TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

4-Year Bachelor of Technology (B.Tech.) Curriculum and Syllabus for Mechanical Engineering (ME)

Third Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIUSD-301	Career Advancement & Skill Development-III	2	1	0	3
TIUMTH-302	Transform Calculus	3	0	0	3
TIUEV-303	Environmental Science	2	0	0	2
TIUHS-304	Engineering Economics and Costing	2	1	0	3
TIUME-301	Fluid Mechanics-I	3	1	0	4
TIUME-302	Thermodynamics-I	2	1	0	3
TIUMTH-307	Partial Differential Equations	3	0	0	3
Practical					
TIUME-391	Workshop Process-II	0	0	3	2
TIUME-392	Fluid Mechanics Laboratory	0	0	3	2
Sessional					
TIUCSL-381	Entrepreneurship Skill Development-III	0	0	3	2
Total Credits					27

Approved By:
External Expert VC Registrar Dean of Academics Mentor of the Dept. HOD

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Syllabus

Transform Calculus

TIUMTH-302

L-T-P: 3-0-0 **Credit: 3**

Laplace Transform: Definition of Laplace Transform, linearity property, conditions for existence of Laplace Transform. First and second shifting properties, Laplace Transform of derivatives and integrals, unit step functions, Dirac delta-function, error function. Differentiation and integration of transforms, convolution theorem, inversion, periodic functions. Evaluation of integrals by Laplace Transform. Solution of initial and boundary value problems. Fourier Series : Periodic functions, Fourier series representation of a function, half range series, sine and cosine series, Fourier integral formula, Parseval's identity. Fourier Transform: Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting and time shifting properties. Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems. Brief Introduction of Z-Transform, Mellin transform and Wavelet Transform.

Environmental Science

TIUEV-303

L-T-P: 2-0-0 **Credit: 2**

Introduction:

Environment and environmental pollution from chemical process industries, characterization of emission and effluents, environmental Laws and rules, standards for ambient air, noise emission and effluents.

Pollution Prevention:

Process modification, alternative raw material, recovery of by co-product from industrial emission effluents, recycle and reuse of waste, energy recovery and waste utilization.

Material and energy balance for pollution minimization. Water use minimization, Fugitive emission/effluents and leakages and their control-housekeeping and maintenance.

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Air Pollution Control:

Particulate emission control by mechanical separation and electrostatic precipitation, wet gas scrubbing, gaseous emission control by absorption and adsorption, Design of cyclones, ESP, fabric filters and absorbers.

Water Pollution Control:

Physical treatment, pre-treatment, solids removal by setting and sedimentation, filtration centrifugation, coagulation and flocculation.

Biological Treatment:

Anaerobic and aerobic treatment biochemical kinetics, trickling filter, activated sludge and lagoons, aeration systems, sludge separation and drying.

Solids Disposal:

Solids waste disposal - composting, landfill, briquetting / gasification and incineration.

Engineering Economics and Costing

TIUHS-304

L-T-P: 2-1-0 **Credit: 3**

Introduction: engineering economy and its importance, want activity – satisfaction of wants. Resource planning and distribution in economic systems – Laissez.

Factors of production: the concept of optimum, laws of return; demand - elasticity of demand – demand- estimation market research; supply and industrial costs.

Money-value of money; quantity theory; inflation and deflation.

Banking: role of commercial banks; credit and its importance in industrial functioning - source of finance; Reserve bank of India and its functions.

Business management and organisation: proprietorship, partnership and joint-stock company – their formation.

Finance and management: elements of taxation, insurance, business combinations, basic principles of management.

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Industrial record-keeping: double entry system, journal, ledger, trial balance, cash book, preparation of final accounts – trading, profit and loss account, balance sheet, simple study of balance.

Industrial costs: classification – material cost control, labour cost control and overhead cost control; depreciation and replacement studies.

Financial control: ratio analysis and their interpretation for industrial control; budgetary control.

