B.Tech.IIYearIISem.

HYDRAULICS AND HYDRAULIC MACHINERY

Course Code	20PC0CE10			
Category	Civil engineering			
Course Title	**HYDRAULICSANDHYDRAULICMACHINERY**			
Scheme and Credits	L	T	P	Credits
	2	1	0	3
Pre requisites	Nil			

CourseObjectives: Theobjectiveofthecourseis

- Todefinethefundamentalprinciplesof waterconveyanceinopenchannels.
- Todiscussandanalyzethe openchannelsinuniformand Non-uniformflowconditions.
- To understand the application of dimensional analysis and hydraulic similitude enables engineers to organize and simplify experiments
- To Study the characteristicsofhydroelectricpowerplant anditscomponents.
- Toanalyzeanddesignofhydraulicmachineryanditsmodeling

CourseOutcomes: Attheendofthecoursethestudentwillableto

- Applytheirknowledgeoffluidmechanicsinaddressingproblemsinopen channelsandhydraulicmachinery.
- Understandandsolveproblemsinuniform,graduallyandrapidlyvariedflowsinopenchann elinsteadystateconditions.
- Applydimensionalanalysisandtodifferentiatethe model,prototypeandsimilitudeconditionsforpracticalproblems.
- Gettheknowledgeondifferenthydraulicmachinerydevicesanditsprinciplesthatwillbeuti lizedinhydropower developmentandforotherpracticalusages

UNIT-I

Open Channel Flow – I: Introduction to Open channel flow-Comparison between open

channel flowandpipeflow,Classificationofopenchannels,Classificationofopenchannelflows,Velocitydistribution. Uniform flow – Characteristics of uniform flow, Chezy's, Manning's and Bazin formulae foruniform flow – Factorsaffecting Manning's Roughness Coefficient "n". Most economical sections.ComputationofUniformflow,Normaldepth.

Critical Flow: Specific energy – critical depth - computation of critical depth – critical, sub critical andsuper criticalflows-Channeltransitions.

UNIT-II

Open Channel Flow – II: Non-uniform flow – Gradually Varied Flow - Dynamic equation for G.V.F;Classification of channelbottom slopes – Classification and characteristics ofSurface profiles –Computation of water surface profiles by Numerical and Analytical approaches. Direct step method.**Rapidlyvariedflow:**Elementsandcharacteristics(LengthandHeight)ofHydraulicjumpin rectangular channel– Types, applications and location of hydraulic jump, Energy dissipation and otheruses– Positive and Negative Surges(Theoryonly).

UNIT-III

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity – Rayleigh's methodand Buckingham's pi methods – Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problems. Distorted models. **Impact of Jets:** Hydrodynamic force of jets on stationary and moving flat, inclined andcurved vanes,Jetstriking centrallyand at tip, Velocitytriangles at inlet and outlet, expressions forwork done and efficiency– Angular

UNIT-IV

Pelton Wheel Turbine: Elements of a typical Hydropower installation – Heads and efficiencies –Classification of turbines –Pelton wheel– Francis turbine– working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency.

Kaplan turbine: Kaplan turbine - working, working proportions, velocity diagram, work done and efficiency, hydraulic design -Governing of turbines – Surge tanks – Unit and specific turbines – Unit speed – Unit quantity – Unit power – Specific speed – Performance characteristics – Geometric similarity –Cavitation. Selection of turbines.

UNIT-V

Centrifugal& Reciprocating Pumps: Pump installation details – classification – work done – Manometric head –minimum starting speed – losses and efficiencies – specific speed. Multistage pumps – Reciprocating Pumps - pumps inparallel– performance of pumps– characteristic curves–NPSH –Cavitation.

Hydropower Engineering: Classification of Hydropower plants – Definition of terms – load factor, utilization factor, capacity factor, estimation of hydropower potential.

