

CIVIL ENGINEERING DEPARTMENT

M.TECH. HYDRO POWER ENGINEERING

**Course of Study & Scheme of Examination
2016-17**



**Maulana Azad National Institute of Technology,
Bhopal**

SCHEME
M. TECH IN HYDRO POWER ENGINEERING

FIRST SEMESTER

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
HYD511	Advanced Fluid Mechanics	3	-	-	3
HYD512	Instrumentation and Measurement	3	-	-	3
HYD513	Hydrology and Hydro Power Plants	3	-	-	3
	Elective 1	3	-	-	3
	Elective 2	3	-	-	3
	Open elective1	3	-	-	3
HYD514	Lab Practice 1	-	-	3	2
HYD515	Seminar 1	-	2	-	2
Total credits 22					

SECOND SEMESTER

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
HYD521	Fundamentals of Hydraulic Machines	3	-	-	3
HYD522	Design of Hydraulic Turbines	3	-	-	3
HYD523	Design of Hydraulic Pumps	3	-	-	3
	Elective 3	3	-	-	3
	Elective 4	3	-	-	3
	Open elective2	3	-	-	3
HYD524	Lab Practice 2	-	-	3	2
HYD525	Seminar 2	-	2	-	2
Total credits 22					

LIST OF DEPARTMENT ELECTIVES

HYD531 Theory of Cascades	HYD532 Water Resources Systems
HYD533 Manufacturing Processes	HYD534 Hydro Power Structures
HYD535 Hydraulic Transients	HYD536 Design of Power House
HYD537 Industrial Hydraulics	HYD539 Governing systems
HYD538 Small Hydro and Tidal Power Plants	

LIST OF OPEN ELECTIVES

- HYD551 Advanced Mathematics
- HYD 552 Environmental Impact Assessment
- HYD553 Computational Fluid Dynamics
- HYD554 Project Planning and Management
- HYD555 Design and Analysis of Piping System

THIRD SEMESTER

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
HYD611	Major Project Dissertation Phase- I	-	-	-	23
Total credits 23					

FOURTH SEMESTER

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
HYD648	Major Project Dissertation Phase- II	-	-	-	23
Total credits 23					

SYLLABUS

M. TECH IN HYDRO POWER ENGINEERING

FIRST SEMESTER

HYD511 ADVANCED FLUID MECHANICS

Continuity equation in cylindrical and polar coordinates energy equation in rotating system, moment of momentum equation, Kinematics of flow, Laminar and turbulent flow through pipes. Navier- Stokes equation, turbulent models, boundary layer parameters and their estimation, boundary layer separation and control, Drag and lift on submerged bodies, flow in open channel.

Reference

1. Fluid Mechanics- Streeter & Wylie., Tata McGraw-Hill Education
2. Fluid Mechanics -Douglas J.F. Gasiorek, & Swaffield J. A, Pearson/Prentice Hall
3. Solution of problems in Fluid Mechanics- Part 1&2, Douglas J.F, Pitman.
4. Mechanics of Fluids- Shames, McGraw-Hill Science
5. Mechanics of Fluids- Frank. M. White, McGraw-Hill

HYD512 INSTRUMENTATION AND MEASUREMENTS

Accuracy, error analysis, pressure measurement, velocity measurement, discharge measurement, speed measurement, force and torque measurement, temperature measurement, viscosity measurement, acoustic measurement, calibration of instruments.

References

1. Instrumentation, Analysis and Measurement- Nakra and Choudhary, Tata McGraw-Hill Education
2. Measurement and Instrumentation Systems- W. Bolton, Butterworth-Heinemann

HYD513 HYDROLOGY AND HYDROPOWER PLANTS

Types of hydropower plants and schemes, hydrology: runoff studies, flood estimation studies, assessment of hydropower potential of a basin, storage and pondage, load studies, elements of

hydropower plants and their hydraulic design: dams, intakes, conveyance system, types of power house.

