ENGINEERING MATHEMATICS – IV

Contact Hours/ Week	: 3+1 (L+T)	Credits :	3.5
Total Lecture Hours	: 39	CIE Marks :	50
Total Tutorial Hours	: 13	SEE Marks :	50
Sub. Code	: MAT41		

Module-I

Complex Variables: Functions of complex variable, Definition of Limit, Continuity, Differentiability. Analytic functions, Cauchy's-Reimann equation in Cartesian and polar forms, Properties of analytic functions. Complex integrals, Cauachy's theorem, Cauachy's integral formula, Taylor's and Laurent's Series (Without proof), Singularities, Poles, Residues, Cauchy's residue Theorem. **10 + 2 Hrs.**

Module-II

Series Solution Of Ordinary Differential Equations And Special Functions: Series Solution of Bessel's differential equation. Equations reducible to Bessel's differential equation, Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula. **7 +2 Hrs.**

Module-III

Probability: Discrete and Continuous random variables p.d.f., Binomial, Poisson, Normal and Exponential distributions. **8 +3 Hrs.**

Module-IV

Sampling: Sampling Distribution, Standard error, Testing of Hypothesis for means. Confidence limits for means, Student's T distribution, Chi-Square Distribution as a test of goodness of Fit. **7 + 3 Hrs.**

Module-V

Joint Probability: Joint probability distribution, Discrete and independent random variables, Expectation, Covariance, Correlation coefficient. Probability vectors, Stochastic matrices, fixed points matrices, Regular stochastic matrices, Markov chains, Higher transition-probabilities, stationary distribution of regular markov chains and absorbing states. **7 + 3 Hrs.**

TEXT BOOK

1	Grewal B.S.	Higher Engineering Mathematics. Ed 39. New Delhi. Khanna Publishers, 2005.

REFERENCE BOOKS

1	Ramana B.V.	Higher Engineering Mathematics. Tata-Macgraw Hill.
2	Erwin Kreyszig	Advanced Engineering Mathematics. Ed 8. New Delhi. John Wiley & Sons.
3	Ray C Wylie	Advanced Engineering Mathematics. Ed 4. New Delhi. Tata McGraw Hill.
4	Pipes and Harvill	Applied Mathematics for Engineers and Physicists. Ed 3. New Delhi. Tata McGraw Hill.

Scheme of Examination :

1. One question should be set from each module
2. All questions are compulsory.
3. Choice may be given in each module.

CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS

Contact Hours/ Week	: 2 (L)	Credits :	0
Total Lecture Hours	: 26	CIE Marks :	50
Sub. Code	: MC03	SEE Marks :	50

Module-I

1. Preamble to the constitution of India, fundamental rights under part III-details of exercise of rights, Limitations & important cases. **4 Hrs.**
2. Relevance of Directive principles of state policy under part-IV, Fundamental duties & their significance. **3 Hrs.**

Module-II

3. Union executive-President, Prime minister, Parliament & the Supreme court of India. **3 Hrs.**
4. State executive–Governors, Chief Minister, State legislator and High courts. **3 Hrs.**

Module-III

5. Constitutional provisions for Scheduled castes & tribes, women, Children & backward classes. Emergency provisions. **4 Hrs.**
6. Electoral process, Amendment procedure, 42nd, 44th, 74th, 76th 86th & 91st constitutional amendments. **3 Hrs.**

Module-IV

7. Scope & aims of Engineering Ethics, responsibility of Engineers, impediments to responsibility. **3 Hrs.**
8. Honesty, Integrity and Reliability, Risks, Safety & Liability in Engineering. **3 Hrs.**

TEXT BOOKS

1	Durga Das Basu	Introduction to Constitution of India. Ed 19/20. (students edition) Prentice-Hall EEE. 2001.
2	Charles E Haries and others	Engineering Ethics. Thompson Asia. 2003.

REFERENCE BOOKS

1	Pylee M.V.	Introduction to constitution of India. Vikas publishing. 2002.
2	Govindarajan M. and others	Engineering Ethics. New Delhi. Prentice Hall of India. 2004.

Scheme of Examination:

Question paper is of objective type. Students have to pass this subject compulsorily.

