GUJARAT TECHNOLOGICAL UNIVERSITY

ENGINEERING ECONOMICS AND MANAGEMENT
SUBJECT CODE: 2140003
B.E. 3rd/4th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	0	3	70	20	10	0	0	0	100

Content:

Sr. No	Topics	Hrs.	Module Weightage
1.	Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity	04	10%
2.	Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical	04	10%
3.	Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly) National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income.	05	10%
4.	Basic economic problems; Poverty-meaning, absolute & relative poverty, causes, measures to reduce Unemployment: meaning, types, causes, remedies Inflation; meaning, types, causes, measures to control	04	10%
5.	Money; meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.	04	10%
6.	Introduction to Management; Definitions, Nature, scope Management & administration, skill, types and roles of managers Management Principles; Scientific principles, Administrative principles, Maslow's Hierarchy of needs theory	04	11%
7.	Functions of Management; Planning, Organizing, Staffing, Directing, Controlling (meaning, nature and importance) Organizational Structures; meaning, principles of organization, types-formal and informal, line, line & staff, matrix, hybrid (explanation with merits and demerits), span of control, departmentalization.	05	11%
8.	Introduction to Marketing management; Marketing Mix, concepts of marketing, demand forecasting and methods, market segmentation Introduction to Finance Management; meaning, scope, sources, functions	05	11%
9.	Introduction to Production Management; definitions, objectives, functions, plant layout-types & factors affecting it, plant location- factors affecting it. Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection	05	11%
10.	Corporate Social Responsibility; meaning, importance Business Ethics; meaning, importance.	02	6%

Reference Books:

1. Engineering Economics, R.Paneerselvam, PHI publication
2. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
3. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
4. Principles and Practices of Management by L.M.Prasad
5. Principles of Management by Tripathy and Reddy
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

Course Outcomes: The course is intended to provide basic understanding of Economics and Management to engineering students with following aspects:

- To impart knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions.
- To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory. The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

AUTOMOBILE ENGINEERING, INDUSTRIAL ENGINEERING (15) & MECHANICAL ENGINEERING (19)

MECHANICAL MEASUREMENT & METROLOGY

SUBJECT CODE: 2141901

B.E. 4th SEMESTER

Type of course: Under Graduate level

Prerequisite: Nil

Rationale:

Measurement and Metrology deals with the application of science in Mechanical Engineering. It provides a means of assessing the suitability of measuring instruments, their calibration, and the quality control of manufactured products. A product that is not manufactured according to metrological specifications will have to incur heavy costs of comply with the specifications later. Any compromise in quality creates rapid negative sentiments in the market and cost of recovering the original market position would be quite high. Hence, an organization should strive towards a ZERO – DEFECT regime in order to survive in a highly competitive market, ensuring this aspect of manufacturing is the responsibility of a quality control engineer, who must be completely familiar with measurements and metrology and also their limitations.

By educating in the area of Measurement and Metrology students will enable to seek employment in engineering upon graduation while, at the same time, provide a firm foundation for the pursuit of graduate studies in engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightag
1	**Mechanical Measurement:** Need of mechanical measurement, Basic definitions: Hysteresis, Linearity, Resolution of measuring instruments, Threshold, Drift, Zero stability, loading effect and system response. Measurement methods, Generalized Measurement system, Static performance characteristics, Errors and their classification.	03	7%
2	**Linear and angular measurements:**	07	15%

