
2. Analyse the Laws of Thermodynamics and correlate them for real life problem solving.
3. Read data from the chart of Mollier diagram and its applications.
4. Assess the importance of entropy and recognize the various curves of phase transformation
5. Identify the various air standard cycles, gas cycles and gas laws toward solving practical applications.

Unit-I

Introduction: Definition and Concept of Thermodynamics, Microscopic and Macroscopic approach of thermodynamics, system, surroundings and property, intensive and extensive properties, Measurement of temperature, Zeroth law of thermodynamics, Temperature Scales, ideal gas and ideal gas thermometer, Reversibility and irreversibility quasi– static process, Specific heats for ideal gases, Thermodynamic Equilibrium.

Unit-II:

First law of Thermodynamics: Statement of First Law, Heat and work interactions, Thermodynamics work and Internal energy, Energy as property of system, First Law applicable to Closed system, Thermodynamic processes and calculation of work, Heat transfer, and internal energy, Heat as Path Function, first law analysis of flow processes and limitation, Calculation of work done during flow processes

Unit-III

Second Law of Thermodynamics: Physical description of second law, Kelvin– Planck and Clausius statement of Second Law of thermodynamics, Equivalence of Kelvin– Planck and Clausius statement, Reversible and irreversible processes, Carnot Theorem, Clausius Inequality, Calculation of entropy change during various thermodynamic processes, principle of Entropy increase, T– S diagram, Available and Unavailable energies in steady flow, Second Law Analysis of Control Volume, Helmholtz and Gibb‘s functions, Available function for flow and non– flow processes and applications.

Unit-IV

***Concept of phase change*:** Graphical representation of pressure, Volume and Temperature, (PVT)– T and H diagrams, Properties of steam, Use of steam Tables and Mollier diagram, Thermodynamic relations involving entropy, Enthalpy, Internal Energy, Maxwell relations and Clapeyron Equation.

Unit-V

***Thermodynamic Cycles*:** Air standard cycles: Otto, Diesel, Dual Combustion Cycle, Joule/ Brayton cycle. Vapour Power cycles: Rankine cycle. Refrigeration cycles: Reversed Carnot cycle, Bell Coleman cycle, Vapour compression refrigeration cycle.

Suggested Reading:

1. P.K. Nag, *Basic & Applied Thermodynamics,* Tata McGraw Hill, 2nd Edn., 2008.
2. Yunus A Cengel & Michael A Boles, *Thermodynamics- An Engineering Approach*, Tata McGraw- Hill, 7th Edition in SI Units (Special Indian Edition), 2011
3. Y.V.C. Rao, *An Introduction to Thermodynamics*, Universities Press, 2nd Edn., 2010.
4. P.L Ballaney, *Thermal Engineering*, Khanna Publishers, 2004.
5. E. Rathakrishnan, *Fundamentals of Engineering Thermodynamics*, PHI Learning Pvt. Ltd, 2005
6. Domkundwar, S., Kothandaraman, C.P., & Domkundwar, A. *A Course in Thermal Engineering* (6th ed.). Dhanpat Rai & Co.2013.

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METALLURGY AND MATERIAL TESTING LAB

PC351ME

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Course Objectives:

1. Acquire basic knowledge by understanding iron-carbide diagram and its application in engineering.
2. Expose to Metallographic study and analysis of various metals.
3. Acquire knowledge in determining the hardness of metals before and after various Heat treatment operations.
4. Understand differences between different heat treatment methods.
5. Expose to T-T-T curve and its application in engineering metallurgy.
6. Understand the relation between micro structure and properties.

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Prepare specimen for metallographic observation.
2. Analyse and identify low, medium and high carbon steels, different types of cast irons, non-ferrous alloys, from the study of their microstructure.
3. Underlines the importance of grain size in evaluating the desired mechanical properties.
4. Correlate the heat treatment methods and the mechanical properties obtained.
5. Analyse and identify microstructures after annealing, normalizing, hardening and tempering Relate the properties of the materials using image analyser.

List of Experiments:

A: Metallurgy Experiments:

1. Study of: Metallurgical Microscope, Iron-Iron Carbide diagram, Procedure for specimen preparation.
2. Metallographic Study of Pure Iron & Low carbon steel.
3. Metallographic Study of Medium carbon steel, Eutectoid steel and Hyper Eutectoid steel.
4. Metallographic Study of, White cast-iron, Malleable cast iron, Nodular cast iron and Grey cast-iron.
5. Metallographic Study of Aluminium, Brass and Bronze.
6. Metallographic study of Muntz metal and Babbit Material.
7. Jominy Quench test or Study of microstructure after heat treatment.
8. Study on OM/SEM/TEM

B: Materials testing Lab

1. Uni-axial tension test, to draw stress- strain diagram, and estimate modulus of elasticity, % of elongation and toughness.
2. Compression test on bricks and Impact test.
3. Hardness test: Brinell and Vickers.
4. Shear force & bending moments tests.
5. Bending test on fixed beam, simply supported beam.
6. Spring test and torsion test.
7. Heat treatment of Metals, Annealing, Normalizing and Quenching.