COMPUTATIONAL METHODS IN ENGINEERING

Contact Hours/ Week	: 3 (L)	Credits :	3
Total Lecture Hours	: 39	CIE Marks :	50
Sub. Code	: ME41	SEE Marks :	50

Module-I

Engineering problem solving:
Introduction to Numerical methods,
Interpolation: Introduction**,** Finite difference operators, Newton's formula for for forward interpolation& Backward interpolation, Lagerange's interpolation formula.
Curve fitting: Introduction**,** Method of least squares, Fitting a straight line,A general procedure for linear regression, Fitting a parabola, General procedure for polynomial regression, conversion of nonlinear fit. **10 Hrs.**

Module-II

Numerical solution of Algebraic and transcendental Equation:
Introduction, Finding initial approximate root, Bisection Method, The method of iteration, Newton-Raphson method, Regula falsi method & secant method. **8 Hrs.**

Module-III

Solution to system of Linear Algebraic Equation:
Introduction, Gauss elimination method, pitfalls of elimination method & remedies**,** Gauss-jordan method, Gauss- Jordan method to obtain inverse of matrix, Crouts method or Choleskey's method, Matrix inversion method, Cramer's rule, Gauss-siedal iteration method, Condition for convergence of iteration method. **10 Hrs.**

Module-IV

Numerical Differentiation & Integration:
Introduction, Numerical differentiation, Differentiation of function with equidistant abscissa values, Differentiation of function tabulated at unequal intervals of abscissa values, Numerical integration, A general quadrature formula for equidistant abscissa, Trapezoidal rule, Simpson's rule(1/3 & 3/8),Weddle's rule. Newton –quote's formula. Gauss-quadrature formula. **8 Hrs.**

Module-V

Numerical solution of ordinary differential Equations
Introduction, Solution of initial value problems, Taylor's method, Eulers's method, Modified Euler's method, Errors in euler's method, Runge-Kutta method, Solutions to set of ODEs by R-K methoa, Milne's predictor-corrector method, solutions to Boundary value problems, Trail & error method(shooting method),Finite difference method. **9 Hrs.**

TEXT BOOKS

1	Steven C Chapra and Raymond P. Canale	Numerical Methods for Engineers. Ed 5. McGraw-Hill International (Indian students edition). 2007.
2	Ssatry S.S.	Introductory Methods of Numerical Analysis. Ed 2. Prentice-Hall of India. New Delhi. 1997.

REFERENCE BOOKS

1	Balaguru swamy E.	Numerical Methods. Ed2. Tata McGraw Hill. 1999.
2	Schauam's Outline series	Theory & problems of Numerical Analysis. Ed 2. TMH.
3	Rajaraman V.	Computer oriented Numerical methods.

SCHEME OF EXAMINATION: Five questions will be set, each from individual modules, answering all questions are compulsory. III module will contain an optional question (With choice).

METROLOGY AND INSTRUMENTATION

Subject code	: ME42	CIE Marks	: 50
Hours/Week	: 3	SEE Marks	: 50
Total Hours	: 39	Credits	: 3

Module-I

Standards of measurement

Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-87, M-112), Numerical problems on building of slip gauges.

System of limits, Fits, Tolerances and gauging

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, types of fits and their designation (IS 919 -1963), hole basis system, shaft basis of system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges -plain plug gauge, ring Gauge, snap gauge, limit gauge, gauge materials, Numerical problems on gauges.

10 Hrs.

Module- II

Comparators

Introduction to Comparator, Characteristics, classification of comparators, mechanical comparators -Johnson Mikrokator, Sigma Comparators, Dial indicator, Optical Comparators -principles, Zeiss ultra optic meter, Electric and Electronic Comparators -principles, LVDT, Pneumatic Comparators, Solex Comparators.

Angular measurement

Angular measurements, Bevel Protractor, Sine Principle and. use of Sine bars, Sine center, use of angle gauges, (numerical on building of angles), Clinometer.

06 Hrs.

Module- III

Measurements and Measurement systems

Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hystersis, repeatability, linearity, loading effect, system response-times delay. Errors in Measurements, Classification of Errors.

Transducers

Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, variable resistance transducer, variable mutual inductance transducer, variable self inductance transducer, liner variable differential transformer, piezo electric transducer, photo electric transducer, electronic transducer.

06 Hrs.

Module- IV

Intermediate modifying devices

Mechanical systems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry.

Terminating devices

Mechanical counters, Cathode Ray Oscilloscope, Oscillographs, X-Y Plotters.

09 Hrs.

Module-V

Measurement of Force

Principle of analytical balance, platform balance, proving ring.

Measurement of Pressure

Principle, use of elastic members, Bridgman gauge, Mc leod gage, Pirani Gauge.

Measurement of Temperature

Resistance thermometers, thermocouple, law of thermocouple materials used for construction, pyrometer, Optical Pyrometer.

08 Hrs.

TEXT BOOKS

1	R.K. Jain	Engineering Metrology, Khanna Publishers, 1994
2	Beckwith Marangoni and Lienhard Buck	Mechanical Measurements. Pearson Education Publications, 6th Ed., 2006.