	Linear Measurement Instruments, Vernier calliper, Micrometer, Interval measurements: Slip gauges, Checking of slip gauges for surface quality, Optical flat, Limit gauges, Problems on measurements with gauge.		
3	**Measurement of Force, Torque and Strain:** Force measurement: load cells, cantilever beams, proving rings, differential transformers. Measurement of torque: Torsion bar dynamometer, servo controlled dynamometer, absorption dynamometers. Power Measurements. Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, bridge arrangement, temperature compensation.	**06**	14%
4	**Displacement, Velocity/Speed, and Acceleration, Measurement:** Working principal of Resistive Potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer,	**04**	7%
5	**Temperature measurement:** Temperature Measuring Devices: Thermocouples, Resistance Temperature Detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer, Bimetallic strip. Calibration of temperature measuring devices, Numerical Examples on Flow Measurement.	**04**	12%
6	**Metrology:** Basics of Metrology, Need for Inspection, Accuracy and Precision, Objectives, Standards of measurements.	**02**	4%
7	**Metrology of Gears and screw threads:** Gear tooth terminology, Sources of errors in manufacturing of gears, Measurement of tooth thickness: Gear tooth vernier, Constant chord method, Addendum comparator method and Base tangent method, Measurement of tooth profile: Tool maker's microscope or projector, Involute tester, Measurement of pitch, Measurement of run out, Lead and Backlash checking. Measurement of concentricity, Alignment of gears. **Screw Thread Measurement:** Errors in threads, screw thread gauges, measurement of element of the external and internal threads, thread calliper gauges.	**06**	12%
8	**Metrology of Surface finish:** Surface Metrology Concepts and terminology, Analysis of surface traces, Specification of surface Texture characteristics, and Method of measuring surface finish: Stylus system of measurement, Stylus probe instruments, Wave length, frequency and cut off, other methods for measuring surface roughness: Pneumatic method, Light Interference microscopes, Mecrin Instruments.	**06**	12%
9	**Comparators:** Functional Requirements, Classification, Mechanical Comparators,	**03**	7%

	Mechanical Optical Comparators, Electrical Comparators, Pneumatic Comparators.		
10	**Miscellaneous Metrology:** Precision Instrumentation based on Laser Principals, Coordinate measuring machines: Structure, Modes of Operation, Probe, Operation and applications. Optical Measuring Techniques: Tool Maker's Microscope, Profile Projector, Optical Square. Basics of Optical Interference and Interferometry, Optoelectronic measurements,	**04**	10%
	Total Hours	**45**	100%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
7	14	21	14	14

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press,
2. Engineering Metrology and Measurements, Bentley, Pearson Education
3. Theory and Design for Mechanical Measurements, 3rd Edition, Richard S Figliola, Donald E Beasley, Wiley India
4. Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill
5. Doebelin's Measurement Systems Ernest Doebelin, Dhanesh Manik McGraw-Hill
6. Instrumentation, Measurement and Analysis, B.C. Nakra, K.K. Chaudhry McGraw-Hill
7. A Text book of Engineering Metrology, I C Gupta, Dhanpat Rai Publications
8. A course in Mechanical Measurements and Instrumentation, A K Sawhney, Dhanpat Rai Publications
9. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication(KATSON)
10. Mechanical Measurement and Metrology by R K Jain, Khanna PublisherMechanical Measurement & Control by D.S. Kumar.
11. Industrial Instrumentation & Control by S K Singh, McGrawHill
12. Mechanical Measurements by Beckwith & Buck, Narosa publishing House

Course Outcome:

After learning the course the students should be able to:

1. Students will describe basic concepts of Metrology
2. Students will select linear measuring instrument for measurement of various components
3. Students select angular and taper measurement devices for measurement of various components
4. Students will discriminate between various screws by measuring their dimensions

5. Students will separate different gears through measurement of various dimensions of gears
6. Students will discriminate capabilities of machining process by measuring surface finish of the component produced
7. Students will evaluate quality of surface produced using various methods
8. Students will describe basic concepts of mechanical measurement and errors in measurements.
9. Students will select appropriate temperature measuring device for various applications
10. Students will describe methods of measurement for various quantities like force, torque, power, displacement, velocity/seed and acceleration

List of Experiments:

Following experiments are suggested for Laboratory work

1. Basic understanding of measurements and metrology: concepts, application, advantage and future aspects
2. Performance on linear and angular measurements and check different characteristics of measurements
3. Performance on Temperature measurements and check different characteristics of measurements and also do calibration
4. Performance on Temperature measurements and check different characteristics of measurements and also do calibration
5. Performance on Stress, strain and force measurements and check different characteristics of measurements and also do calibration
6. Performance on Speed/Velocity, acceleration measurements.
7. Performance on surface measurements
8. Performance on measurements of gears and screw threads

Important Note:

80 % From above suggested laboratory work should be covered and remaining 20 % is as per facility available at Department.

