4th Semester	**RAG4C002**	**Mechanics & Open Channel Hydraulics**	**L-T-P 3-0-0**	**3 CREDITS**

MODULE- I (8 hrs)

Index Properties and Soil Consistency: Index Properties – Introduction, phase diagram, definitions and relations, physical and index properties of soil, Particle size distribution, grain size distribution curve, soil indices. Soil Consistency - Plastic limit, liquid limit, shrinkage limit; Soil Stress:Stress in Soils- Effective and neutral stress, stress in soil, Boussinesq and Westerguard's analysis, new mark's influence chart, stress distribution and diagrams; Shear stress and Mohr's stress circle, direct shear stress, triaxial test and vane shear test, Numerical examples on different tests.

MODULE- II (8 hrs)

Compaction and Consolidation - Compaction of soils, standard and modified proctor test, abbot's compaction test, jodhpur mini compaction test, field compaction methods; Consolidation of soils, Terzaghi's theory of one dimensional consolidation, spring analogy, consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Cassagrande method; Earth Pressure and Stability of Slopes - Active and passive earth pressure, Rankine's theory of earth pressure for cohesive soils; Stability of slopes, stability analysis of infinite and finite slope, Taylor's stability number, friction circle method.

MODULE- III (6 hrs)

Fluid Properties, Fluid Pressure and its Measurement - Ideal and real fluids, density, specific weight, specific volume, specific gravity, viscosity, units of measurements; pressure, intensity of pressure, pascal's law, pressure head, transmissibility of liquid pressure, Bramah's press or hydraulic press, atmospheric pressure, negative or vacuum pressure, absolute pressure, pressure gauges and manometers(barometer, piezometer, manometer, differential u-tube manometer, inverted manometer)

MODULE- IV (8 hrs)

Hydrostatics, Equilibrium of Floating Bodies and Hydro-kinematics - Hydrostatics and its application - Pressure forces on plane and curved surfaces- total pressure, centre of pressure, pressure on curved surfaces, pressure on irregular shaped lamina, pressure on masonry dam: water pressure on one side and both side of dam, stability of a dam – rectangular and trapezoidal dam. Equilibrium of Floating Bodies - Buoyancy, Archimedes principle, centre of buoyancy, metacentre, metacentric height- determination of metacentric height by analytical and practical method, Condition of floatation and stability of submerged and floating bodies. Hydro-kinematics - Kinematics of fluid flow; methods of describing fluid motion- Langrangian and Eulerian description of fluid motion, path line, stream line, streak line, stream function, velocity potential and flow net, Types of fluid flow – steady and unsteady flows, uniform and non-uniform flows, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, rate of flow or discharge, control volume, continuity equation.

MODULE- V (7 hrs)

Vortex Flow, Bernoulli's equation and its Applications -Vortex motion - free and forced vortex , Dynamics of fluid flow: energy possessed by a fluid body- Bernoulli's theorem, venturimeter, pitot tube, orifice meter; Flow through devices and pipes - Flow through orifices- types, jet, vena-contracta, hydraulic coefficients, discharge of orifice, Flow through mouth pieces- types, losses in pipes, discharge of mouthpiece; Flow through notches- types, discharge through rectangular notch; Discharge over triangular, trapezoidal and stepped notch; weirs and barrages, Cipoletti weir, end contraction of rectangular weirs; Ventilation of weirs, types of nappe- free, depressed and clinging nappe;

MODULE- VI (8 hrs)

Flow through simple and compound pipes - Pipe flow, minor and major hydraulic losses through pipes, fluid friction, Darcy Weisbach equation of loss of head in pipes, hydraulic gradient and total energy line; Pipes in series, pipes in parallel, flow through network of pipes-branching of pipes; Power transmission through pipes- efficiency of transmission, condition for maximum power transmission, siphon.

Open channel flow, Dimensional analysis and fluid machinery Flow through open channel-Chezy's equation, manning's equation, most economical or best hydraulic section- rectangular and trapezoidal channel; Hydraulic jump- critical, sub-critical and super critical flow, Moody's diagram; Dimensional analysis and similitude- Rayleigh's method, Buckingham's pi theorem; Dimensionless numbers-Froude's no., Reynold's no., Euler's no., Mach's no., weber's number; Model analysis: types of similarities- geometric, kinematic and dynamic similarity, scale ratio; Introduction to fluid machinery - positive displacement and Variable displacement pump.

Books:

1. Punmia,B.C, Jain, A.K. Soil Mechanics and Foundations,Laxmi Publications (P) Ltd.
2. Ranjan Gopal and Rao A S R. Basic and Applied Soil Mechanics, Welly Eastern Ltd.
3. Singh, Alam. Soil Engineering, Vol.1. CBS Publishers and Distributers, Delhi
4. Bansal, R.K. A Text book of Fluid Mechanics, Laxmi Publications, New Delhi.
5. Ramanuthan,S.Hydraulics, Fluid Mechanics & Hydraulic Machines, Dhanpat rai & Sons,
6. Khurmi, R.S. Hydraulics & Fluid Mechanics, S. Chand & Co. Ltd., New Delhi.
7. Modi, P.N. and Seth, S.M. Hydraulics & Fluid Mechanics, Standard Book House, Delhi
8. Paul, J. C. and Panigrahi, B. Practical Manual in Fluid Mechanics, CAET, OUAT, Bhubaneswar