

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****II Year B.Tech. AE. I Sem**

L	T/P/D	C
4	1/-	4

**(53001) MATHEMATICS – II****UNIT – I: Linear Systems**

Matrices: Elementary row transformations – Rank – Normal form - Echelon form) - Consistency – Solution of system of simultaneous linear homogeneous and non-homogeneous equations.

**UNIT – II : Eigen values & Eigen vectors**

Eigen Values, Eigen vectors - properties – Cayley-Hamilton Theorem - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonalization of matrix. Calculation of powers of matrix – Modal and spectral matrices.

**UNIT-III: Linear Transformations**

Real matrices -Symmetric, skew - symmetric, orthogonal, Linear Transformation - Orthogonal Transformation. Complex matrices: Hermitian, Skew-Hermitian and Unitary – Eigen values and Eigen vectors of complex matrices and their properties.

**UNIT –IV: Quadratic forms**

Quadratic Forms - Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - index - signature - Sylvester law, Applications of quadratic forms.

**UNIT-V : Fourier Series**

Fourier Series: Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

**UNIT –VI : Introduction to partial differential equations**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations.

**UNIT –VII: Solution of partial differential equations**

Classification of second order linear Partial Differential Equations, separation of variables methods for the solutions of one dimensional heat equation,

wave equation and two-dimensional Laplace's equation under initial and boundary conditions.

**UNIT-VIII: Fourier transforms**

Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

**TEXT BOOKS:**

1. Engineering Mathematics – II by P.B. Bhaskara Rao, S.K.V.S. Rama Chary, M.Bhujanga Rao, B.S. Publications.
2. Engineering Mathematics – II by G.Shankar Rao & Others, I.K. International Publications.

**REFERENCES:**

1. Engineering Mathematics – II by T.K.V. Iyengar, B.Krishna Gandhi & Others, S.Chand.
2. Higher Engineering Mathematics by B.S.Grewal, Khanna Publications.
3. Engineering Mathematics – II by Engineering Mathematics – II by C. Shankaraiah, Vijaya Publications.
4. Advanced Engineering Mathematics by Jain and S.R.K. Iyengar, Narasa Publications.
5. Engineering Mathematics – II by Dr. A. Anjaneyulu & others, Deepti Publications.

[www.engineershup.in](http://www.engineershup.in)

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## (53017) THERMODYNAMICS

## UNIT-I

**Introduction: Basic Concepts :** System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function.

## UNIT II

[www.engineershut.in](http://www.engineershut.in)

Zeroth Law of Thermodynamics – Concept of quality of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

## UNIT-III

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

## UNIT IV

Pure Substances, p-V-T surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables, Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

## UNIT-V

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables.

## UNIT-VI

[www.engineershut.in](http://www.engineershut.in)

Mixtures of perfect Gases – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Carrier's Equation – Psychrometric chart.

## UNIT-VII

**Power Cycles :** Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

## UNIT VIII

**Refrigeration Cycles :** Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell-

Coleman cycle, Vapour compression cycle-performance Evaluation.

## TEXT BOOKS :

1. Engineering Thermodynamics / PK Nag / TMH, III Edition
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles / TMH

## REFERENCES :

1. An introduction to Thermodynamics - YVC Rao / University press
2. Solution Manual to Introduction to Thermodynamics, YVC Rao / University Press

3. Engineering Thermodynamics – Jones & Dugan
4. Thermodynamics – Robert Balmer, Jaico Pub.
5. Thermodynamics – J.P.Holman, McGrawHill
6. Engineering Thermodynamics – K. Ramakrishna, Anuradha Publishers.
7. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd

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### (53016) MECHANICS OF SOLIDS

#### UNIT-I

**SIMPLE STRESSES & STRAINS :** Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain– Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

#### UNIT-II

**SHEAR FORCE AND BENDING MOMENT :** Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

#### UNIT-III

**FLEXURAL STRESSES :** Theory of simple bending – Assumptions – Derivation of bending equation:  $M/I = f/y = E/R$  Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.

#### UNIT-IV

**SHEAR STRESSES :** Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

#### UNIT-V

**ANALYSIS OF PIN-JOINTED PLANE FRAMES :** Determination of Forces in members of plane, pin jointed, perfect trusses by (i) method of joints and (ii) method of sections. Analysis of various types of cantilever & simply-supported trusses-by method of joints, method of sections & tension coefficient methods.