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Note: At least ten (each 5 from A &B) experiments should be conducted

ENGINEERING THERMODYNAMICS LAB

PC352ME

Instruction: 2 periods per week *Duration of SEE: 3 hours*

CIE: 25 marks *SEE: 50 marks Credits: 1*

Course Objectives:

1. To understand applications of thermal engineering concepts through experimentation.
2. To provide knowledge in testing of properties of fuels and lubricating oils.
3. To demonstrate and conduct experiments, Interpret and analyze data and report results of IC engine testing.

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Conduct performance tests on various IC engines and analyze efficiency and power output.
2. Interpret valve and port timing diagrams to understand engine operation cycles.
3. Evaluate engine heat balance and combustion characteristics through experimental analysis.
4. Analyze exhaust emissions to assess engine performance and environmental impact.
5. Determine properties of fuels and lubricants and relate them to engine safety and performance.

List of Experiments:

1. To determine volumetric efficiency, isothermal efficiency and mass flow rate of a two stage reciprocating air compressor.
2. To determine valve timing diagram of a Petrol/Diesel engine.
3. To determine port timing diagram of a Petrol/Diesel engine.
4. To conduct performance test on single cylinder Diesel engine.
5. To conduct heat balance test on a Diesel engine.
6. To conduct Morse test on multi cylinder Petrol engine.
7. To conduct performance test on multi cylinder Petrol engine.
8. To conduct performance test on a two-stroke Petrol engine.
9. To conduct performance test on multi cylinder Diesel engine.
10. To study the performance of a Petrol engine under different compression ratios.
11. Exhaust gas analysis of Petrol engine for carbon-monoxide and unburnt hydrocarbons.
12. Exhaust gas analysis of Diesel engine for carbon deposits using smoke meter.
13. Determination of viscosity of lubricating oil.
14. Determination of flash and fire points of a fuel
15. Study of Boiler Models.

Note: At least ten experiments should be conducted in the Semester.

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CAD (Computer Aided Drafting) LAB

PC353ME

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Course Objectives:

1. To enable students to create accurate 3D models of mechanical components using industry-standard CAD software.
2. To develop skills in generating 2D part drawings, sectional views, and assembly drawings from 3D models.
3. To familiarize students with standard engineering drawing conventions and practices.
4. To prepare students for practical engineering design and documentation tasks in professional settings.

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Utilize modern engineering tools and software essential for contemporary engineering practice.
2. Develop accurate 2D part drawings, sectional views, and assembly drawings in compliance with industry standards.
3. Create detailed 3D models using CAD software.
4. Convert 3D solid models into 2D technical drawings, including multiple views, sectional representations, and precise dimensioning.
5. Perform interference checks to verify proper fit and function of assembled components.

Exercises in modelling and drafting of mechanical components-assembly using parametric and feature based packages like PRO-E/SOLIDWORKS /CATIA.

- Introduction to CAD modelling.

Part Modelling

- *Sketch tools* – Offset, Trim, Extend, Fillet, Chamfer, Mirror, Scale and Stretch, etc.
- *Solid modelling* – Features like Extrude, Revolve, Swept, Loft, Shell, Draft, etc.
- *Surface modelling* – Features like Extrude, Sweep, Freeform, Trim, Boundary surface and Planar Surface, etc.
- *Feature manipulation* – Copy, Edit, Pattern, Suppress, History operations, etc.

Assembly Modelling

- *Assembly* - Constraints, Exploded Views, Interference check, etc.

Drawing

- *Drawing* - Layouts, Standard & Sectional Views, Detailing & Plotting, etc.
- *Exercises* – Stuffing Box, Steam Engine Cross Head, Knuckle Joint, Cross Head, Plumber Block, Universal Coupling, Oldham Coupling.

Note: The test is designed to assess the student's ability to read and interpret engineering drawings. The drawing provided will include a parts list formatted according to standard industry conventions.

