

Course Contents

1. Give details of the course, on the following lines:

- a. Course Code ESE-825
- b. Title Hydropower Engineering
- c. Credit Hours 3
- d. Objectives

To provide quality education in the field of hydropower engineering to the MS students to know about various hydropower resources whereby they learn approach / technique to initiate a project, take it through its life cycle till its implementation, operation and maintenance. The graduates should have a basic engineering degree of civil, electrical, environmental or mechanical engineering. Having good command of the basic theories, knowledge and skills required in the industry; possess overall management ability in the design and construction of general hydropower projects; be good at self-directed learning and be able to obtain up-to-date knowledge in the field of hydropower engineering.

- e. Outcomes
 - (1) To produce highly-skilled professionals focused on productive research and development in the vast domain of Hydropower.
 - (2) To prepare a team of specialist engineers who will be able to work on and able to undertake the HP development independently.

f. Contents with suggested contact hours

Contents	Mode	Contact Hours
1: World Total Energy <ul style="list-style-type: none">a. World Total Energy Scenariob. Major Energy Resources and Expectancyc. Comparison of Energy Resources of Pakistan, Iran, Turkey, China and India	Lecture	3
2: Energy Resources of Pakistan	Lecture	3

<ul style="list-style-type: none"> a. Hydropower Resources b. Thermal Power Plants c. Potential of Bio- fuel in Pakistan d. Solar and Wind Potential e. Imported Natural Gas f. Coal Sector in Pakistan 		
3: Comparison of Hydro Power with other Energy Resources <ul style="list-style-type: none"> a. Alternate Energy Projects 	Lecture	3
4: Classification of Hydro Power Schemes <ul style="list-style-type: none"> a. Micro b. Mini c. Small d. Medium e. Large f. Super 	Lecture	3
5: Components of MHP <ul style="list-style-type: none"> a. Head Race, Fore bay, Penstock, Turbine and generator, Tail Race 	Lecture	3
6: Stages of Hydro Power Development <ul style="list-style-type: none"> a. Survey of Hydropower Potential Scheme b. Site Selection Criteria c. Power Estimation d. Preparation of Feasibility Study e. Scheme Design Parameters f. Geology g. Hydrology h. Hydraulics i. Project Layout and Plant Sizing j. Alternate Project Layout k. Tunneling engineering 	Lecture	9

I. Reservoir Engineering		
7: Governmental Policy and Tariff Structure for a Hydro Power Project a. Governmental Power Policy for developing a new Hydro Power Project b. Tariff Determination of a Hydropower Project	Lecture /Case Study	3
8: Design Parameters of E&M Equipment a. Design Parameters of Pelton wheel Turbine b. Design Parameters of Kaplan Turbine c. Design Parameters of Francis Turbine d. Design Parameters of Cross flow Turbine	Lecture	6
9: Selection Criteria and Estimation of Cost a. Selection Criteria for E&M Equipment b. Feasibility Study Cost c. Development Cost d. Civil Structure Cost e. Electro Mechanical and auxiliary equipment Cost	Lecture	9
10: Environmental Impact Analysis of Hydropower Scheme a. Case Study of Neelam Jehlum Hydro Power Project	Case Study	3
Total		45
Visit of a Hydro Project Site will be conducted during the course work		

g. Details of lab work, workshops practice (if applicable).

No lab work will be needed at this stage, however lab equipment and few software's related to hydropower will be required in future for which a separate working paper will be submitted in due course of time after obtaining the price of lab equipment and soft wares.

h. Recommended Reading (including Textbooks and Reference books).

- (1) J. G Brown, Hydro Electric Engineering Practices (3 Vol.) (Text Book)
- (2) P.S Nigam, Hydro Electric Engineering
- (3) M.M Dandekar, Water Power Engineering
- (4) Hans Jonnson and Paulina Bohdanowicz, Sustainable Energy Utilization
- (5) Brian K, The Economies of Hydroelectric Power
- (6) Energy for Rural Development