References

1. Water Power Engineering- M.M. Desmukh,
2. Water Power Engineering - M.M. Dandekar & K.N. Sharma, Dhanpat Rai & Sons
3. Water Power Engineering - H.K. Barrows, New York: McGraw-Hill Book Company,
4. Water Power Development ,Vol. I & II E.- Mosoyni, House of the Hungarian Academy of Sciences

HYD514 LAB PRACTICE 1

Experiments on fluid mechanics and hydraulic machines

HYD515 SEMINAR 1

SECOND SEMESTER

HYD521 FUNDAMENTALS OF HYDRAULIC MACHINES

Classification and Euler's equation for hydraulic machines of hydraulic turbines and pumps, energy losses in hydraulic machines, scale effects, hydraulic similarity, non-dimensional numbers and model laws, cavitation, similarity laws in cavitating flows, Affinity laws for hydraulic machines, model testing and performance characteristics. Introduction to field testing.

References

1. Fluid Mechanics of Turbo Machinery- G. Wislicenus, Dever,
2. Principle of Turbo Machinery- D.G Shepherd, MacMillan & Co LTD

HYD522 DESIGN OF HYDRAULIC TURBINES

Components of hydraulic turbines, Standardization and selection of turbine, Francis turbine runner design, design of axial turbine runner including bulb turbine, hydraulic calculations of spiral casing and guide wheel, draft tube theory, standardization and applications draft tube, Pelton turbine design

References

1. Hydraulic Turbines- M. Nechleba, Constable and Co Limited
2. Hydraulic Turbine and Pumps- I. Smirnov,
3. Hydraulic Machines- Jagdish Lal, Metropolitan Book Co. Pvt Ltd
4. Hydro Power- The design, Use and Function Raabelng. Joachim, VDI Verlag

HYD523 DESIGN OF HYDRAULIC PUMPS

Theory of impeller design, design of impellers, design of pump casing, axial and radial thrust, shaft design for critical speed, special purpose pumps, bowers and compressors, Pumps characteristics curves.

References

1. Centrifugal and axial flow Pump- A.J. Stephenoff, Krieger Publishing Company
2. Impeller Pumps- Stephen Lazarkiewicz and Adam T, Pergamon Press
3. Centrifugal Pumps and Blower- Church & J. Lal, Delhi, Metropolitan

HYD524 LAB PRACTICE2

Numerical simulation of simple flow systems

HYD525 SEMINAR 2

DEPARTMENT ELECTIVE

HYD531THEORY OF CASCADES

Potential flow, Rankine body, doublet, flow past cylinders, forces and moments on the profiles, Kutta-Joukowski theorem, , induced drag, velocity triangles, cascade parameters, direct and indirect problem, flow through cascades, conformal transformation.

References

1. Fluid Flow - Rolf H. Sabersky & Allan J. Acosta, Pearson
2. Theory of Turbo Machines- G.T. Canady,
3. Hydrodynamics of Turbo Machinery- Cascades G.U. Stepanoff, Physmatgir,
4. Turbo machinery Performance Analysis- R.I. Lewis, Arnold

HYD 532 WATER RESOURCES SYSTEM

Nature of water resources systems. water resources planning and development: steps of planning and development, conjunctive use planning, planning for operation, integrated planning and developments. System analysis techniques in water resources: optimization, linear programming, dynamic programming, simulation. Application of system analysis in water resources: applications of various optimization techniques to water resources engineering problems. Economic considerations in water resources systems: basic principles of economics, project feasibility and optimality, cost allocation

References

1. Water Resources Systems- Subhas Chander and Rajesh Prasad, Jain Brothers
2. Water Resources System Planning and Management- S.K. Jain and V.P. Singh, Elsevier Science
3. Water Resources Systems- S. Vedula and P. P. Majumdar, Tata McGraw-Hill Education,
4. Water Resources System Planning and Analysis- D.P. Loucks, J.R. Stedinger, D.A. Haith. Moskva : Energoatomizdat

HYD533 MANUFACTURING PROCESS

Different materials used for manufacturing of water turbines components. Factors influencing their selection, resistance to corrosion, oxidation and erosion due to cavitations, casting of metals, methods of melting, moulding machines, shell moulding, die casting, centrifugal casting, miscellaneous casting methods.