Design based Problems (DP)/Open Ended Problem:
All above performance are to be carried out in the laboratory and students will prepare experiments and note down reading and conclusion. The can prepare for calibration and compare results with existing and with alternate methods of measurements. At least 5 open ended problems are proposed for better understanding the subject and to apply real life application. The projects are listed below:

1. Calibration of temperature measuring devices
2. Design and prepare for strain/force/torque measurements experiments
3. Setup preparation and experiments on linear and angular measurements
4. Experiment for gear and screw thread measurements
5. Setup preparation and experiments on Displacement, Speed/Velocity and acceleration measurement

Major Equipment:

1. Temperature Measurements Equipments/Devices/Sensors
2. Stress/Strain/Force Measurements Equipments/Devices/Sensors
3. Surface Measurements Equipments/Devices/Sensors
4. Linear/Angular Measurements Equipments/Devices/Sensors
5. Resistive Potentiometer, Tachometers, Piezoelectric Accelerometer

6. Gears/Screw Threads Measurements Equipments/Devices/Sensors
7. Miscellaneous measurements equipments

List of Open Source Software/learning website:

1. http://nptel.ac.in/courses/112106138

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GUJARAT TECHNOLOGICAL UNIVERSITY

AUTOMOBILE ENGINEERING (02), INDUSTRIAL ENGINEERING (15) & MECHANICAL ENGINEERING (19)

COMPLEX VARIABLES AND NUMERICAL METHODS

SUBJECT CODE: 2141905

B.E. 4th SEMESTER

Type of course: Engineering Mathematics

Prerequisite: As a pre-requisite to this course students are required to have a reasonable mastery over multivariable calculus, differential equations and Linear algebra

Rationale:
Mathematics is a language of Science and Engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	30	0	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Complex Numbers and Functions: Exponential, Trigonometric, De Moivre's Theorem, Roots of a complex number ,Hyperbolic functions and their properties, Multi-valued function and its branches: Logarithmic function and Complex Exponent function Limit ,Continuity and Differentiability of complex function, Analytic functions, Cauchy-Riemann Equations, Necessary and Sufficient condition for analyticity, Properties of Analytic functions, Laplace Equation, Harmonic Functions, Harmonic Conjugate functions and their Engineering Applications	10	24
2	Complex Integration: Curves, Line Integral(contour integral) and its properties, Cauchy-Goursat Theorem, Cauchy Integral Formula, Liouville Theorem (without proof), Maximum Modulus Theorems(without proof)	04	10
3	Power Series: Convergence(Ordinary, Uniform, Absolute) of power series, Taylor and Laurent Theorems (without proof), Laurent series expansions, zeros of analytic functions , Singularities of analytic functions and their classification Residues: Residue Theorem, Rouche's Theorem (without proof)	05	12
4	Applications of Contour Integration: Evaluation of various types of definite real integrals using contour	02	5

	integration method		
5	Conformal Mapping and its Applications: Conformal and Isogonal mappings , Translation, Rotation & Magnification, Inversion, Mobius(Bilinear) , Schwarz-Christoffel transformations	03	7
6	Interpolation: Finite Differences, Forward, Backward and Central operators, Interpolation by polynomials: Newton's forward ,Backward interpolation formulae, Newton's divided Gauss & Stirling's central difference formulae and Lagrange's interpolation formulae for unequal intervals	04	10
7	Numerical Integration: Newton-Cotes formula, Trapezoidal and Simpson's formulae, error formulae, Gaussian quadrature formulae	03	7
8	Solution of a System of Linear Equations: Gauss elimination, partial pivoting , Gauss-Jacobi method and Gauss-Seidel method	03	7
9	Roots of Algebraic and Transcendental Equations : Bisection, false position, Secant and Newton-Raphson methods, Rate of convergence	03	7
10	Eigen values by Power and Jacobi methods	02	4
11	Numerical solution of Ordinary Differential Equations: Euler and Runge-Kutta methods	03	7