Value analysis and project evaluation: pay back, DCF, IRR.

Fluid Mechanics-I

TIUME-305

L-T-P: 3-1-0 **Credit: 4**

Introduction: Definition of fluid, continuum hypothesis, different properties of fluid, classification (like Newtonian/non-Newtonian, ideal/real etc.).

Fluid Statics: pressure at a point, Pascal's law, variation of pressure within a static fluid – equation of hydrostatic pressure distribution, variation of properties in static atmosphere; measurement of pressure; hydrostatic thrust on plane and curved surfaces; buoyancy, stability of submerged and floating bodies.

Fluid Kinematics: preliminaries of Eulerian and Lagrangian description of fluid flow; velocity and acceleration of fluid particles in rectilinear and curvilinear co-ordinates; different types of flow – steady and unsteady flow, uniform and non-uniform flow, one, two and three dimensional flow, rotational and irrotational flow, laminar and turbulent flow; stream line, streak line and path line; stream filament and stream tube; principle of conservation of mass – equation of continuity for a stream tube and for unsteady three dimensional flow; deformation of a fluid particle – linear and angular deformation and rotation; vortex motion.

Fluid Dynamics: principle of conservation of linear momentum, Euler's equation of motion along a streamline and for unsteady three dimensional flow; derivation of Bernoulli's equation and physical significance of different terms; applications of Bernoulli's equation in flow measurement devices: stagnation tube, pitot tube, venturi meter, orifice meter.

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Application of Linear Momentum to Control Volume: linear momentum equation; analysis of force exerted by a fluid stream on a solid boundary – jet impingement, thrust on pipe bends etc.

Application of Angular Momentum to Control Volume: Principle of Conservation of Angular Momentum and its applications.

Characteristics of Laminar and Turbulent Flow: Reynolds experiment, critical Reynolds number; laminar flow through pipe – Hagen Poiseuille equation.

Flow through Closed Conduits: Darcy Weisbach equation, friction factor of closed conduits, flow through noncircular ducts, Moody's diagram and its use; minor losses – at sudden expansion, at sudden contraction, at bends, at valves and fittings etc.; analysis of simple pipe network problems.

Recommended books

1. Fluid Mechanics by F.M. White, McGraw Hill Education (India) Private Limited.

2. Fluid Mechanics by R.W. Fox, A.T. McDonald and P.J. Pritchard, Wiley.

3. Introduction to Fluid Mechanics and Fluid Machines by S.K. Som, G. Biswas and S. Chakraborty, McGraw Hill Education (India) Private Limited.

4. Textbook of Fluid Mechanics and Hydraulic Machines by Sukumar Pati, McGraw Hill Education (India) Private Limited.

5. Fluid Mechanics: Including Hydraulic Machines by A.K.Jain, Khanna.

Thermodynamics-I

TIUME-306

L-T-P: 2-1-0 **Credit: 3**

Introduction: Microscopic and Macroscopic viewpoints in thermodynamics. Fundamental concepts of System, Control volume, State, Property, Equilibrium, Processes etc.

The Zeroth law of thermodynamics: Thermal equilibrium. Temperature. Principle of thermometry. International practical temperature scale.

Energy: Different energy forms-stored energy, energy in transition. Definitions.

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Properties of pure substances: Thermodynamics properties of pure substances in solid, liquid and vapour phases. P-V-T behaviour simple compressible substances. Phase rule. State postulate. Thermodynamic property tables and charts. Ideal and Real gases. Equations of state. Compressibility factor. Generalised compressibility chart. Problems.

The First law of thermodynamics: The first law of thermodynamics for systems. Corollaries. Internal energy and enthalpy. First law for control volumes. Steady state and unsteady state applications. Process calculations for ideal and real gases using equations, tables and charts. Problems.