TEXTBOOKS:

1. FluidMechanicsbyModiandSeth,StandardBookHouse.
2. FluidMechanicsandHydraulicmachinesby A.K. Jain, Khanna Publishers.

REFERENCEBOOKS:

1. FluidMechanicsby R.C.Hibbeler,PearsonIndiaEducationServicesPvt.Ltd
2. Fluid Mechanic & Fluid Power Engineering by D. S. Kumar (Kataria& SonsPublicationsPvt.Ltd.).
3. Open channel flowbyV.T.Chow(McGrawHill BookCompany).
4. IntroductiontoFluidMechanicsandFluidMachinesbySKSom,GautamBiswas,SumanChakraborthy,McGrawHillEducation (India)PrivateLimited
5. HydraulicMachinesbyBanga&Sharma(KhannaPublishers).
6. FluidMechanicsandHydraulicmachinesby ManishKumarGoyal,PHIlearningPrivateLimited.

CE405PC: HYDRAULICS AND HYDRAULIC MACHINERY

B.Tech. II Year II Sem.

Course Objectives: The objective of the course is

- To Define the fundamental principles of water conveyance in open channels.
- To Discuss and analyze the open channels in uniform and Non-uniform flow conditions.
- To Study the characteristics of hydroelectric power plant and its components.
- To analyze and design of hydraulic machinery and its modeling

Course Outcomes: At the end of the course the student will able to

- Apply their knowledge of fluid mechanics in addressing problems in open channels andhydraulic machinery.
- Understand and solve problems in uniform, gradually and rapidly varied flows in open channelin steady state conditions.
- Apply dimensional analysis and to differentiate the model, prototype and similitude conditionsfor practical problems.
- Get the knowledge on different hydraulic machinery devices and its principles that will beutilized in hydropower development and for other practical usages

UNIT - I

Open Channel Flow – I: Introduction to Open channel flow-Comparison between open channel flow and pipe flow, Classification of open channels, Classification of open channel flows, Velocity distribution. Uniform flow – Characteristics of uniform flow, Chezy's, Manning's and Bazin formulae for uniform flow – Factors affecting Manning's Roughness Coefficient "n". Most economical sections. Computation of Uniform flow, Normal depth.

Critical Flow: Specific energy – critical depth - computation of critical depth – critical, sub critical and super critical flows-Channel transitions.

UNIT - II

Open Channel Flow – II: Non-uniform flow – Gradually Varied Flow - Dynamic equation for G.V.F; Classification of channel bottom slopes – Classification and characteristics of Surface profiles – Computation of water surface profiles by Numerical

and Analytical approaches. Direct step method. **Rapidly varied flow:** Elements and characteristics (Length and Height) of Hydraulic jump in rectangular channel– Types, applications and location of hydraulic jump, Energy dissipation and other uses – Positive and Negative Surges (Theory only).

UNIT - III

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity – Rayleigh's method and Buckingham's pi methods – Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problems. Distorted models. **Basicsof Turbo Machinery:** Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency – Angular

UNIT - IV

Hydraulic Turbines – I: Elements of a typical Hydropower installation – Heads and efficiencies – Classification of turbines – Pelton wheel – Francis turbine – Kaplan turbine – working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency.

Hydraulic Turbines – II: Governing of turbines – Surge tanks – Unit and specific turbines – Unit speed

– Unit quantity – Unit power – Specific speed – Performance characteristics – Geometric similarity – Cavitation. Selection of turbines.

UNIT - V

Centrifugal Pumps: Pump installation details – classification – work done – Manometric head – minimum starting speed – losses and efficiencies – specific speed. Multistage pumps – pumps in parallel – performance of pumps – characteristic curves – NPSH – Cavitation.

Hydropower Engineering: Classification of Hydropower plants – Definition of terms – load factor, utilization factor, capacity factor, estimation of hydropower potential.