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
10%	15%	20%	20%	35%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. R. V. Churchill and J. W. Brown, Complex Variables and Applications (7th Edition), McGraw-Hill (2003)
2. J. M. Howie, Complex Analysis, Springer-Verlag(2004)
3. M. J. Ablowitz and A.S. Fokas, Complex Variables-Introduction and Applications, Cambridge University Press, 1998 (Indian Edition)
4. E. Kreyszig, Advanced Engineering Mathematics(8th Edition), John Wiley (1999)
5. S. D. Conte and Carl de Boor, Elementary Numerical Analysis-An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980
6. C.E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley,1981
7. Gerald C. F. and Wheatley,P.O., Applied Numerical Analysis (Fifth Edition), Addison-Wesley, Singapore, 1998.
8. Chapra S.C, Canale, R P, Numerical Methods for Engineers **,** Tata McGraw Hill, 2003

Course Outcome:

After learning the course the students should be able to:

- evaluate exponential, trigonometric and hyperbolic functions of a complex number
- define continuity, differentiability, analyticity of a function using limits. Determine where a function is continuous/discontinuous, differentiable/non-differentiable, analytic/not analytic or entire/not entire.
- determine whether a real-valued function is harmonic or not. Find the harmonic conjugate of a harmonic function.
- understand the properties of Analytic function.
- evaluate a contour integral with an integrand which have singularities lying inside or outside the simple closed contour.
- recognize and apply the Cauchy's integral formula and the generalized Cauchy's integral formula.
- classify zeros and singularities of an analytic function.
- find the Laurent series of a rational function.
- write a trigonometric integral over $[0, 2\pi]$ as a contour integral and evaluate using the residue theorem.
- distinguish between conformal and non conformal mappings.
- find fixed and critical point of Bilinear Transformation.
- calculate Finite Differences of tabulated data.
- find an approximate solution of algebraic equations using appropriate method.
- find an eigen value using appropriate iterative method.
- find an approximate solution of Ordinary Differential Equations using appropriate iterative method.

List of Open Source Software/learning website:

http://ocw.mit.edu/resources/res-18-008-calculus-revisited-complex-variables-differential-equations-and-linear-algebra-fall-2011/part-i/
http://nptel.ac.in/courses/111105038/
http://nptel.ac.in/courses/111104030/
http://nptel.ac.in/courses/111107063/
http://nptel.ac.in/courses/111101003/

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GUJARAT TECHNOLOGICAL UNIVERSITY

FLUID MECHANICS
SUBJECT CODE: 2141906
B.E. 4th SEMESTER

Type of course: Fundamental

Prerequisite: -- Elements of Mechanical Engineering

Rationale: The course is designed to give fundamental knowledge of fluid, its properties and behavior under various conditions.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No	Content	Total Hrs	% Weightage
1	**Fluids and Their Properties:** Introduction of fluid, fluid classifications, hypothesis of continuum, Shear stress in a moving fluid, molecular structure of material, fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus	3	5
2	**Pressures and Head:** Types of Pressure, Pascal's law of pressure at a point, variation of pressure vertically in a fluid under gravity, equality of pressure at the same level in a static fluid, general equation for the variation of pressure due to gravity from a point to point in a static fluid, pressure and head, the hydrostatic paradox, pressure measurements using Elastic Pressure Transducers, Force Balance Pressure gauge, Electrical Pressure Transducers	5	9
3	**Static Forces on Surface and Buoyancy:** Fluid static, action of fluid pressure on surface, resultant force and center of pressure on a plane surface under uniform pressure, resultant force and center of pressure on a plane surface immersed in a liquid, pressure diagrams, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacentre relative to the center of buoyancy.	8	14
4	**Motion of Fluid Particles and Streams:** Fluid flow, different types of flow, frames of reference, analyzing	4	7