REFERENCE BOOKS

1	I.C.Gupta	Engineering Metrology. Dhanpat Rai Publications, Delhi
2	R.K.Jain	Mechanical measurements

APPLIED THERMODYNAMICS

Contact Hours/ Week	: 3 + 1 (L+T)	Credits :	3.5
Total Lecture Hours	: 39	CIE Marks :	50
Total Tutorial Hours	: 13	SEE Marks :	50
Sub. Code	: ME43		

Module-I

Air Standard cycles

Air standard cycles, Carnot, Otto, Diesel, Dual and Stirling cycles, p-v and T-s diagrams, description, efficiencies and mean effective pressures. Comparison of Carnot's Otto, diesel and Dual cycles. Problems for finding efficiency and mean effective pressures. **7 Hrs.**

Module-II

Gas turbines

Gas turbine (Brayton) cycle; description and analysis.Derivations of equations for work ratio and Pressure ratio for maximum power output. Considering machine effencies. Methods of improving effeiciency of Gas turbine cycle, Regenerative gas turbine cycle. Inter-cooling and reheating in gas turbine cycles with numerical problems. **6 Hrs.**

Pure substances

P- T and P- V diagrams, triple point and critical points. Sub- cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapour states of a pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness factor (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter. **6 Hrs.**

Module-III

Vapour Power Cycles

Carnot vapour power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T –s diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle. **7 Hrs.**

I.C. Engines

Basic definitions of Brake power, Indicated power, Thermal efficiencies etc. Testing of two-stroke and four-stroke Sl and CI engines for performance, related numerical problems, heat balance, Morse test. **6 Hrs.**

Module-IV

Reciprocating Compressors

Operation of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multi-stage compressor, Saving in work, optimum intermediate pressure, inter-cooling, minimum work for compression. **6 Hrs.**

Module-V

Refrigeration

Vapour compression refrigeration system; description, analysis, refrigerating effect, capacity, power required, units of refrigeration, COP. Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle. Vapour absorption refrigeration system. **5 Hrs.**

Psychorometry

Atmospheric air and psychorometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidifies and the relation between the two Enthalpy and adiabatic saturation temperature. Construction and Use of psychometric chart. Analysis of various processes; heating, cooling, dehumidifying and humidifying. Adiabatic mixing of stream of moist air. Summer and winter air – conditioning

5 Hrs.

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TEXT BOOKS

1	Rajput R.K.	Thermal Engineering. Lakshmi publications.
2	Nag P.K.	Basic & Applied Thermodynamics. Tata McGraw Hill.2002.

REFERENCE BOOKS

1	Radhakrishnan E.	Fundamentals of Engineering Thermodynamics. Prentice-hall of India.
2	Yunus A. Cenegal and Michael A.Boles	Thermodynamics-An Engineering Approach. Tata McGraw Hill. 2002.

SCHEME OF EXAMINATION:

Five questions will be set, each from individual modules, answering all questions are compulsory. I module will contain an optional question (With choice)

DYNAMICS OF MACHINERY

Contact Hours/ Week	: 3 +1 (L+T)	Credits :	3.5
Total Lecture Hours	: 39	CIE Marks :	50
Total Tutorial Hours	: 13	SEE Marks :	50
Sub. Code	: ME44		

Module-I

Static Force Analysis and Friction:

Reaction between members without friction. Analysis of engine mechanism, four bar mechanism (without friction). Definition, Laws of solid friction: Belt drives, ratio of belt tensions, centrifugal tension, power transmitted, Effect or centrifugaltension on power transmitted and V -belt drives. **10 Hrs.**

Module-II

Dynamics of Engine Mechanism:

Turning Moment Diagrams and flywheel design **10 Hrs.**

Module-III

Balancing of Machinery:

Static and dynamic balancing, balancing of single rotating mass in same plane and in different planes. Balancing of several rotating masses in same plane and in different planes. Balancing of reciprocating masses. Inertia effect of crank and connecting rod; single cylinder engine, balancing in multi cylinder-inline engine and V-engines (primary & secondary forces) **12 Hrs.**

Module-IV

Governors:

Types of governors; force analysis of Porter, Proell and Hartnell governors. Controlling force, stability, sensitiveness, isochronism, effort and power **10 Hrs.**

Module-V

Gyroscope:

Vectorial representation of angular motion, Gyroscopic couple, Effect of gyroscopic couple on disc, ship, plane, two wheelers and four wheelers. **10 Hrs.**

TEXT BOOKS

1	Rattan S.S.	Theory of Machines. Ed2. Tata McGraw-Hill. New Delhi. 2005.

REFERENCE BOOKS

1	Shigley J.V. and Uickers J.J.	Theory of Machines & Mechanisms Ed 2. McGraw Hill. 1995.
2	Sadhu Singh.	Theory of Machines. Ed2. Pearson Education (Singapore). Indian Branch. New Delhi. 2006.