TEXT BOOKS:

1. Fluid Mechanics by Modi and Seth, Standard Book House.
2. Fluid Mechanics and Hydraulic machines by Manish Kumar Goyal, PHI learning

Private Limited,2015
3. Fluid mechanics & Hydraulic Machines, Domkundwar & Domkundwar Dhanpat Rai &Co

REFERENCE BOOKS:

1. Fluid Mechanics by R. C. Hibbeler, Pearson India Education Services Pvt. Ltd
2. Fluid Mechanic & Fluid Power Engineering by D. S. Kumar (Kataria & Sons Publications Pvt.Ltd.).
3. Open channel flow by V.T. Chow (McGraw Hill Book Company).
4. Introduction to Fluid Mechanics and Fluid Machines by SK Som, Gautam Biswas, SumanChakraborthy, Mc Graw Hill Education (India) Private Limited
5. Hydraulic Machines by Banga & Sharma (Khanna Publishers).

Course Title	ELECTRICAL MACHINES – II			
Branch	B. Tech Electrical & Electronics Engineering			
Year & Sem	II Year & II Sem			
Course Code	20PC0EE06			
Category	Professional Core Course			
Scheme and Credits	L	T	P	Credits
	3	1	0	4
Pre requisites (If any)	Basic Electrical Engineering, Electrical Machines-I			

Course Objectives:

- To deal with the detailed analysis of poly-phase induction motors & Alternators
- To understand operation, construction and types of single phase motors and their applications inhouse hold appliances and control systems.
- To introduce the concept of parallel operation of alternators
- To introduce the concept of regulation and its calculations.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the concepts of rotating magnetic fields.
- Understand the operation of ac machines.
- Analyze performance characteristics of ac machines.

UNIT-I:

THREE PHASE INDUCTION MACHINES

Constructional details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation.

UNIT-II:

CHARACTERISTICS OF INDUCTION MACHINES

Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation- deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic - equivalent circuit - phasor diagram - crawling and cogging - No-load Test and Blocked rotor test –Predetermination of Performance-Methods of starting and starting current and Torque calculations. Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT-III:

SYNCHRONOUS MACHINES

Constructional Features of round rotor and salient pole machines – Armature windings – Integral

slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – determination of Xd and Xq (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT-IV:

PARALLEL OPERATION OF SYNCHRONOUS MACHINES

Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance's. Synchronous Motors: Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed - hunting and its suppression– Methods of starting – synchronous induction motor.

UNIT-V:

SINGLE PHASE INDUCTION MOTOR & SPECIAL MACHINES

Single phase induction motor – Constructional Features-Double revolving field theory – split-phase motors – shaded pole motor.

Construction, Working Principle, Characteristics and Applications – Stepper Motor – Switched reluctance motor – Permanent Magnet Brushless DC Motor

TEXT BOOKS:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, 2011.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 3rd Edition, 2010.

REFERENCES:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 6th Edition, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 3rd Edition, 2002.
3. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
4. Electrical Machines – II online NPTEL course by Prof. Tapas Kumar Bhattacharya, IIT Kharagpur.

Course Title	ELECTRICAL CIRCUIT ANALYSIS			
Branch	B. Tech Electrical & Electronics Engineering			
Year & Sem	II Year & I Sem			
Course Code	20PC0EE01			
Category	Professional Core Course			
Scheme and Credits	L	T	P	Credits
	3	1	0	4
Pre requisites (If any)	Mathematics - II (Ordinary Differential Equations and Multivariable Calculus) & Basic Electrical Engineering			

Course Objectives:

- To understand Magnetic Circuits, Network Topology and Three phase circuits.
- To analyze transients in Electrical systems.
- To evaluate Network parameters of given Electrical network
- To design basic filter configurations

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Apply network theorems for the analysis of electrical circuits.
- Obtain the transient and steady-state response of electrical circuits.
- Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
- Analyze two port circuit behavior.

UNIT-I:

NETWORK THEOREMS

Superposition theorem, Thevenins theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

UNIT-II:

SOLUTION OF FIRST AND SECOND ORDER NETWORKS

Solution of first and second order differential equations for Series and parallel R-L, R-C, RL-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response for DC and AC Excitations, Locus diagrams of RL and RC circuits.

UNIT-III:

THREE-PHASE CIRCUITS AND COUPLED CIRCUITS

Three-phase circuits: Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits –Measurement of active and reactive power.

