COURSES SCHEME

&

SYLLABUS

FOR

B.E.

ELECTRICAL ENGINEERING

2015

Applicable from July 2015 to electrical engineering program
ENGINEERING DEPARTMENTS –COURSE SCHEME (ELE)

COURSES SCHEME & SYLLABUS FOR B.E. (ELECTRICAL ENGINEERING)

SEMESTER – I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UMA003	MATHEMATICS-I	3	1	0	3.5
2	UTA007	COMPUTER PROGRAMMING-I	3	0	2	4.0
3	UPH004	APPLIED PHYSICS	3	1	2	4.5
4	UEE001	ELECTRICAL ENGINEERING	3	1	2	4.5
5	UHU003	PROFESSIONAL COMMUNICATION	2	0	2	3.0
6	UTA008	ENGINEERING DESIGN-I	2	4	0	4.0
		TOTAL	16	7	8	23.5

SEMESTER – II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UMA004	MATHEMATICS-II	3	1	0	3.5
2	UTA009	COMPUTER PROGRAMMING-II	3	0	2	4.0
3	UES009	MECHANICS	2	1	2*	2.5
4	UEC001	ELECTRONIC ENGINEERING	3	1	2	4.5
5	UCB008	APPLIED CHEMISTRY	3	1	2	4.5
6	UTA010	ENGINEERING DESIGN-II (Catapult and more such projects) (6 Self Effort Hours)	1	0	2	5.0
		TOTAL	15	4	8	24.0

* EACH STUDENT WILL ATTEND ONE LAB SESSION OF TWO HOURS IN A SEMESTER FOR A BRIDGE PROJECT IN THIS COURSE (MECHANICS).

SEMESTER – III

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UMA031	OPTIMIZATION TECHNIQUES	3	1	0	3.5
2	UTA002	MANUFACTURING PROCESSES	2	0	3	3.5
3	UES010	SOLIDS AND STRUCTURES	3	1	2	4.5
4	UES011	THERMO-FLUIDS	3	1	2	4.5
5	UTA011	ENGINEERING DESIGN-III (Buggy and more such projects)(with 8 self effort hours)	2	0	4	8.0
6	UEE301	DIRECT CURRENT MACHINES AND TRANSFORMERS	3	1	2	4.5
		TOTAL	16	4	13	28.5

SEMESTER – IV

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UMA007	NUMERICAL ANALYSIS	3	1	2	4.5
2	UES012	ENGINEERING MATERIALS	3	1	2	4.5
3	UHU005	HUMANITIES FOR ENGINEERS	2	0	2	3.0
4	UEN002	ENERGY AND ENVIRONMENT	3	0	0	3.0
5	UEE505	ANALOG AND DIGITAL SYSTEMS	3	1	2	4.5
6	UEE405	NETWORK THEORY AND DESIGN (Project with 7 self effort hours)	3	1	2	8.0
		TOTAL	17	4	10	27.5

* The L T P of Department Specific subjects may vary for different branches but the weekly contact hours should not exceed 32. The design projects have higher number of credits to compensate for self effort hours each student is expected to put in.

SEMESTER – V

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEE401	ALTERNATING CURRENT MACHINES	3	1	2	4.5
2	UEE403	MEASUREMENT AND TRANSDUCERS	3	0	2	4.0
3	UEE404	TRANSMISSION AND DISTRIBUTION OF POWER	3	1	0	3.5
4	UEE507	ENGINEERING ELECTROMAGNETICS	3	1	0	3.5
5	UEE504	POWER ELECTRONICS	3	1	2	4.5
6	UEI404	DIGITAL SIGNAL PROCESSING FUNDAMENTALS	3	1	0	3.5
7	UTA012	INNOVATION AND ENTREPRENEURSHIP (with 5 self effort hours)	1	0	2	4.5
		TOTAL	19	5	8	28.0

SEMESTER – VI

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEI609	FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS	3	1	2	4.5
2	UEI501	CONTROL SYSTEMS	3	1	2	4.5
3	UEE605	POWER SYSTEM ANALYSIS AND STABILITY	3	1	2	4.5
4	UEE603	SWITCHGEAR AND PROTECTION	3	0	2	4.0
5	UEE801	ELECTRIC DRIVES	3	1	2	4.5
6	UEE	ELECTIVE-I	3	0	0	3.0
7	UEE693	CAPSTONE PROJECT (START)(with 4 self effort hours)	0	0	2	0.0
		TOTAL	18	4	12	25.0

SEMESTER – VII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEE502	HIGH VOLTAGE ENGINEERING	3	0	2	4.0
2	UEE604	FLEXIBLE AC TRANSMISSION SYSTEMS	3	1	0	3.5
3	UEE702	INTELLIGENT TECHNIQUES IN ELECTRICAL ENGINEERING	3	0	2	4.0
4	UEE804	OPERATION AND CONTROL OF POWER SYSTEMS	3	1	2	4.5
5	-	ELECTIVE-II	3	1	0	3.5
6	UEE793	CAPSTONE PROJECT (COMPLETION) (with 8 self effort hours)	0	0	2	8.0
		TOTAL	15	3	8	27.5

SEMESTER – VIII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEE891	PROJECT	–	–	–	20.0
OR						
ALTERNATE PROJECT SEMESTER						
1	UEE892	DESIGN PROJECT	–	–	–	13.0
2	UEE806	ALTERNATE SOURCES OF ENERGY	3	0	2	4.0
3	UEI805	ENVIRONMENTAL INSTRUMENTATION	3	0	0	3.0
		TOTAL	6	0	2	20
OR						
1	UEE893	START- UP SEMESTER	–	–	–	20.0

ELECTIVE-I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEE631	HVDC TRANSMISSION SYSTEMS	3	0	0	3.0
2	UEE632	POWER GENERATION AND ECONOMICS	3	0	0	3.0
3	UEE633	GENERALIZED THEORY OF ELECTRICAL MACHINES	3	0	0	3.0

ELECTIVE-II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEE524	POWER QUALITY MONITORING AND CONDITIONING	3	1	0	3.5
2	UEE841	INDUSTRIAL ELECTRONICS	3	1	0	3.5
3	UEE521	ELECTRIC MACHINE DESIGN	3	1	0	3.5
4	UEE850	SMART GRID	3	1	0	3.5
5	UEI841	ADVANCED CONTROL SYSTEMS	3	1	0	3.5