[www.engineershub.in](http://www.engineershub.in)

## UNIT-VI

[www.engineershup.in](http://www.engineershup.in)

**DEFLECTION OF BEAMS:** Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

## UNIT-VII

**THIN CYLINDERS:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

## UNIT-VIII

Thick cylinders – lame's equation – cylinders subjected to inside & out side pressures – compound cylinders.

## TEXT BOOKS:

1. Strength of materials – R.S. Kurmi and Gupta.
2. Solid Mechanics, by Popov
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH

## REFERENCES:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol-III, by S.B.Junnarkar.
4. Strength of Materials by S.Timshenko

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## (53043) MECHANICS OF FLUIDS

## UNIT I

**Fluid Properties And Fluid Statics:** Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Pressure at a point, Pascal's law, pressure variation with temperature, density and attitude. Hydrostatic law, Piezometer. Simple and differential manometers, pressure gauges, total pressure and center of pressure plane, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

## UNIT II

**Fluid Kinematics:** Stream line, path line, streak line, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, one, two and three dimensional flows Continuity equation in 3D flow, stream function, velocity potential function.

## UNIT III

**Fluid Dynamics:** Surface and Body forces Euler's and Bernoulli's equation derivation, Navier- stokes equation (explanation only) Momentum equation - applications, vortex Free and Forced. Forced vortex with free surface.

## UNIT IV

Similitude and Flow Measurement Similarly laws, distorted models, Flow through Venturimeters and Orificemeter, flow through notches and weirs, Viscometers, Hotwire Anemometers. Pitot tube. Flow through nozzles.

UNIT V [www.engineershup.in](http://www.engineershup.in)

Approximate solutions of N.S. Equations - Boundary layer- concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate Von-karman's momentum integral equation (No derivation), laminar and turbulent Boundary layers, BL in transition, separation of BL, control of BL separation, flow around submerged objects, Drag and lift types of drag magnus effect.

## UNIT VI

**Closed Conduit Flow:** Characteristics of real fluids Reynolds experiment

Darcy's equation, Minor losses pipes in series pipes in parallel Total energy line and hydraulic gradient line.

#### UNIT VII

Exact Solutions of Navier Stokes Equations. Flow between parallel plates, flow through long tubes - Flow through inclined tubes, Turbulent flow, variation of friction factor with Reynold's Number Mody's chart.

#### UNIT VIII

Flow of Compressible Fluid: Introduction, Thermodynamic relations, basic equations of compressible flow, velocity of sound wave in a fluid for isothermal and adiabatic process, mach number and its applications, mach angle, Propagation of Pressure waves and stagnation properties

#### TEXT BOOKS:

1. Fluid Mechanics Hydraulics and Hydraulics Machines Modi & Seth, Standard publications, New Delhi.
2. Engineering Fluid Mechanics by K.L.Kumar, S.Chand & Co.

#### REFERENCES:

1. Fluid Mechanics Frnk in white Mc-Grawhill.
2. Fluid Mechanics - John F.Dauglas, Pearson Educations publishers.
3. Fluid Mechanics & Hydraulic Machines - D. Ramadurgaiah, Newage Publishers 2005.

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#### (53044)INTRODUCTIONTOAEROSPACEENGINEERING

##### UNIT-I

##### HISTORY OF FLIGHT

Balloons and dirigibles, heavier than air aircraft, commercial air transport, introduction of jet aircraft, helicopters, conquest of space, commercial use of space, exploring solar system and beyond, a permanent presence of humans in space.

##### UNIT-II

[www.engineershut.in](http://www.engineershut.in)

##### INTRODUCTIONTOENGINEERING

The ages of engineering, the bronze age, iron age the middle ages, the renaissance, the industrial revolution, Indian science and technology through the ages.

##### UNIT-III

[www.engineershut.in](http://www.engineershut.in)

##### AERODYNAMICSANDFLIGHTVEHICLEPROPULSION

Aerodynamic forces on a wing, force coefficients. Generating lift. Moment coefficients, centre of pressure aerodynamic of wings. Sources of drag. Thrust for flight, the propeller and the jet engine, governing equations, rocket engines.

##### UNIT-IV

[www.engineershut.in](http://www.engineershut.in)

##### FLIGHTVEHICLEPERFORMANCEANDSTABILITY

Anatomy of the airplane, helicopter, launch vehicles and missiles, space vehicles. Static forces and moments on the vehicle. Understanding engineering models. Performance parameters, performance in steady flight, accelerated flight. Stability, static stability, dynamic stability. Longitudinal and lateral stability.