Powder metallurgy, methods of producing metal powders, mixing, pressing, briquetting, sintering sizing and finishing, application to runners affected by cavitation erosion.

Forging processes, application to large forging in water turbines, stamping and forming, blanking and shearing.

Welding processes, applications to welding of spiral casing, draft tubes, runner, distributors.

Machining Processes.

Reference

1. Fundamentals of Modern Manufacturing, Material process and systems - Mickell P. Groover, John Wiley & Sons
2. Production Technology (Manufacturing Processes)- Dr. P.C.Sharma, S Chand
3. Production Technology- P.N.Rao, McGraw Hill Education

HYD534 HYDRO POWER STRUCTURES

Design and construction of storage dams and weirs, design of canals and fore bays, design of penstock, overflow sections, surge tanks and their design, draft tubes, turbine casing

References

1. Hydraulic Structures- Novak and Narayanan, CRC Press
2. Irrigation Engineering and Hydraulic Structures- S.K. Garg, Khanna
3. Concrete Dams- R.S. Varshney, Oxford & IBH Publishing Co., New Delhi
4. Hydraulic Structures- R.S. varshney, Jain Publishers.

HYD535 HYDRAULIC TRANSIENTS

Water Hammer: phenomenon, equations for elastic waves in simple and complex conduits, arithmetic integration and graphical methods of solution, Differential equations of water hammer and solution by method of characteristics.

Influence of water hammer on turbine speed regulation, transfer functions for the effect of water hammer on governing stability

Reflection and transmission of water hammer waves, Allievi's equations and charts for uniform valve closure, Unsteady flow in canals: General differential equations of motion and continuity, shallow water equations and their solution using method of characteristics.

Surge Tanks: Functions, Different types, Design of surge tanks- Calame-Gaden equations, Johnson's method. Stability of surge tanks

References

1. Applied Hydraulic Transients- Hanif Choudhary, Springer
2. Hydraulic Transients- Streeter, McGraw-Hill Book Company
3. Water Power Engineering- M.M Desmukh, Dhanpat Rai & Sons;
4. Hydraulic Transients- G.Rich ,Dover Publication.

HYD536 DESIGN OF POWER HOUSE

Classification and preliminary dimensions of power house, foundation investigation methods, foundation treatment, power house, sub structures, constructional form and sizes, design and constructional details, power house super structures, general planning, Steel structure, Reinforced concrete construction, Roof construction, wall construction.

Hydro dynamics of underground systems and types of underground stations, Economics of underground power stations, Civil works of micro/mini hydro schemes.

References

1. Power House Design- J.F.C. Snell, Longman Series, Longmans, Green and Co
2. Hydro Power Structures- R.S. Varshney, Nem Chand
3. Planning and Design of Hydro Electric Plants- Gilbert Gedeon, P.E, Continuing Education and Development Inc.

HYD537 INDUSTRIAL HYDRAULICS

Fluid power systems, symbols, circuit diagrams, different type of power pumps and motors, type of pressure control valves, hydraulic fuse, pressure switch, type of flow and directional control valves, hydraulic coupling, torque converter

References

1. Industrial Hydraulics- John J. Pippenger and Tyler G. Hicks, McGraw-Hill
2. Oil Hydraulic Systems- Principles and Maintenance, S.R. Majumdar, McGraw-Hill Education

HYD538 SMALL HYDRO AND TIDAL PLANTS

Small hydro power (SHP) development in India, small hydro plant design, Types and selection of turbines for SHP, types of generator for SHP, control systems for SHP, Governing system for SHP, financial aspects of SHP, components of tidal power plant, Operation methods, estimate of energy in simple and double cycled systems, site requirements of tidal energy power plants.

References

1. Small hydroelectric engineering practice- Bryan Leyland, CRC Press
2. Hydropower Engineering- C.C. Warnik, Prentice Hall.
3. Ocean Energy: Tidal and Tidal power- R.H. Charlier, Springer.