TOTAL CREDITS: 204

Course Syllabi: UMA003 Mathematics - I (L : T : P :: 3 : 1 : 0)

1. **Course number and name**: UMA003 Mathematics – I

2. **Credits and contact hours**: 3.5 and 4

3. **Text book, title, author, and year**

   Text Books / Reference Books
   - *Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007), 9th ed.*
   - *Stewart James, Essential Calculus; Thomson Publishers (2007), 6th ed.*
   - *Wider David V, Advanced Calculus: Early Transcendentals, Cengage Learning (2007).*
   - *Apostol Tom M, Calculus, Vol I and II, John Wiley (2003).*

   a. Other supplemental materials
   - *Nil*

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Applications of Derivatives: Mean value theorems and their geometrical interpretation, Cartesian graphing using first and second order derivatives, Asymptotes and dominant terms, Graphing of polar curves, Applied minimum and maximum problems.
   Sequences and Series: Introduction to sequences and Infinite series, Tests for convergence/divergence, Limit comparison test, Ratio test, Root test, Cauchy integral test, Alternating series, Absolute convergence and conditional convergence.
   Series Expansions: Power series, Taylor series, Convergence of Taylor series, Error estimates, Term by term differentiation and integration.
   Partial Differentiation: Functions of several variables, Limits and continuity, Chain rule, Change of variables, Partial differentiation of implicit functions, Directional derivatives and its properties, Maxima and minima by using second order derivatives.
   Multiple Integrals: Change of order of integration, Change of variables, Applications of multiple integrals.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Apply the knowledge of calculus to plot graphs of functions and solve the problem of maxima and minima.
   - Determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and error estimation.
   - Evaluate multiple integrals and their applications to engineering problems.
   - Examine functions of several variables, define and compute partial derivatives, directional derivatives and their use in finding maxima and minima.
   - Analyze some mathematical problems encountered in engineering applications.

6. **Brief list of topics to be covered**
   - Applications of Derivatives
   - Sequences and Series
   - Series Expansions
   - Partial Differentiation

- Multiple Integrals

Course Syllabi: UTA007: Computer Programming-I (L : T : P :: 3 : 0 : 2)

1. **Course number and name**: UTA007; Computer Programming-I

2. **Credits and contact hours**: 4.0 and 5

3. **Text book, title, author, and year**

   Text Books / Reference Books
   - *"Brain W. Kernighan, Dennis M. Rithchie", The C Programming Language (2nd Edition), Prentice Hall, 1988.*
   - *"Ajay Mittal", Programming in C-A Practical Approach, Pearson, 2010.*
   - *"Reema Thareja", Computer Fundamentals and Programming in C, Oxford University Press, 2012.*
   - *"Zed. A. Shaw", Learn C the Hard Way, Pearson, 2015.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Computers Fundamentals: Classification of Computers, Application of Computers, Basic organization of computer, Input and Output Devices, Binary Number System, Computer memory, Computer Software.
   Algorithms and Programming Languages: Algorithm, Flowcharts, Pseudocode, Generation of Programming Languages.
   C Language: Structure of C Program, Life Cycle of Program from Source code to Executable, Compiling and Executing C Code, Keywords, Identifiers, Primitive Data types in C, variables, constants, input/output statements in C, Operators, type conversion and type casting. Conditional branching statements, Iterative statements, Nested loops, break and continue statements.
   Functions: Declaration, Definition, Call and return, Call by value, Call by reference, showcase stack usage with help of debugger, Scope of variables, Storage classes, Recursive functions, Recursion vs Iteration.
   Arrays, Strings and Pointers: One-dimensional, Two-dimensional and Multi-dimensional arrays, operations on array: traversal, insertion, deletion, merging and searching, Inter-function communication via arrays: passing a row, passing the entire array, matrices. Reading, writing and manipulating Strings, Understanding computer memory, accessing via pointers, pointers to arrays, dynamic allocation, drawback of pointers.
   Linear and Non-Linear Data Structures: Linked lists, Stacks and Queues.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm/pseudocode.
   - Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
   - Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of

memory by the use of pointers.

- Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

6. Brief list of topics to be covered

- Functions
- Arrays
- Strings
- Pointers

Course Syllabi: UPH004: Applied Physics (L : T : P :: 3 : 1 : 2)

1. **Course number and name**: UPH004: Applied Physics

2. **Credits and contact hours**: 4.5 and 6

3. **Text book, title, author, and year**

Text Books / Reference Books

- *Beiser, A., Concept of Modern Physics, Tata McGraw Hill (2007) 6th ed.*
- *Griffiths, D.J., Introduction to Electrodynamics, Prentice Hall of India (1999) 3rd ed.*
- *Jenkins, F.A. and White, H.E., Fundamentals of Optics, McGraw Hill (2001) 4th ed.*
- *Wehr, M.R, Richards, J.A., Adair, T.W., Physics of The Atom, Narosa Publishing House (1990) 4th ed.*
- *Verma, N.K., Physics for Engineers, Prentice Hall of India (2014)1st ed.*
- *Pedrotti, Frank L., Pedrotti, Leno S., and Pedrotti, Leno M., Introduction to Optics, Pearson Prentice Hall™ (2008) 3rd ed.*

a. Other supplemental materials
   - Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Oscillations and Waves: Oscillatory motion and damping, Applications - Electromagnetic damping – eddy current; ***Acoustics:*** Reverberation time, absorption coefficient, Sabine's and Eyring's formulae (Qualitative idea), Applications - Designing of hall for speech, concert, and opera; ***Ultrasonics:*** Production and Detection of Ultrasonic waves, Applications - green energy, sound signalling, dispersion of fog, remote sensing, Car's airbag sensor.
Electromagnetic Waves: Scalar and vector fields; Gradient, divergence, and curl; Stokes' and Green's theorems; Concept of Displacement current; Maxwell's equations; Electromagnetic wave equations in free space and conducting media, Application - skin depth.
Optics: ***Interference:*** Parallel and wedge-shape thin films, Newton rings, Applications as Non-reflecting coatings, Measurement of wavelength and refractive index. ***Diffraction:*** Single and Double slit diffraction, and Diffraction grating, Applications - Dispersive and Resolving Powers. ***Polarization:*** Production, detection, Applications – Anti-glare automobile headlights, Adjustable tint windows. ***Lasers:*** Basic concepts, Laser properties, Ruby, HeNe, and Semiconductor lasers, Applications – Optical communication and Optical alignment.
Quantum Mechanics: Wave function, Steady State Schrodinger wave equation, Expectation value, Infinite potential well, Tunnelling effect (Qualitative idea), Application - Quantum computing.