##### UNIT-V

##### THESPACEENVIRONMENT

Earth's atmosphere, the standard atmosphere. The temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity. The near earth radiative environment. The magnetosphere. Environmental impact on spacecraft. Meteoroids and micrometeoroids, space debris. Planetary environments.

**UNIT-VI****SATELLITE SYSTEMS ENGINEERING**

Satellite missions, an operational satellite system, elements of satellite, satellite bus subsystems, Satellite structures, mechanisms and materials. Power systems. Communication and telemetry. Thermal control. Attitude determination and control. Propulsion and station keeping. Space missions. Mission objectives. Case studies.

**UNIT-VII****VII HUMANS SPACE EXPLORATION**

Goals of human space flight missions. Historical background. The Soviet and US missions (The Mercury, Gemini, Apollo (manned flight to the moon), Skylab, Apollo-Soyuz, Space Shuttle. International Space Station, extravehicular activity. The space suit, The US and Russian designs. Life support systems. Flight safety. Indian effort in aviation, missile and space technology.

**UNIT-VIII****ENGINEERING DESIGN**

Design as a critical component of engineering education. Design as a skill. The design process, design thinking and design drawing. Design for mission, performance and safety requirements. Concurrent engineering. Computer aided engineering, design project. Example: the lighter-than-air vehicle student design project of MIT.

**TEXT BOOKS**

1. Newman, D., Interactive Aerospace Engineering and Design. (with software and reference material on CD), McGraw-Hill, 2002, ISBN 0-07-112254-0
2. Aircraft Flight, 3<sup>rd</sup> edition, Barnard, R. H. and Philpot, D.R., Pearson, 2004, ISBN: 81-297-0783-7.
3. Anderson, J.D., Introduction to Flight, fifth edition, Tata McGraw-Hill, 2007, ISBN: 0-07-006082-4.

**REFERENCES:**

1. Numerous references cited in Newman's book.
2. NASA Education Home Page, <http://www.ne.nasa.gov/education>.
3. The Wikipedia: Transportation Systems, Air Transportation, Aviation.

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**(53013) ENVIRONMENTAL STUDIES**

**UNIT-I : ECOSYSTEMS:** Definition, Scope and Importance of ecosystem, Concept of ecosystem, Classification of ecosystems, Structure and Structural Components of an ecosystem, Functions of ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Homeostasis / Cybernetics, Food chain concentration, Biomagnification, ecosystems value, services and carrying capacity.

**UNIT-II: NATURAL RESOURCES:** Classification of Resources: Living and Non-Living resources, Renewable and non-renewable resources. Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources – case studies. Energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources – case studies. Land resources: land as a resource, land degradation, man induced landslides and land use / land cover mapping.

**UNIT-III: BIODIVERSITY AND BIOTIC RESOURCES:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and intrinsic values, Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, conservation of biodiversity: In-Situ and Ex-situ conservation. Food and fodder resources, Timber and non-timber forest products.

**UNIT-IV: ENVIRONMENTAL POLLUTION AND CONTROL:** Classification of pollution and pollutants, causes, effects and control technologies. Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Point and non-point sources of pollution, Major pollutant of water and their sources, drinking water quality standards, Waste water treatment methods: effluent treatment plants (ETP), Sewage treatment plants (STP), common and combined effluent treatment plants (CETP). Soil Pollution: Soil as sink for pollutants, Impact of modern agriculture on soil, degradation of soil. Marine Pollution: Misuse of International water for dumping of hazardous waste, coastal pollution due to sewage and marine disposal of industrial

effluents. Noise Pollution: Sources, Industrial Noise- Occupational Health hazards, standards, Methods of control of Noise. Thermal Pollution: Thermal Comforts, Heat Island effect, Radiation effects. Nuclear Pollution: Nuclear power plants, nuclear radiation, disasters and impacts, genetical disorders. Solid waste: types, Collection processing and disposal of industrial and municipal solid wastes composition and characteristics of e-Waste and its management.

**UNIT-V: GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFORTS :** Green house effect, Green House Gases (GHG), Global Warming, Sea level rise, climate change and their impacts on human environment. Ozone depletion and Ozone depleting substances (ODS).Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

**UNIT-VI: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND ENVIRONMENTAL MANAGEMENT PLAN:** Definition of Impact: classification of impacts, Positive and Negative, Reversible and irreversible, light, moderate and severe, methods of baseline data acquisition. Impacts on different components: such as human health resources, air, water, flora, fauna and society. Prediction of impacts and impact assessment methodologies. Environmental Impact Statement (EIS). Environmental Management Plan (EMP): Technological Solutions, preventive methods, Control technologies, treatment technologies: green-belt-development, rain water harvesting, Remote sensing and GIS methods.