	fluid flow, motion of a fluid particle, acceleration of a fluid particle, discharge and mean velocity, continuity of flow, continuity equations for 2-D and 3-D flow in Cartesian coordinates of system.		
5	**The Energy Equation and its Application:** Momentum and fluid flow, Momentum equation for 2-D and 3-D flow along a stream line, momentum correction factor, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid – Bernoulli's theorem, kinetic energy correction factor, pitot tube, determination of volumetric flow rate via pitot tube, changes of pressure in tapering pipe, principle of venturimeter, pipe orifices, theory of small orifices discharging to atmosphere, theory of large orifices, Rotameter, elementary theory of notches and weirs, flow in a curved path	8	15
6	**Two-Dimensional Ideal Fluid Flow:** Rotational and ir-rotational flow, circulation and vorticity, streamlines and the stream functions, velocity potential and potential flow, relation between stream function and velocity potential; flow nets, stream function and velocity potential for uniform flow, vortex flow.	4	7
7	**Dimensional Analysis And Similarities:** Dimension reasoning, dimensional homogeneity, dimensional analysis using Rayleigh's method, Buckingham π-theorem, significance of dimensionless, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity, Kinematic similarity, model testing-Model laws, Undistorted and Distorted models.	5	9
8	**Viscous Flow:** Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing , movement of piston in dash pot, methods of measurement of viscosity.	6	11
9	**Turbulent Flow:** Expression for coefficient of friction -Darchy Weishbach Equation, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.	4	7
10	**Flow through pipes**: Major energy losses, Minor energy losses, Hydraulic gradient and total energy lines, Pipes in series and parallel, Equivalent pipes, Siphon, power transmission through pipe, Flow through nozzle at end of pipe, Water hammer in pipes	6	11
11	**Compressible Flow:** Basic equations for one dimensional compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties	3	5

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
10	10	15	20	15

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K.Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
4. Fluid Mechanics by Frank .M. White, McGraw Hill Publishing Company Ltd.
5. Fundamentals of Fluid Mechanics by Munson, Wiley India Pvt. Ltd
6. Fluid Mechanics by A. K. Mohanty, PHI Learning Pvt. Ltd.
7. Laboratory Manual Hydraulics and Hydraulic Machines by R V Raikar

Course Outcome:

After learning the course the students should be able to:

- Understand the basic concept of fluid mechanics.
- Understand statics, dynamics and various approaches to fluid mechanics.
- Understand fundamentals of flow through pipes
- Understand basics of compressible flow
- Correlate fundamentals of fluid mechanics with various mechanical systems

List of laboratory experiments:

1. To understand pressure measurement procedure and related instruments/devices.
2. To determine metacentric height of floating body.
3. Verification of Bernoulli's theorem.
4. To measure the velocity of flow using Pitot tube.
5. To determine the Coefficient of discharge through different flow meters. (Any two out of Orifice meter, Venturi meter and Nozzle meter.)
6. To determine the Coefficient of discharge through open channel flow over a Notch. (Rectangular or V notch)
7. To determine the different types of flow Patterns by Reynolds's experiment.
8. To determine the Friction factor for the different pipes.
9. To determine the loss coefficients for different pipe fittings.
10. To determine the viscosity of fluid by viscometer (Redwood or Saybolt).