Laboratory Work:

- Determination of damping effect on oscillatory motion due to various media.
- Determination of velocity of ultrasonic waves in liquids by stationary wave method.
- Determination of wavelength of sodium light using Newton's rings method.
- Determination of dispersive power of sodium-D lines using diffraction grating.
- Determination of specific rotation of cane sugar solution.

- Study and proof of Malus' law in polarization.
- Determination of beam divergence and beam intensity of a given laser.
- Determination of displacement and conducting currents through a dielectric.
- Determination of Planck's constant

5. Specific goals for the course

After the completion of the course, the students will be able to:

- Understand damped and simple harmonic motion, the role of reverberation in designing a hall and generation and detection of ultrasonic waves.
- Use Maxwell's equations to describe propagation of EM waves in a medium.
- Demonstrate interference, diffraction and polarization of light.
- Explain the working principle of Lasers.
- Use the concept of wave function to find probability of a particle confined in a box.

6. Brief list of topics to be covered

- Oscillations and Waves
- *Ultrasonics*
- Electromagnetic Waves
- Optics, *Polarization, Lasers*
- Quantum Mechanics

Course Syllabi: UEE001: Electrical Engineering (L : T : P :: 3 : 1 : 2)

1. **Course number and name**: UEE001; Electrical Engineering

2. **Credits and contact hours**: 4.5 and 6

3. **Text book, title, author, and year**

Text Books / Reference Books

- *Hughes, E., Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, PHI (2008).*
- *Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill (2002).*
- *Naidu, M.S. and Kamashaiah, S., Introduction to Electrical Engineering, Tata McGraw Hill (2007).*
- *Chakraborti, A., Basic Electrical Engineering, Tata McGraw–Hill (2008).*
- *Del Toro, V., Electrical Engineering Fundamentals, Prentice–Hall of India Private Limited (2004)*

a. Other supplemental materials

- Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

DC Circuits: Kirchhoff's Voltage and Current Laws; Power Dissipation; Voltage Source and Current Source; Mesh and Nodal Analysis; Star-Delta Transformation; Superposition Theorem; Thevenin's Theorem; Norton's Theorem; Maximum Power Transfer Theorem; Millman's Theorem and Reciprocity Theorem; Transient Response of Series RL and RC Circuits.

Steady state analysis of DC Circuits: The Ideal Capacitor, Permittivity; The Multi-Plate Capacitor, Variable Capacitor; Capacitor Charging and Discharging, Current-Voltage Relationship, Time-Constant, Rise-Time, Fall-Time; Inductor Energisation and De-Energisation, Inductance Current-Voltage Relationship, Time-Constant; Transient Response of RL, RC and RLC Circuits.

AC Circuits: Sinusoidal sources, RC, RL and RLC circuits, Concept of Phasors, Phasor representation of circuit elements, Complex notation representation, Single phase AC Series and parallel circuits, Power dissipation in AC circuits, Power factor correction, Resonance in Series and Parallel circuits, Balanced and unbalanced 3-phase circuit - voltage, current and power relations, 3-phase power measurement, Comparison of single phase and three phase supply systems.

Electromagnetism: Electromagnetic induction, Dot convention, Equivalent inductance, Analysis of Magnetic circuits, AC excitation of magnetic circuit, Iron losses, Fringing and stacking applications: solenoids and relays.

Single Phase Transformers: Constructional features of transformer, operating principle and applications, equivalent circuit, phasor analysis and calculation of performance indices.

Motors and Generators: DC motor operating principle, construction, energy transfer, speed-torque relationship, conversion efficiency, applications, DC generator operating principle, reversal of energy transfer, emf and speed relationship, applications.

Laboratory Work: Network laws and theorems, Measurement of R,L,C parameters, A.C. series and parallel circuits, Measurement of power in 3 phase circuits, Reactance calculation of variable reactance choke coil, Open circuit and Short circuit tests on single phase transformer, Starting of rotating machines.

5. Specific goals for the course

After the completion of the course, the students will be able to:

- Apply networks laws and theorems to solve electric circuits.
- Analyze transient and steady state response of DC circuits.
- Signify AC quantities through phasor and compute AC system behaviour during steady state.
- Explain and analyse the behaviour of transformer.
- Elucidate the principle and characteristics of DC motor and DC generator**.**

6. Brief list of topics to be covered

- DC Network
- DC Tansients
- AC Circuits
- Electromagnetism
- Single Phase Transformers
- DC Motors and Generators

Course Syllabi: UHU003: Professional Communication (L : T : P :: 2 : 0 : 2)

1. **Course number and name**: UHU003: Professional Communication

2. **Credits and contact hours**: 3.0 and 4

3. **Text book, title, author, and year**

Text Books / Reference Books

- *Lesikar R.V and Flately M.E., Basic Business Communication Skills for the Empowering the Internet Generation. Tata McGraw Hill. New Delhi (2006).*
- *Raman,M& Sharma, S.,Technical Communication Principles and Practice, Oxford University Press New Delhi.(2011).*
- *Mukherjee H.S.,Business Communication-Connecting at Work,Oxford University Press New Delhi, (2013).*
- *Butterfield, Jeff.,Soft Skills for everyone,Cengage Learning New Delhi,(2013).*
- *Robbins, S.P., &Hunsaker, P.L.,Training in Interpersonal Skills,Prentice Hall of India New Delhi,(2008).*
- *DiSianza,J.J&Legge,N.J.,Business and PrfofessionalCommunication,Pearson Education India New Delhi,(2009).*

a. Other supplemental materials
   - Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Effective Communication: Meaning, Barriers, Types of Communication and Essentials Interpersonal Communication Skills.

Effective Spoken Communication: Understanding essentials of spoken communication, Public speaking, Discussion techniques, Presentation strategies.

Effective Professional and Technical writing: Paragraph development, Forms of writing, Abstraction and Summarization of a text; Technicalities of letter writing, internal and external organizational communication. Technical reports, proposals and papers.

Effective Non-verbal communication: Knowledge and adoption of the right non-verbal cues of body language, interpretation of the body language in professional context. Understanding Proxemics and other forms of Non-verbal communication.