SCHEME OF EXAMINATION:

Five questions will be set, each from individual modules, answering all questions are compulsory. III module will contain an optional question (With choice).

FLUID MECHANICS

Contact Hours/ Week	: 4 (L)	Credits :	3.5
Total Lecture Hours	: 50	CIE Marks :	50
Sub. Code	: ME45	SEE Marks :	50

Module-I

Introduction, Properties of fluids- Mass Density, Weight density, specific gravity, Bulk modules, compressibility, surface tension, capillarity, vapour pressure,Viscosity, simple problems. **8 Hrs.**

Module-II

Fluid statics- Introduction, fluid pressure at a point, Hydrostatic' law, Pascal's law.

Terms of pressure, Pressure measuring devices-simple manometers, differential, Inverted differential manometers. Simple problems.

Total pressure, Center of pressure on vertical and inclined surfaces. Simple problems. Buoyancy, center of buoyancy, Metacenter, metacentric height,

Conditions of stability of floating bodies.Determination of metacentric height-

Analytical and experimental method. Simple problems. **16 Hrs.**

Module-III

Fluid kinamatics- Introduction, types of flow, Continuity equation in three dimensions(Cartesian co-ordinate system only), Velocity and acceleration.

Simple problems. Stream function and velocity potential function. Simple Problems **8 Hrs.**

Module-IV

Fluid dynamics-Introduction, Various forces acting on the fluid flow. Eulers equation of motion along a stream line, Bernoulli's equation from Euler's equation. Modification of Bernoulli's equation, Impulse- momentum equation,

Its application. Simple problems.

Application of Bernoulli's equation-Fluid flow measurements, Hydraulic

Co-efficients, Vertical orifice, Venturimeter, Orifice meter, Pitot- tube, V-notch Simple problems. **10 Hrs.**

Module-V

Flow through pipes-Frictional losses in pipe flow-Darcy equation, Chezy equation. Reynolds number, its Significance .Simple problems. Flow

Through compound pipes, Equivalent size of pipe.

Dimensional analysis-Introduction, dimensions of physical quantities, Buckingham's π-theorem, dimensionless numbers. Simple problems. **8 Hrs.**

TEXT BOOKS

1	Dr. Bansal R.S.	Fluid mechanics. Lakshmi publications. 2006.
2	Hegde R.K.	Fluid Mechanics. Niranjan murthy. Sapna book house.

REFERENCE BOOKS

1	Dr.Jagdeeshlal.	Fluid mechanics and hydraulics. Metropoliton book.
2	Dr Kumar D.S.	Fluid mechanics and fluid power engineering. Katson publishing.

SCHEME OF EXAMINATION: Five questions will be set, each from individual modules, answering all questions are compulsory. II module will contain an optional question (With choice)

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY

Lab Hours/ Week	: 3	Credits :	1.5
Sub. Code	: MEL41	CIE Marks :	50
		SEE Marks :	50

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges

PART-B: METROLOGY

6. Measurements using Profile Projector / Toolmaker Microscope
7. Measurements of angle using Sine Center / Sine bar / Bevel protractor
8. Measurements of alignment using Autocollimator / Roller set
9. Measurements of cutting tool forces using Lathe tool Dynamometer
10. Measurements of Tolerance using Mechanical Comparator
11. Measurements of gear tooth profile using gear tooth vernier /gear tooth micrometer
12. Calibration of micrometer using slip gauges
13. Measurement of the flatness using Optical Flats

SCHEME OF EXAMINATION:

ONE question from Metrology (part -A)	: 20 Marks
ONE question from Instrumentation (part -B)	: 20 Marks
Viva –Voce	: 10 Marks

Total 50 Marks

FOUNDRY LABORATORY

Lab Hours/ Week	: 3	Credits :	1.5
Sub. Code	: MEL42	CIE Marks :	50
		SEE Marks :	50

PART – A

1. Testing of Moulding sand and core sand

Preparation of specimen and conduction of the following tests:

a. Compression, Shear and Tensile tests
b. Permeability test
c. Core hardness and mould hardness tests
d. Grain fineness test
e. Clay content test

PART - B

2. Foundry Practice

Use of foundry tools and other equipments

Preparation of moulds (ready to pour) using two boxes.

Use of Split pattern Match plate pattern and Cores.

Preparation of one casting using Aluminium or cast iron. (demonstration only)

SCHEME OF EXAMINATION:

One question is to be set from Part-A	:	15 marks + 5
One question is to be set from either Part-B	:	15 marks + 5
Viva-Voce	:	10 marks