Design based Problems (DP)/Open Ended Problem:

1. Develop a model to measure viscosity of the fluid.
2. Study the behavior of fluid under various conditions using software.
3. Study continuum problems with reference to fluid mechanics**.**

Major Equipment:

1. Pitot Tube
2. Venturimeter apparatus
3. Reynold's apparatus
4. Pressure Measurement apparatus
5. Orifice meter apparatus
6. Pipe fitting apparatus
7. Metacentric height apparatus
8. Open Channel apparatus (Notches)
9. Nozzle Meter
10. Manometer
11. Viscometer
12. Elastic Pressure Transducers, Force Balance Pressure gauge, Electrical Pressure Transducers

List of Open Source Software/learning website:

1. http://nptel.ac.in/
2. www.learnerstv.com
3. http://www.mne.psu.edu/cimbala/Learning/Fluid/fluid.htm
4. http://www.efluids.com/efluids/pages/edu_tools.htm

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GUJARAT TECHNOLOGICAL UNIVERSITY

AUTOMOBILE ENGINEERING (02), INDUSTRIAL ENGINEERING (15) & MECHANICAL ENGINEERING (19)

MACHINE DESIGN & INDUSTRIAL DRAFTING

SUBJECT CODE: 2141907

B.E. 4th SEMESTER

Type of course: Under Graduate

Prerequisite: None**.**

Rationale: The course aims to impart basic skills for analysis of mechanical component and communicate assembly and production drawings for the components designed.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction:** Concepts of stresses and Strain, Combinations of Axial, Shear, Torsional and Bending loads; Theories of Failures: Distortion energy (von Mises), Maximum-Shear stress, Maximum Principal stress, Coulomb-Mohr Theory, Selection and Use of theories of failures; Factor of safety, Contact stresses, Crushing and Bearing stress. **Application Problems:** Eccentric Loading; Cotter and Knuckle Joints; Design and analysis of levers: Cranked, Bell crank, Foot, Rocker arm.	**13**	**25%**
2	**Beams and Columns:** Different types of supports / end conditions, Revision of Stresses in beams: Effect of Section, Orientation, and type of loading; Deflection of beams for different loading conditions. Compressive axial loading of columns and struts, Slenderness ratio, Compressive stress and Buckling of members, Effect of end conditions; Euler's Formula, Applications, validity and limitations; Rankine's Formula, Johnson's equation; Eccentric loading of long columns.	**7**	**14%**
3	**Shafts, Keys and Couplings:** Design of solid and hollow circular shaft subjected to torque and combined loading; Design of shaft for rigidity and stiffness; Design of Keys: Saddle, Sunk, Woodruff, Square, Flat, Kennedy key and Splines. Design of Couplings: Concept of rigid and flexible couplings, Design of: Clamp, Rigid flange and Flexible couplings.	**10**	**22%**

4	**Power Screws and Threaded Joints:** Forms of thread, Single and Multiple threaded screw, Terminology of power screw, Torque requirement of lifting/lowering, Self-locking, Efficiency of threads, coefficient of friction, design of screw and nut. Basic types of screw fastening, Cap and Set screw, Bolt of Uniform strength, locking devices, Terminology of Screw thread, Bolted Joint: Simple and Eccentric loading, Torque requirement for bolt tightening, Design of turnbuckle, Elastic analysis of bolted joints.	**18**	**25%**
	Welded and Riveted Joints: Welded joints: stress relieving of welded joints, Strength of butt and fillet joint, Eccentric load in the plane of weld, Welded joint subjected to bending and torsion. Riveted joints: rivet materials, types of failure, strength and efficiency of joint, Caulking and Fullering, Longitudinal and Circumferential lap joint, Eccentrically loaded riveted joint.		
5	**Tolerances, Limits and Fits:** Introduction, Basic Definitions, Maximum Metal Condition, Least Metal Condition, Grade of tolerance, Linear and Angular Tolerances, Fundamental deviations, Types of Fits and its basis, Gauge design.	**6**	**14%**
	Basic terminology of GD & T, Different tolerance characteristics, symbols and tolerance modifiers, Different aspects of datums, Parameters of surface texture and qualifications, Relation of surface roughness and various manufacturing processes, Surface Lay Indication.	******	