Communicating for Employment: Designing Effective Job application letter and resumes; Success strategies for Group discussions and Interviews.

Communication Networks in organizations: Types, barriers and overcoming the barriers.

Laboratory Work:

- Needs-assessment of spoken and written communication and feedback.
- Training for Group Discussions through simulations and role plays.
- Training for effective presentations.
- Project based team presentations.
- Proposals and papers-review and suggestions.

Minor Project (if any):

Team projects on technical report writing and presentations.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Understand and appreciate the need of communication training.
   - Use different strategies of effective communication.
   - Select the most appropriate mode of communication for a given situation.
   - Speak assertively and effectively.
   - Correspond effectively through different modes of written communication.
   - Write effective reports, proposals and papers.
   - Present himself/ herself professionally through effective resumes and interviews.

6. **Brief list of topics to be covered**

   - Effective Communication
   - Effective Spoken Communication
   - Effective Professional and Technical Writing
   - Effective Non-Verbal Communication
   - Communicating for Employment
   - Communication Networks in Organizations

Course Syllabi: UTA008: Engineering Design-I (L : T : P :: 2 : 4 : 0)

1. **Course number and name**: UTA008; Engineering Design-I

2. **Credits and contact hours**: 4.0 and 6

3. **Text book, title, author, and year**

   Text Books / Reference Books

   - *Jolhe, D.A., Engineering Drawing, Tata McGraw Hill, 2008*
     Davies, B. L., Yarwood, A., Engineering Drawing and Computer Graphics, Van Nostrand Reinhold *(UK), 1986*
   - *Gill, P.S., Geometrical Drawings, S.K. Kataria & Sons, Delhi (2008).*
   - *Gill, P.S., Machine Drawings, S.K. Kataria & Sons, Delhi (2013).*
   - *Mohan, K.R., Engineering Graphics, Dhanpat Rai Publishing Company (P) Ltd, Delhi (2002).*
   - *French, T. E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company, New Delhi (1986).*
     Rowan, J. and Sidwell , E. H., Graphics for Engineers, Edward Arnold, London (1968).

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Engineering Drawing

   1. Introduction
   2. Orthographic Projection: First angle and third angle projection system
   3. Isometric Projections
   4. Auxiliary Projections
   5. Perspective Projections
   6. Introduction to Mechanical Drawing
   7. Sketching Engineering Objects
   8. Sections, Dimensions and Tolerances

   AutoCAD

   1. Management of screen menus commands
   2. Introduction to drawing entities
   3. Co-ordinate systems: Cartesian, polar and relative coordinates
   4. Drawing limits, units of measurement and scale
   5. Layering: organizing and maintaining the integrity of drawings
   6. Design of prototype drawings as templates.
   7. Editing/modifying drawing entities: selection of objects, object snap modes, editing commands,
   8. Dimensioning: use of annotations, dimension types, properties and placement, adding text to drawing

   Micro Projects /Assignments:

   1. Completing the views - Identification and drawing of missing lines in the projection of objects

2. Missing Views – using two views to draw the projection of the object in the third view, primarily restricting to Elevation, Plan and Profile views
3. Projects related to orthographic and isometric projections
    a. Using wax blocks or soap bars to develop three dimensional object from given orthographic projections
    b. Using wax blocks or soap bars to develop three dimensional object, section it and color the section
    c. Use of AUTOCAD as a complementary tool for drawing the projections of the objects created in (1) and (2).
4. Develop the lateral surface of different objects involving individual or a combination of solids like Prism, Cone, Pyramid, Cylinder, Sphere etc.
5. To draw the detailed and assembly drawings of simple engineering objects/systems with due sectioning (where ever required) along with bill of materials.
   e.g. Rivet joints, simple bearing, wooden joints, Two plates connected with nut and bolt etc.

5. Specific goals for the course

After the completion of the course, the students will be able to:

- Creatively comprehend geometrical details of common engineering objects.
- Draw dimensioned orthographic and isometric projections of simple engineering objects.
- Interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism.
- Create the engineering drawings for simple engineering objects using autocad.
- Manage screen menus and commands using autocad.
- Operate data entry modes and define drawings geometrically in terms of cartesian, polar and relative coordinates in autocad.
- Create and edit drawings making selections of objects, discriminating by layering and using entities, object snap modes, editing commands, angles and displacements using autocad.

6. Brief list of topics to be covered

- Orthographic Projection: First angle and third angle projection system
- Isometric Projections
- Auxiliary Projections
- Perspective Projections

Course Syllabi: UMA004 Mathematics - II (L : T : P :: 3 : 1 : 0)

1. **Course number and name**: UMA004 Mathematics - II

2. **Credits and contact hours**: 3.5 and 4

3. **Text book, title, author, and year**

   Text Books / Reference Books

   - *Simmons, G.F., Differential Equations (With Applications and Historical Notes), Tata McGraw Hill (2009).*
   - *Krishnamurthy, V.K., Mainra, V.P. and Arora, J.L., An introduction to Linear Algebra, Affiliated East West Press (1976).*
   - *Kreyszig Erwin, Advanced Engineering Mathematics, John Wiley (2006), 8^{th} ed.*
   - *Jain, R.K. and Iyenger, S.R.K , Advanced Engineering Mathematics, Narosa Publishing House(2011), 11^{th} ed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Linear Algebra: Row reduced echelon form, Solution of system of linear equations, Matrix inversion, Linear spaces, Subspaces, Basis and dimension, Linear transformation and its matrix representation, Eigen-values, Eigen-vectors and Diagonalisation, Inner product spaces and Gram-Schmidt orthogonalisation process.

   Ordinary Differential Equations: Review of first order differential equations, Exact differential equations, Second and higher order differential equations, Solution techniques using one known solution, Cauchy - Euler equation, Method of undetermined coefficients, Variation of parameters method, Engineering applications of differential equations.

   Laplace Transform: Definition and existence of Laplace transforms and its inverse, Properties of the Laplace transforms, Unit step function, Impulse function, Applications to solve initial and boundary value problems.

   Fourier Series: Introduction, Fourier series on arbitrary intervals, Half range expansions, Applications of Fourier series to solve wave equation and heat equation

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Solve the differential equations of first and second order and basic application problems described by these equations.
   - Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.
   - Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.
   - Solve systems of linear equations by using elementary row operations.
   - Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the eigen values and eigen vectors.