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Service course offered to other Departments

B.E. III - SEMESTER (**Computer Science and allied branches**)

APPLIED OPERATIONS RESEARCH

ES301ME

Instruction: 3 periods per week Duration of SEE: 3 hours

CIE: 30 marks SEE: 70 marks

Credits: 3

Objectives:

1. Use variables for formulating complex mathematical models in management science, industrial engineering and transportation models
2. Use the basic methodology for the solution of linear programming problems
3. Understand the mathematical tools that are needed to solve optimization problems like Transportation models and Assignment models
4. Understand the replacement models with change in money value considering with time and without time
5. Model a system as a queuing model and compute important performance measures

Outcomes: at the end of the course student will be able to:

1. Understand the basics of Operations Research and solve linear programming problems using graphical, simplex method and dual simplex methods
2. Use PERT and CPM techniques for project planning
3. Solve transportation and assignment problems using methods like MODI and Hungarian, including special cases like unbalanced and maximization problems
4. Understand how to plan for replacing equipment and use game theory to make decisions in competitive situations
5. Use sequencing methods to plan jobs on machines and study queuing models to understand and improve waiting line systems.

UNIT – I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions

UNIT – II

Duality: Definition, Relationship between primal and dual solutions, Dual Simplex Method.

Network Analysis in Project Planning: PERT & CPM – Cost Analysis and Crashing the network

UNIT – III

Transportation Models: Finding an initial feasible solution - North West corner method, least cost method, Vogel's Approximation method, Finding the optimal solution by MODI methods, Unbalanced Transportation problem.

Assignment Problems: Hungarian method of Assignment problem, Maximization in Assignment

problem, unbalanced problem, travelling salesman problems.

UNIT – IV

Replacement Models: Introduction, Replacement Policy for Items Whose Running Cost Increases with Time and Value of Money Remains Constant During a Period, Running Cost Increases with Time but Value of Money Changes with Constant Rate During a Period, Individual replacement policy, Group replacement policy.

Game Theory: Introduction, 2 person zero sum games, Maximin - Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for 2 x n and m x 2 games.

UNIT – V

Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, processing 'n' jobs through 3 machines, Processing 2 jobs through m machines.

Queuing Theory: Introduction, single channel - Poisson arrivals with Exponential Service Time – Infinite Population and Service in Random Order, Generalization of Model (Birth and Death Process).

Suggested Readings:

1. Hamdy, A. Taha, "Operations Research-An Introduction", Sixth Edition, Prentice Hall of India Pvt. Ltd.,1997
2. J.B. Gupta, "Utilization of Electric Power and Electric Traction" S.K. Kataria & Sons Publications, 2010
3. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi,2004
4. Hrvey M. Wagner, Principles of Operations Research, Second Edition, Prentice Hall of India Ltd., 1980.
5. R. Paneer Selvam, Operations Research, Second Edition, PHI Learning Pvt. Ltd., New Delhi,2008.

Prof. K. Saraswathamma

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(wef: Academic year 2025-2026)

Common to B.E. (Civil & Mechanical)

Course Code	Course Title						Core/Elective
BS205MT	Partial Differential Equations, Probability & Statistics						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	4

Course Objectives.

1. To introduce the solution methodologies for first and second order Partial Differential Equations
2. Exploring random variables and probability distributions
3. Exploring regression analysis and correlation and applying statistical methods to real-world problems

Course Outcomes.

After completing this course, the students will be able to:

1. Solve field problems in engineering involving PDEs
2. Solution of boundary value problems involving PDEs
3. Evaluate statistical parameters of discrete and continuous probability distributions.
4. Perform regression analysis to compute the coefficient of correlation to interpret data.
5. Testing of hypothesis of few unknown statistical parameters using types of sampling, Sampling distribution of means, Sampling distribution of variance, Estimations of statistical parameters.

UNIT-I: Formation of Partial Differential Equations, First order Partial Differential Equations, solutions of first order linear Partial Differential Equations, Lagrange's equation, Non-linear First Order equations, Charpit's method.

UNIT-II: Second-order linear equations and their classification, Method of separation of variables, vibration of stretched string wave equation, one dimensional heat equation, solution of Laplace's equation in Cartesian coordinates.

UNIT-III: Probability distributions: Uniform, Poisson and Normal distributions, Mean, variance, moment generating function, and evaluation of statistical parameters for these distributions, Moments.

Unit-IV: Curve fitting by the method of least squares- Fitting of straight lines, second degree parabolas and more general curves, Correlation, regression and rank correlation. Test of significance- Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Unit-V: Test for single mean, difference of means, and correlation coefficients, test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.

References

1. R. K Jain S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publication. 4Th Edition, 2014.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication 43rd Edition, 2014.
3. S.C Gupta and V.K Kapoor, Fundamental of Mathematical Statistics, Sultand Chand & sons, New Delhi, 2014.

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(4) 2/7/2025 (5). 2/7/25 (6). 02/07/2025

(7). (8). 02-07-25 (9). 02/07/2025

(10). 02/07/2025 (11).