Coupled circuits: Mutual coupled circuits, Dot Convention in coupled circuits,

UNIT-IV:

ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS

Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

UNIT-V:

TWO PORT NETWORKS AND FILTERS

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters. comparison of various filter circuits in terms of ripple factors.

TEXT BOOKS:

1. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 7th Edition, 2013.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 2nd Edition, 2013.

REFERENCES:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. C. K. Alexander and M. N. O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill Education, 6th Edition, 2019.
3. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
4. Network Analysis online NPTEL course by Prof. Tapas Kumar Bhattacharya, IIT Kharagpur.

ENGINEERING MECHANICS

Course Code	20ES0ME03				
Category	Basic Sciences				
Course Title	**ENGINEERING MECHANICS**				
Scheme and Credits	L	T	P	D	Credits
	3	0	0	0	3
Pre requisites	Physics at pre-university level				

Course Objectives: The objectives of this course are to

- Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium
- Perform analysis of bodies lying on rough surfaces.
- Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections
- Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies.
- Explain the concepts of work-energy method and its applications to translation, rotation and plane motion and the concept of vibrations

Course Outcomes: At the end of the course, students will be able to

- Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.
- Solve problem of bodies subjected to friction.
- Find the location of centroid and calculate moment of inertia of a given section.
- Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
- Solve problems using work energy equations for translation, fixed axis rotation and plane motion and solve problems of vibration.

UNIT - I:

Introduction to Engineering Mechanics - Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT - II:

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications. – Theorem of Pappus

UNIT - III:

Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem Mass Moment of Inertia: Moment of Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of composite bodies.

UNIT - IV:

Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT - V:

Kinetics of Rigid Bodies -Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D' Alembert's principle and its applications in plane motion and connected bodies.

TEXT BOOKS:

1. Shames and Rao (2006), Engineering Mechanics, Pearson Education
2. Reddy Vijay Kumar K. and J. Suresh Kumar (2010), Singer's Engineering Mechanics – Statics & Dynamics

REFERENCE BOOKS:

1. Beer F.P & Johnston E.R Jr., Vector Mechanics for Engineers – Statics and Dynamics, Mc Graw Hill, 12th Edition.
2. Dumir P.C, Sengupta, Srinivas, Engineering Mechanics- Universities Press, 2020.
3. Hibbeler R.C, Engineering Mechanics, Pearson, 14th Edition.
4. Arshad Noor, Zahid & Goel, Engineering Mechanics, Cambridge University Press, 2018.
5. Khurmi R.S, Khurmi N., Engineering Mechanics, S. Chand, 2020.
6. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press

ENGINEERING MECHANICS
B.Tech. I Year I Sem. L T/P/D C
Course Code: ME105ES 3 0/0/0

Pre Requisites: None

Course Objectives:

- To understand the resolving forces and moments for a given force system
- To analyze the types of friction for moving bodies and problems related to friction.
- To determine the centroid and second moment of area

UNIT-I

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II

Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions - Motion of Bodies –Wedge Screw, Screw-jack and differential screw –jack.

UNIT-III

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of composite bodies.

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration. Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

UNIT-IV

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies. **Virtual Work:** Theory of virtual work-Application.

UNIT-V

Kinetics: Kinetics of a particle-D'Alemberts principle-Motion in a curved path – work, energy and power. Principle of conservation of energy- Kinetics of rigid body in translation, rotationwork done-Principle of work-energy-Impulse-momentum.

Mechanical Vibrations: Definitions, Concepts-Simple Harmonic motion- free vibrations- Simple and compound pendulums

Text Books:

1. Singer's Engineering Mechanics Statics and Dynamics/ K. Vijaya Kumar Reddy, J. Suresh Kumar/ BSP
2. Engineering Mechanics/ Irving Shames, G. Krishna Mohan Rao / Prentice Hall
3. Foundations and applications of Engineering Mechanics by HD Ram and AK Chouhan, Cambridge publications.

References:

1. A Text of Engineering Mechanics /YVD Rao/ K. Govinda Rajulu/ M. Manzoor Hussain / Academic Publishing Company
2. Engineering Mechanics / Bhattacharyya/ Oxford.