6. **Brief list of topics to be covered**
    - Linear Algebra
    - Ordinary Differential Equations
    - Laplace Transform
    - Fourier Series

Course Syllabi: UTA009 Computer Programming - II (L : T : P :: 3 : 0 : 2)

1. **Course number and name**: UTA009 Computer Programming- II

2. **Credits and contact hours**: 4.0 and 5

3. **Text book, title, author, and year**

   Text Books / Reference Books
   - *"Balaguruswamy", Object Oriented Programming with C++ 6th Edition, Tata Mcgraw Hill, 2013.*
   - *"Bruce Eckel", Thinking in C++, Prentice-Hall of India Pvt. Ltd, 2000.*
   - *"Joyce Farrell", Object Oriented Programming Using C++ 4th Edition, Cengage Learning, 2013.*
   - *https://msdn.microsoft.com/en-s/library/windows/desktop/ff381399(v=vs.85).aspx*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Object Oriented Programming with C++: Class declaration, creating objects, accessing objects members, nested member functions, memory allocation for class, objects, static data members and functions. Array of objects, dynamic memory allocation, this pointer, nested classes, friend functions, constructors and destructors, constructor overloading, copy constructors, operator overloading and type conversions.
   Inheritance and Polymorphism: Single inheritance, multi-level inheritance, multiple inheritance, runtime polymorphism, virtual constructors and destructors.
   File handling: Stream in C++, Files modes, File pointer and manipulators, type of files, accepting command line arguments.
   Templates and Exception Handling: Use of templates, function templates, class templates, handling exceptions.
   Introduction to Windows Programming in C++: Writing program for Windows, using COM in Windows Program, Windows Graphics, User Input
   Laboratory work: to implement Programs for various kinds of programming constructs in C++ Language.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Write, compile and debug programs in C++, use different data types, operators and I/O function in a computer program.
   - Comprehend the concepts of classes, objects and apply basics of object oriented programming, polymorphism and inheritance.
   - Demonstrate use of file handling.
   - Demonstrate use of templates and exception handling.
   - Demonstrate use of windows programming concepts using C++.

6. **Brief list of topics to be covered**
   - Class

- Object
- Inheritance
- Polymorphism
- File handling
- Exception handling

Course Syllabi: UES009 Mechanics (L : T : P :: 2 : 1 : 0)

1. **Course number and name**: UES009 Mechanics

2. **Credits and contact hours**: 2.5 and 3

3. **Text book, title, author, and year**

   Text Books / Reference Books
   - *Shames, I. H. Engineering Mechanics: Dynamics, Pearson Education India (2002).*
   - *Beer, Johnston, Clausen and Staab, Vector Mechanics for Engineers, Dynamics, McGraw-Hill Higher Education (2003).*
   - *Hibler, T.A., Engineering Mechanics: Statics and Dynamics, Prentice Hall (2012).*
   - *Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill Education Private Limited (2000).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Review of Newton's law of motion and vector algebra
   Equilibrium of bodies: Free-body diagrams, conditions of equilibrium, torque due to a force, statical determinacy.
   Plane trusses*:* Forces in members of a truss by method of joints and method of sections.
   Friction: Sliding, belt, screw and rolling.
   Properties of plane surfaces: First moment of area, centroid, second moment of area etc.
   Virtual work: Principle of virtual work, calculation of virtual displacement and virtual work.
   Work and energy: Work and energy, work-energy theorem, principle of conservation of energy, collisions, principles of momentum etc.
   Dynamics of Rigid Bodies: Newton's Laws, D'Alembert's Principle, Energy Principles.
   Experimental project assignment/ Micro project: Students in groups of 4/5 will do project on
   Model Bridge Experiment: This will involve construction of a model bridge using steel wire and wood.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Determine resultants in plane force systems.
   - Identify and quantify all forces associated with a static framework.
   - Solve problems in kinematic and dynamic systems.

6. **Brief list of topics to be covered**
   - Plane trusses
   - Friction
   - Virtual work
   - Work and energy

- Dynamics of rigid bodies

Course Syllabi: UEC001 Electronic Engineering (L : T : P :: 3 : 1 : 2)

1. **Course number and name**: UEC001 Electronic Engineering

2. **Credits and contact hours**: 4.5 and 6

3. **Text book, title, author, and year**

Text Books / Reference Books

- *M. M. Mano and M.D. Ciletti, Digital Design, Pearson, Prentice Hall, 2013.*
- *Milliman, J. and Halkias, C.C., Electronic Devices and Circuits, Tata McGraw Hill, 2007.*
- *Donald D Givone, Digital Principles and Design, McGraw-Hill, 2003.*
- *John F Wakerly, Digital Design: Principles and Practices, Pearson, (2000).*
- *N Storey, Electronics: a Systems Approach, Pearson, Prentice Hall, (2009).*
- *Boylestad, R.L. and Nashelsky, L., Electronic Devices & Circuit Theory, Perason (2009).*
- *M. M. Mano and M.D. Ciletti, Digital Design, Pearson, Prentice Hall, 2013.*
- *Milliman, J. and Halkias, C.C., Electronic Devices and Circuits, Tata McGraw Hill, 2007.*
- *Donald D Givone, Digital Principles and Design, McGraw-Hill, 2003.*
- *John F Wakerly, Digital Design: Principles and Practices, Pearson, (2000).*
- *N Storey, Electronics: a Systems Approach, Pearson, Prentice Hall, (2009).*
    1. *Boylestad, R.L. and Nashelsky, L., Electronic Devices & Circuit Theory, Perason (2009).*

a. Other supplemental materials
   - Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Semiconductor Devices: P-N junction diode: Ideal diode, V-I characteristics of diode, Diode small signal model, Diode switching characteristics, Zener diode

Electronics Devices and Circuits: P-N Diode as a rectifier, Clipper and clamper, Operation of Bipolar Junction Transistor and Transistor Biasing, CB, CE, CC (Relationship between α, β, γ) circuit configuration Input-output characteristics, Equivalent circuit of ideal and real amplifiers, Low frequency response of amplifiers, Introduction to Field Effect Transistor and its characteristics

Operational Amplifier Circuits: The ideal operational amplifier, the inverting, non-inverting amplifiers, Op-Amp Characteristics, Frequency response of op-amp, Application of op-amp

Digital Systems and Binary Numbers: Introduction to Digital signals and systems, Number systems, Positive and negative representation of numbers, Binary arithmetic, Definitions and basic theorems of boolean Algebra**,** Algebraic simplification, Sum of products and product of sums formulations (SOP and POS), Gate primitives, AND, OR, NOT and Universal Gate, Minimization of logic functions, Karnaugh maps.