The Second law of thermodynamics: Limitations of the first law of thermodynamics. Steadily operating systems–Heat engine, Heat Pump and refrigerator. Thermal efficiency. Coefficient of Performance. Carnot cycle. Statements of the second law of thermodynamics. Equivalence of Kelvin Planck and Clausius statements of the second law of thermodynamics. Corollaries. Entropy. Reversibility and Irreversibility. Second law analysis of control volume. Entropy generation. Reversible work. Availability. Irreversibility. Problems.

Thermodynamic relationships: Tds relations. Maxwell equations. Clapeyron equation, Clausius Clapeyron equation. Joule-Thompson coefficient. Compressibility and expansion coefficient. Problems.

Recommended books

1. Thermodynamics: An Engineering Approach by Y.A. Cengel and M.A. Boles, McGraw Hill Education (India) Private Limited.

2. Fundamentals of Thermodynamics by C. Borgnakke and R.E. Sonntag, Wiley.

3. Thermodynamics by M.C. Potter, C.W. Somerton and SukumarPati, Tata McGraw Hill Education.

4. Engineering Thermodynamics by P.K. Nag, McGraw Hill Education (India) Private Limited.

5. Basic Engineering Thermodynamics by R. Joel, Pearson Education.

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Partial Differential Equations

TIUMTH-307

L-T-P: 3-0-0 **Credit: 3**

Review of power series solution of ODE, Frobenius series, Bessel functions and Legendre polynomials. Introduction to partial differential equations, linear and quasi-linear equations of first order. Classification of integrals. Lagrange's Method of solution and its geometrical interpretation, compatibility condition, Charpit's method, special types of first order equations. Second order partial differential equations with constant and variable coefficients, classification and reduction of second order equation to canonical form, characteristics. Cauchy problem, Cauchy's, Neumann and Dirichlet problems. Fourier series solution of wave equation, vibrations of a string. Riemann's method for hyperbolic equation. Method of separation of variables to solve heat equation, Laplace equation, Diffusion equation. Integral transform method to solve second order partial differential equations.

Workshop Process-II

TIUME-391

L-T-P: 0-0-3 **Credit: 2**

Selected jobs for practicing Machining: facing, drilling, boring, turning-straight, taper, eccentric, grooving, thread cutting, forming etc. in centre lathes surfacing, making regular polygons and cutting gear teeth in milling machines gear teeth generation in gear shaping machine and hobbing machine part programming and machining in CNC machining center setting and operation of EDM finishing by grinding Measurement of dimensions, forms and surface finish of machined products. Foundry Technology: The practice-cum-experiments to impart an understanding on the various steps in metal casting including pattern design, sand preparation, moulding and melting: (a) Study on various types of patterns and pattern materials (b) Layout of a pattern (a) Study on sand preparation (b) Study on variation of mould properties with different moulding machines Study on the effect of moulding parameters on the properties of moulds Study of melting furnace and melting of aluminium alloys including degasification. Welding: Practical classes designed with the objective of imparting hands on training as well as understanding of welding technology. Suggested exercises are: Understanding of welding machine characteristics and controls, electrode specifications, selection of electrode size and current, laying of beads. Study of joint configuration and specification, required edge preparations; practice on preparing both side

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square groove butt weld; grinding of weld crown to make bead flush with plate surface; visual inspection of defects and reporting. Study of various types of oxy-acetylene flames; practice on flame adjustment, gas welding/brazing. Study and practice on submerged arc welding/ MIG welding.

Fluid Mechanics Laboratory

TIUME-392

L-T-P: 0-0-3 **Credit: 2**

Experiments on Basic Concepts:

Verification of Bernoulli's Equation.

Reynolds Experiment.

Verification of Stokes' Law.

Experiments on Pipes:

Calibration of Venturi Meter.

Calibration of Orifice Meter.

Friction Losses in Pipes.

Experiments on Open Channels:

Calibration of Triangular Notch.

Calibration of Rectangular Notch.

Calibration of Trapezoidal Notch.