**** Should be covered during practical session with application to production/assembly drawings.**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
12	20	18	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Design of Machine Elements, V B Bhandari, 3/e, McGraw Hill.
2. Machine Design: Fundamentals and Applications, P C Gope, 1/e PHI.
3. Fundamentals of Machine Component Design, R C Juvinall, 4/e, Wiley.
4. Machine Design: An Integrated Approach, R L Norton, Pearson
5. Machine Drawing, B Bhattacharyya, 1/e, Oxford Press.
6. Engineering Metrology and Measurements, N.V. Raghavendra & L. Krishnamurthy, Oxford Press.
7. Machine Drawing, K C John, PHI.
8. IS SP 46, 2003.

Course Outcome:

After learning the course the students should be able to:

1. Students will be able to analyse components subjected to various mechanical loads.
2. Students will be able to analyse beams and columns for stresses and deflection.
3. Students will be able to design and analyse shafts, keys and couplings.

4. Students will be able to select fasteners and design welded / riveted joints.
5. Students will be able to generate and interpret assembly and production drawings.

List of Experiments:

Practical should be designed to include followings:

1. Solve problems related to Eccentric Loading; Cotter and Knuckle Joints; Design and Analysis of Levers: Cranked, Bell Crank, Foot, Rocker arm. Also prepare 3D models and detailed drawings of Cotter and Knuckle Joints.
2. Case studied for design and analyse components which can be idealized as beams and columns.
3. Design of shafts, keys and Couplings. Design of Screw jack and Toggle jack.
4. Problems for design of joints using welding, riveting and fasteners.
5. Problems related to Limits, fits and tolerances.
6. Introduction to computer aided drafting tools.
7. Using drafting software, generate Assembly and Production drawings (emphasis should be to demonstrate guidelines of IS SP 46 2003).

Design based Problems (DP)/Open Ended Problem:

1. Design / Analyse a mechanical structure which may involve different components included in syllabus. Prepare assembly and production drawings.

Major Equipment:

1. Computational facility.
2. CAD Software.

List of Open Source Software/learning website:

1. http://nptel.ac.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

INDUSTRIAL ENGINEERING (15) & MECHANICAL ENGINEERING (19)

MANUFACTURING PROCESSES -II

SUBJECT CODE: 2141908

B.E. 4th SEMESTER

Type of course: Under Graduate Level

Prerequisite: Manufacturing Processes – I**.**

Rationale:

The Manufacturing Processes-II course is to prepare students to understand different manufacturing processes like Casting, Welding, Forging, Sheet metal working, Plastic technology, Glass and Ceramic and super finishing operations with Process parameter. It also helps them to understand the advancement of Technology in manufacturing.

By educating in the area of manufacturing students will enable to seek employment in engineering upon graduation while, at the same time, provide a firm foundation for the pursuit of graduate studies in engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Manufacturing Processes:** Basic Introduction, Importance of Manufacturing, Economics and Technological Definition, Classification and Selection of Manufacturing Processes.	**02**	05
2	**Metal Casting Processes:** Patterns, Types of patterns, allowances and material used for patterns, moulding materials, moulding sands, Moulding sands; properties and sand testing: Grain fineness, moisture content, clay content and permeability test. Core materials and core making. Moulding practices: Green, dry and loam sand moulding, pit and floor moulding; shell moulding; permanent moulding; carbon dioxide moulding. Metal casting: Melting furnaces: Rotary, Pit electric, Tilting and cupola. Review of casting processes, casting design considerations, capabilities and applications of casting processes; Gating and Rising design	**12**	25