Combinational and Sequential Logic: Code converters, multiplexors, decoders, Addition circuits and priority encoder,Master-slave and edge-triggered flip-flops,Synchronous and Asynchronous counters, Registers

Logic families: N and P channel MOS transistors, CMOS inverter, NAND and NOR gates, General CMOS Logic, TTL and CMOS logic families, and their interfacing.

Laboratory Work:

Familiarization of CRO and Electronic Components, Diodes characteristics Input-Output and Switching characteristics, BJT and MOSFET Characteristics, Zener diode as voltage regulator, Transistorized Series voltage regulator. Half and Full wave Rectifiers with and without filter circuit, Half and full adder circuit implementation, Decoder, DMUX and MUX, Binary/BCD up/down counters.

5. **Specific goals for the course**

After the completion of the course, the students will be able to

- Demonstrate the use of semiconductor diodes in various applications.
- Discuss and explain the working of transistors and Operational Amplifiers, their configurations and applications.
- Recognize and apply the number systems and Boolean Algebra.
- Reduce Boolean Expressions and implement them with Logic Gates.
- Analyze, design and Implement combinational and sequential circuits.
- Analyze and differentiate logic families, TTL and CMOS.

6. **Brief list of topics to be covered**

- Semiconductor devices
- Transistor
- FET
- Op-amp
- Digital circuits
- Sequential circuits

Course Syllabi: UCB008: Applied Chemistry (L : T : P :: 3 : 1 : 2)

1. **Course number and name**: UCB008: Applied Chemistry

2. **Credits and contact hours**: 4.5 and 6

3. **Text book, title, author, and year**

Text Books / Reference Books

- *Ramesh, S. and Vairam S. Engineering Chemistry, Wiley India (2012) 1st ed.*
- *Jain, P.C. and Jain, M. Engineering Chemistry, DhanpatRai Publishing Co. (2005) 15th ed.*
- *Puri, B.R., Sharma and L.R., Pathania, M.S. Principles of Physical Chemistry, Vishal Publishing Co. (2008).*
- *Brown, Holme, Chemistry for engineering students, Thompson, 1st ed.*
- *Shulz, M.J. Engineering Chemistry, Cengage Learnings, (2007) 1st ed.*

a. *Other supplemental materials*

- *Nil*

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Atomic Structure and Bonding: Chemical change; elements, compounds and mixtures, Atomic structure, dual nature of electron, concept of atomic orbitals, Pauli`s Exclusion principle, Concept of chemical bonding: covalent, ionic, metallic, hydrogen bond, Vander Waal`s, Hybridization and shapes of molecule, electronic structure and periodic table.

Chemical Equilibrium: Law of mass action, Factors that influence the position of equilibrium. Ionic equilibria: ionic equilibria in aqueous solutions; strong and weak acids and bases; buffer solution and indicators.

Electrochemistry: Migration of ions, Transference number, Specific, Equivalent and Molar Conductivity of electrolytic solutions, Conductometric titrations, Electrode potential and types of electrodes, Introduction to galvanic and concentration cells, Liquid junction potential.

Colligative Properties of Dilute Solutions: Depression of freezing point and elevation of boiling point.

Phase Rule: States of matter, Phase, Component and Degree of freedom, Gibbs phase rule, One component and two component systems.

Water Treatment and Analysis: Hardness and alkalinity of water: Units and determination, External and internal method of Softening of water: Lime-soda Process, Ion exchange process, Desalination of brackish water.

Fuels: Classification of fuels, Calorific value, Cetane and Octane number, fuel quality, Comparison of solid liquid and gaseous fuel, properties of fuel, alternative fuels: Biofuels, Power alcohol, Synthetic petrol.

Application of Atomic and Molecular Spectroscopic Methods: Structure determination of certain model compounds of industrial importance.

Assignments based on working and applications of advanced instruments will be given in the tutorial class.

Laboratory Work

Electrochemical measurements: Experiments involving use of pH meter, conductivity meter, potentiometer.

Acid and Bases: Determination of mixture of bases

Spectroscopic techniques: Colorimeter, UV-Vis spectrophotometer.
Kinetics: Kinetics of oxidation of iodine ion by peroxydisulphate ion.
Thermochemistry: Cloud point and pour point determination
Water and its treatment: Determination of hardness, alkalinity, chloride, chromium, iron and copper in aqueous medium.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Analyse trends in periodic table with electronic and atomic structure.
- Interpret phase diagrams of pure and binary substances.
- Demonstrate the working of electrodes and their applications.
- Calculate various parameters defining water and fuel quality.
- Identify the various functional groups through IR spectra.
- Carry out basic experimental procedure and to emphasize need for safety and safety procedure in laboratory.

6. **Brief list of topics to be covered**

- Atomic Structure and Bonding
- Chemical Equilibrium
- Electrochemistry
- Colligative Properties of Dilute Solutions
- Phase Rule
- Water Treatment and Analysis
- Fuels

Course Syllabi: UTA010 Engineering Design-II (L : T : P :: 1 : 0 : 2)

1. **Course number and name**: UTA0101 Engineering Design-II

2. **Credits and contact hours**: 3 and 5.0

3. **Text book, title, author, and year**

   Text Books / Reference Books
   - *Michael McRoberts, Beginning Arduino, Technology in action publications.*
   - *Alan G. Smith, Introduction to Arduino: a piece of cake, CreateSpace Independent Publishing Platform (2011)*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

Breakup of lecture details to be taken up by MED:

Lec No.	Topic	Contents
Lec 1	Introduction	The Mangonel Project History.
Lec 2	CDIO	Conceive Design Implement and Operate.
Lec 3	Manufacturing	Manufacturing and assembling the Mangonel.
Lec 4		
Lec 5	Materials	How to choose the right material
Lec 6	Modelling	The role of modelling in Engineering Design
Lec 7	Structures	Why things fail?
Lec 8	Dynamics	Dynamics of the Mangonel
Lec 9	Structures	Designing against structural failure
Lec 10	Kinematics/Software Modelling	Simulation as an Analysis Tool in Engineering Design

Breakup of lecture details to be taken up by ECED:

Lec No.	Topic	Contents
Lec 11-15	Digital Electronics	Prototype, Architecture, Using the Integrated Development Environment (IDE) to Prepare an Arduino Sketch, Structuring an Arduino Program, Using Simple Primitive Types (Variables), Simple programming examples. Definition of a sensor and actuator.