**UNIT-VII: ENVIRONMENTAL POLICY, LEGISLATION, RULES AND REGULATIONS**

National Environmental Policy, Environmental Protection act, Legal aspects Air (Prevention and Control of pollution ) Act- 1981, Water( Prevention and Control of pollution ) Act-1974, Water pollution Cess Act-1977, Forest Conservation Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules .

**UNIT: VIII — TOWARDS SUSTAINABLE FUTURE**

Concept of Sustainable Development, Threats to Sustainability, Population and its explosion, Crazy Consumerism, Over-exploitation of resources, Strategies for Achieving Sustainable development, Environmental Education, Conservation of Resources, Urban Sprawl, Sustainable Cities and Sustainable Communities, Human health, Role of IT in Environment, Environmental Ethics,

Environmental Economics, Concept of Green Building, Clean Development Mechanism (CDM).

#### SUGGESTED TEXT BOOKS:

1. Environmental studies , From crisis to cure by R.Rajagopalan, 2005
2. Text book of Environmental Science and Technology by M.Anji Reddy 2007
3. Environmental studies by Erach Bharucha 2005, University Grants Commission, University Press.

#### REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela .2008 PHI Learning Pvt. Ltd.

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**(53628) AIRCRAFT ENGINEERING DRAWING LAB with CAD**

*Note: 40% Course Work Should be Done on Drawing Board & 60% Course Work Should Be Done By Computer.*

**UNIT: I**

[www.engineershup.in](http://www.engineershup.in)

Machine Drawing conventions. Need for Drawings conventions – Introduction to ISI- Conventions

- Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs
- Types of sections – Selection of sectional planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned
- Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and Tapered features
- Title boxes, their size, location and details – common abbreviations and their liberal usage.
- Types of drawing – working drawing for machine parts

**UNIT: II**

Drawing of Machine Elements and simple parts. Section of views, additional views for the following machine elements and parts with every drawing proportions

- Popular forms of screw threads, bolts, set screws and bolted joints.
- Keys, cottered joint and knuckle joint
- Riveted joints for plates.
- Shaft couplings, spigot and socket pipe joint.
- Journal, pivot, collar and foot step bearing
- Welded joints and welding symbols.

**UNIT: III**

Following simple Aircraft assembly drawings only.

- Different types of trusses used in wings fuselage including ribs, stringers, skin, brackets

- Different elements of fuselage structures, bulk head, rings (frame) long irons
- Different types of fuselage.
- landing gear basic elements, structural brackets, wheel, shock absorber and Hydraulic cylinder
- connecting rod for aero piston engine

**Text Books:**

- Daniel P. Raymer Aircraft Design a Conceptual Approach Third Addition.
- Machine drawing by N.D. Baht / V.M. Panchal / Charotar Publication House – 2000 Ed.
- Megson THG, "Aircraft Structures for Engineering Students", Edward Arnold Publication.

**REFERENCES:**

- Machine Drawing by K.L.Narayana, P.Kannaiah and K.Venkata Reddy / New Age Publishers.
- Air Craft structures by Bruhn.E.H
- Machine Drawing by P.S.Gill
- Machine Drawing by Luzzader
- Machine Drawing by Rajput.

**Equipment Needed**

- Hardware assembly models relevant to above are needed for demonstration
- Drawing Boards with Mini drafting machines, 60 required for strength of 60 capacity.

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## (53629) MECHANICS OF SOLIDS AND MECHANICS OF FLUIDS LAB

### (A) MECHANICS OF SOLIDS LAB :

1. Direct tension test
2. Bending test on
  - a) Simple supported
  - b) Cantilever beam
3. Torsion test
4. Hardness test
  - a) Brinells hardness test
  - b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

[www.engineershup.in](http://www.engineershup.in)

### (B) MECHANICS OF FLUIDS LAB

1. Calibration of Venturimeter
2. Determination of co-efficient of discharge for a small orifice by a constant head method.
3. Calibration of Triangular notch
4. Verification of Bernailli's apparatus.
5. Pipe friction.
6. Calibration of orifice meter
7. Determination of co-efficient of discharge for an external mouth piece by variable head method.
8. Determination of co-efficient of loss of head in a sudden retraction.

Note: A minimum of Ten experiments should be taking at least four experiments from each lab.