	fundamentals, casting defects.		
3	**Metal Joining Processes:** Principle of welding, soldering, Brazing and adhesive bonding. Classification of welding and allied processes. Capabilities and applications; welding parameters, general concepts of weldability, welding metallurgy and weldament design, Gas welding and gas cutting, Arc welding, Power sources and consumables, Resistance welding: Spot, Projection and seam welding process, Atomic hydrogen, ultrasonic, Plasma and laser beam welding, Electron beam welding, and special welding processes e.g. TIG, MIG, friction and explosive welding, welding of C.I. and Al. Defects of welding and remedial actions. Numerical Calculation of Different process parameters of welding.	**12**	25
4	**Metal Shaping and Forming:** Metal working, Elastic and plastic deformation, Concept of strain hardening, Hot and cold working, Rolling, Principle and operations, Roll pass sequence, Forging, Forging operations, extrusion, Wire and tube drawing processes. Forging: Method of forging, Forging hammers and presses, Principle of forging tool design, Cold working processes: Shearing, Drawing Squeezing, Blanking, Piercing, deep drawing, Coining and embossing, Metal working defects, cold heading, Riveting, Thread rolling bending and forming operation. Numerical Calculation of Different process parameters of metal shaping and forming.	**12**	25
5	**Plastic, Ceramic and Glass Processing:** Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, Transfer moulding, Injection moulding, Extrusion moulding, Blow moulding, Calendaring, Thermoforming, slush moulding, laminating. Ceramic Structure, Properties, and Applications, Shaping Ceramics, Glasses Structure, Properties, and Applications, Forming and shaping of glass, Composite materials, Processing of metal matrix and ceramic matrix composites, Processing semiconductors.	**07**	20
	Total Hours	**45**	100%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
7	21	14	14	14

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Manufacturing Engineering And Technology By S. Kalpakjian, Pearson.
2. Manufacturing Processes, Kalpakjian, Pearson
3. Degarmon's Materials and Processes in Manufacturing, 11th Ed. Black, Ronald A Kohser, Wiley India
4. Manufacturing Processes and Systems, 9th Ed. Phillip F., Ostwald, Jairo Munoz, Wiley India

5. Production technology, by R.K. Jain, Khanna publishers.
6. Production Technology by P.C. Sharma S Chand & Co Ltd.
7. Manufacturing Technology Vol. II, By P.N. Rao, Tata McGraw Hill.
8. Welding Technology, by O. P. Khanna, Dhanpat Rai publishers.

Course Outcome:

After learning the course the students should be able to:

1. The student will demonstrate the ability to think in core concept of their engineering application by studying various topics involved in branch specific applications.
2. The student will demonstrate the ability to use different processes and its process parameters to obtain qualitative solutions.
3. Students will understand the relevance and importance of the Different manufacturing techniques and real life application in industry.
4. Learn about different process parameter.

List of Experiments:

Following experiments are suggested for Laboratory work

1. Basic understanding of Different Manufacturing Processes: concepts, application, advantage and future aspects
2. Hands on Exercise on Pattern Making
3. Performance on Metal Casting of Simple component
4. Performance on Welding of simple workpiece (Example Arc and Resistance Welding)
5. Exercise Problems on Welding
6. Exercise problems on Casting
7. Exercise problems on Sheet Metal Works
8. Demonstration on Plastic, Glass and Ceramic Processing (Industrial Visit)

Important Note:

80 % From above suggested laboratory work should be covered and remaining 20 % is as per facility available at Department.

Design based Problems (DP)/Open Ended Problem:
All above performance are to be carried out in the laboratory and students will prepare experiments and note down reading and conclusion. The can prepare setup and perform on batch wise. At least 5 open ended problems are proposed for better understanding the subject and to apply real life application. The projects are listed below:

Major Equipment:

1. Different patterns for Demonstration
2. Small Foundry, Welding and Sheet Metal Working Shop
3. Sand and Mold
4. Welding Machine (Arc/Resistance, TIG, MIG etc.)
5. Small rolling machine for demonstrating rolling (if possible otherwise may arrange for industrial visit)
6. Machine for Plastic processing (if possible otherwise may arrange for industrial visit)
7. Industrial Visit for Processing glass and ceramics

List of Open Source Software/learning website:

1. **http://www.nptel.ac.in**

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