Laboratory Work:
Associated Laboratory/Project Programme:

Laboratory Title	Code
Dynamics of Mangonel - No Drag	L1

Dynamics of Mangonel - with Drag	L2
Design against failure under static actions	L3
Design against failure under dynamic actions	L4
Simulation	L5
Manufacturing components of the Mangonel	L6
Manufacturing components of the Mangonel	L7
Manufacturing components of the Mangonel	L8
Manufacturing components of the Mangonel	L9
Assembly of Mangonel	L10
Spring Test of Mangonel	L11
Distance Test of Mangonel	L12
Speed Test of Mangonel	L13
Mangonel redesign for competition	L14
Competition	L15

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Model trajectories of masses with and without aerodynamic drag.
   - Develop a software tool to allow trajectories be optimized.
   - Analyse the static and dynamic stresses of elements of an engineering mechanism.
   - Optimally design structural elements of an engineering mechanism.
   - Perform a test to acquire an engineering material property.
   - Develop and test software code to process sensor data.
   - Design and construct and test an electronic hardware solution to process sensor data.
   - Construct a roman catapult “mangonel” using tools, materials and assembly instructions.
   - Operate and evaluate the “mangonel” for functional and structural performance.
   - Validate theoretical models by comparison with experiments.
   - Integrate skills to innovatively redesign an element of the “mangonel”.
   - Participate and cooperate in a team.

Course Syllabi: UMA031: Optimization Techniques (L : T : P :: 3 : 1 : 0)

1. Course number and name: UMA031 Optimization Techniques

2. Credits and contact hours: 3.5 and 4

3. Text book, title, author, and year

Text Books / Reference Books

- *Chandra, S., Jayadeva, Mehra, A., Numerical Optimization and Applications, Narosa Publishing House, (2013).*
- *Taha H.A., Operations Research-An Introduction, PHI (2007).*
- *Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)*
- *Bazaarra Mokhtar S., Jarvis John J. and Shirali Hanif D., Linear Programming and Network flows, John Wiley and Sons (1990)*
- *Swarup, K., Gupta, P. K., Mammohan, Operations Research, Sultan Chand & Sons, (2010).*

a. Other supplemental materials

- Nil

4. Specific course information

a. Brief description of the content of the course (catalog description)

Scope of Operations Research: Introduction to linear and non-linear programming formulation of different models.

Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Duality theory, Dual simplex method, Sensitivity analysis.

Integer Programming: Branch and bound technique.

Transportation and Assignment Problem: Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions.

Project Management: Construction of networks, Network computations, Floats (free floats and total floats), Critical path method (CPM), Crashing.

Game Theory: Two person zero-sum game, Game with mixed strategies, Graphical method and solution by linear programming.

5. Specific goals for the course

After completion of this course, the students will be able to:

- Formulate and solve linear programming problems.
- Solve the transportation and assignment problems
- Solve the project management problems using cpm.
- Solve two person zero-sum games.

6. Brief list of topics to be covered

- Scope of Operations Research
- Linear Programming
- Integer Programming
- Transportation and Assignment Problem
- Project Management
- Game Theory

Course Syllabi: UTA002: Manufacturing Processes (L : T : P :: 2 : 0 : 3)

1. Course number and name: UTA002 Manufacturing Processes

2. Credits and contact hours: 3.5 and 5

3. Text book, title, author, and year

Text Books / Reference Books

- *Chandra, S., Jayadeva, Mehra, A., Numerical Optimization and Applications, Narosa Publishing House, (2013).*
- *Taha H.A., Operations Research-An Introduction, PHI (2007).*
- *Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)*
- *BazaarraMokhtar S., Jarvis John J. and ShiraliHanif D., Linear Programming and Network flows, John Wiley and Sons (1990)*
- *Swarup, K., Gupta, P. K., Mammohan, Operations Research, Sultan Chand & Sons, (2010).*

a. Other supplemental materials
   - Nil

4. Specific course information

a. Brief description of the content of the course (catalog description)

Machining Processes: Principles of metal cutting, Cutting tools, Cutting tool materials and applications, Geometry of single point cutting tool, Introduction to multi-point machining processes – milling, drilling and grinding, Tool Life, Introduction to computerized numerical control (CNC) machines, G and M code programming for simple turning and milling operations, introduction of canned cycles.

Metal Casting: Principles of metal casting, Introduction to sand casting, Requisites of a sound casting, Permanent mold casting processes.

Metal Forming: Forging, Rolling, Drawing, Extrusion, Sheet Metal operations.

Joining Processes: Electric arc, Resistance welding, Soldering, Brazing.

Laboratory Work:

Relevant shop floor exercises involving practices in Sand casting, Machining, Welding, Sheet metal fabrication techniques, CNC turning and milling exercises, Experiments on basic engineering metrology and measurements to include measurements for circularity, ovality, linear dimensions, profiles, radius, angular measurements, measurement of threads, surface roughness.

Basic knowledge and derivations related to above measurements, uncertainties, statistical approaches to estimate uncertainties, Line fitting, static and dynamic characteristics of instruments will be discussed in laboratory classes.

5. Specific goals for the course

After the completion of this module, students will be able to:

- Develop simple CNC code, and use it to produce components while working in groups.
- Analyse various machining processes and calculate relevant quantities such as velocities, forces.
- Recognise cutting tool wear and identify possible causes and solutions.
- Understand the basic principle of bulk and sheet metal forming operations for analysis of forces.
- Analyse various shearing operations for tooling design.
- Apply the knowledge of metal casting for different requirements.
- Analyse and understand the requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials.