HYD539 GOVERNING SYSTEMS

Need of governing of turbines, economic operation of power system, load flow analysis, Load frequency control, flow and load control governors, mechanical governors, electronic governors, Oil less governors, governor stability, Discrete time systems, Principle of optimality, performance of governors, dynamic response, load compensation and reliability, simulation of governing systems.

References

1. Hydro Turbine Governing- Z. Shen,
2. PID Controllers- Theory, Design and Testing, K. Astrom and T. Hagglund, ISA
3. Operation and Control in Power Systems ,PSR Murthy, Wiley

OPEN ELECTIVE

HYD551 ADVANCED MATHEMATICS

Elementary conformal mapping, conformal transformations of harmonic functions and boundary conditions, , solution of linear and non-linear equations, applications to problems of fluid mechanics, collection and representation of experimental data, curve fitting, regression, interpolation, numerical integration and differentiation.

References

1. Probability and Statistics for Engineers- R.A. Jhonson, Prentice Hall
2. Numerical Methods for Scientist and Engineers-H.M. Anita ,Birkhäuser

HYD552 ENVIRONMENTAL IMPACT ASSESSMENT

EIA as a tool for sustainable development, significance and uses of multipurpose water resources projects impact assessment: environmental, social and economic issues, issues in collection of baseline data, concept of scoping, screening, environmental impact assessment (EIA),and environmental impact statement (EIS), rapid and comprehensive EIA, methodologies: including checklists, matrices and networks, irrigation related environmental impacts, impact of water resources projects on environment, large dams versus small dams: issues and controversies. green revolution and its consequences, case studies relating to large multi-purpose water resources projects, mitigation strategies specific to water resources projects, environmental management, rehabilitation policies of the government of India.

References

1. Introduction to environmental impact assessment -John Glasson, Riki Therivel, Routledge
2. Methods of environmental impact assessment- Peter Morris, Riki Therivel, Routledge;
3. Environmental impact assessment: theory and practice- Peter Wathern, Routledge;

HYD553 COMPUTATIONAL FLUID DYNAMICS

Introduction and overview of CFD, Accuracy and errors, consistency, stability and convergency, applications areas, differential flow equations, initial and boundary conditions, finite difference method, finite element method, finite volume method, turbulence models, type of grids, grid generation methods, application to flow governing equations.

References

1. Computational Fluid Flow and Heat Transfer-Murlidhar K. & Sundararajan, Alpha Science Intl, Ltd.
2. An Introduction to Computational Fluid Dynamics- Versteeg H.K.& Malalasekera W Pearson
3. Turbulent Flow- Garde R.J, New Age Science Ltd.
4. Numerical Heat Transfer and Fluid Flow- Patankar Suhas V, CRC Press

HYD554 PROJECT PLANNING AND MANAGEMENT

Economic planning-Basic economics, Investment analysis, Socio-economic analysis, Environmental impact studies, Feasibility studies, Implementation of hydropower projects, Management of estimation, sanction, contracts, planning after award of contract, Management of project coordination, project control system, Construction management, Operation and maintenance

References

1. Water Resources System Planning- M.C. Chaturvedi. McGraw-Hill Inc.
2. Water Management System Application- A.K. Biswas,
3. Principle of Water Resources planning- Goodman, Prentice Hall.
4. Water Resources Planning and Management -O.J. Helwege, Jonh Wiley and Sons.Inc.

HYD555 DESIGN AND ANALYSIS OF PIPING SYSTEM

Pipe materials and sizes, laying of pipes, laminar and turbulent flow, pipe fittings, losses in pipes and fittings, pipes in series and parallel, system loss characteristics, pump capacity, optimal diameter selection, valves and their locations, transient flow, analysis of pipe networks, pipe network analysis software.

References

1. Fluid mechanics & Hydraulic machines- Modi &Seth, Standard Book House.
2. Fluid mechanics- Streeter & Wylie, McGraw Hill Education
3. Water Transmission and Distribution- AWWA, American Water Works Association
4. Piping - Handbook ,Naynor, McGraw, Hill.