6. Brief list of topics to be covered

- Machining process
- Metal casting
- Metal forming

Course Syllabi: UES010 : Solids and Structures (L : T : P :: 3 : 1 : 2)

1. Course number and name: UES010 Solids and Structures

2. Credits and contact hours: 4.5 and 6

3. Text book, title, author, and year

Text Books / Reference Books

- *Popov, E.P. and Balan, T.A., Engineering Mechanics of Solids, Prentice Hall of India (2012).*
- *Singh, D.K., Mechanics of Solids, Pearson Education (2008).*
- *Shames, I. H. and Pitarresi, J. M., Solid Mechanics, Prentice Hall of India (1996).*
- *Crandall, S.H., Dahl, N.C. and Lardner, T.J., An Introduction to Mechanics of Solids, McGraw Hill International, Tokyo(1969).*

a. Other supplemental materials
   - Nil

4. Specific course information

a. Brief description of the content of the course (catalog description)

Elastic Plastic Behavior

Axial Stress and Strain: Concept of stress, strain, elasticity and plasticity; one-dimensional stress-strain relationships; Young's modulus of elasticity, shear modulus and Poisson's ratio; two-dimensional elasticity; isotropic and homogeneous materials; ductile and brittle materials; statically determinate and indeterminate problems, compound and composite bars; thermal stresses. Torsion of shafts; buckling of struts, concept of factor of safety.

Shear Force and Bending Moment Diagrams: Types of load on beams, classification of beams; axial, shear force and bending moment diagrams: simply supported, overhung and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, equation of condition, load function equation, qualitative analysis for two-dimensional frames.

Bending & Shear Stresses in beams: Derivation of flexural formula for straight beams, concept of second moment of area, bending stress calculation for beams of simple and built up sections, Flitched beams. Shear stress formula for beams, shear stress distribution in beams

Transformation of Stress and Strain: Transformation equations for plane stress and plane strain, Mohr's stress circle, relation between elastic constants, strain measurements, strain rosettes.

Deformations: Governing differential equation for deflection of straight beams having constant flexural rigidity, double integration and Macaulay's methods for slopes and deflection, unit load method for deflection of trusses

Laboratory Work

Experimental Project Assignment: Students in groups of 4/5 will do projects:

1. Calculation of tensile strength using UTM.
2. Buckling of struts.
3. Experimental verification of Theory of bending (calculation of bending stress and deflections at various points in the beam theoretically and verifying the same experimentally) and indirect evaluation of the modulus of elasticity.

4. Torsion: Study the behavior of circular shafts under torsion and analysis of failure and indirect evaluation of the modulus of rigidity.

Micro Project:
Model Bridge Experiment: This will involve construction of a model bridge using steel wire and wood.

5. **Specific goals for the course**
After completion of this course, the students will be able to:
   - Evaluate axial stresses and strains in various determinate and indeterminate structural systems.
   - Draw Shear Force Diagram and Bending Moment Diagram in various kinds of beams subjected to different kinds of loads.
   - Calculate load carrying capacity of columns and struts and their buckling strength.
   - Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
   - Determine deformations and deflections in various kinds of beams and trusses.

6. **Brief list of topics to be covered**
   - Axial stress and strain
   - Shear force
   - Bending moment
   - Bending and shear stress in beams

Course Syllabi: UES011 : Thermo Fluids (L : T : P :: 3 : 1 : 2)

1. Course number and name: UES011 Thermo Fluids

2. Credits and contact hours: 4.5 and 6

3. Text book, title, author, and year

Text Books / Reference Books

- *Kumar, D. S, Fluid Mechanics and Fluid Power Engineering, S. K. Kataria (2009)*
- *Cengel and Boles, Thermodynamics: an Engineering Approach, McGraw-Hill (2011)*
- *Jain, A. K. , Fluid Mechanics: including Hydraulic Machines, Khanna Publishers (2003)*
- *Rao, Y.V. C, An Introduction to Thermodynamics, Universities Press (2004)*

a. Other supplemental materials
   - Nil

4. Specific course information

a. Brief description of the content of the course (catalog description)

Fluid Mechanics

Introduction: Definition of a fluid and its properties

Hydrostatics: Measurement of pressure, thrust on submerged surfaces

Principles of Fluid Motion: Description of fluid flow; continuity equation; Euler and Bernoulli equations; Pitot total head and static tubes, venturi-meter, orifice-meter, rotameter; Momentum equation and its applications

Pipe Flow: Fully developed flow; laminar pipe flow; turbulent pipe flow, major and minor losses; Hydraulic gradient line (HGL) and total energy line (TEL)

Boundary Layer: Boundary layer profile; displacement, momentum and energy thickness

Thermodynamics

Introduction: Properties of matter, the state postulate, energy, processes and thermodynamic systems;

Properties of Pure Substances: property tables, property diagrams, phase change, equations of state (ideal gas);

Energy: Energy transfer by heat, work and mass;

First Law of Thermodynamics: Closed system, open system, steady-flow engineering devices;

Second Law of Thermodynamics: Statements of the Second Law, heat engines, refrigeration devices, reversible versus irreversible processes, the Carnot cycle.

Laboratory/Project programme

List of Experiments

1. Verification of Bernoulli's theorem
2. Determination of hydrostatic force and its location on a vertically immersed surface
3. Determination of friction factor for pipes of different materials
4. Determination of loss coefficients for various pipe fittings
5. Verification of momentum equation
6. Visualization of laminar and turbulent flow, and rotameter

7. Calibration of a venturi-meter
8. Boundary layer over a flat plate

Sample List of Micro-Projects

Students in a group of 4/5 members will be assigned a micro project.

1. Design a physical system to demonstrate the applicability of Bernoulli's equation
2. Determine the pressure distribution around the airfoil body with the help of wind tunnel.
3. Demonstrate the first law of thermodynamics for an open system, for example: a ordinary hair dryer.
4. Develop a computer program for solving pipe flow network.

5. Specific goals for the course

After the completion of this course, the students will be able to:

- Analyze and solve problems of simple fluid based engineering systems including pressures and forces on submerged surfaces .
- Analyze fluid flow problems with the application of the mass, momentum and energy equations.
- Evaluate practical problems associated with pipe flow systems.
- Conceptualize and describe practical flow systems such as boundary layers and their importance in engineering analysis.
- Estimate fluid properties and solve basic problems using property tables, property diagrams and equations of state.
- Analyze and solve problems related to closed systems and steady-flow devices by applying the conservation of energy principle.
- Analyze the second law of thermodynamics for various systems and to evaluate the performance of heat engines, refrigerators and heat pumps.

6. Brief list of topics to be covered

- Hydrostatics
- Pipe flow
- Fluid mechanics
- Thermostatics