

## Hydraulic Structures & Hydropower Engineering Module

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|--|---|----------|---------------|------------|
| Course Title                                   | Basics of Hydropower Engineering  |          |               |            |
| Course Code                                    | WRIE3154  |          |               |            |
| Degree Program                                 | B.Sc in Water Resources and Irrigation Engineering  |          |               |            |
| Module name                                    | Hydraulic Structures  |          |               |            |
| Module Coordinator                             | Name: .....<br>Office location . .....<br>Mobile: .....; e-mail: .....<br>Consultation Hours: _____   |          |               |            |
| Instructor Name                                | Name: .....<br>Office location . .....<br>Mobile: .....; e-mail: .....<br>Consultation Hours: _____   |          |               |            |
| ECTS   | <b>3 ECTS</b>   |          |               |            |
| Contact Hours (per week)                       | Lecture   | Tutorial | Lab/Practical | Home study |
|  | <b>2</b>  | <b>0</b> | <b>0</b>      | <b>3</b>   |
| Course Objectives & Competences to be Acquired | The main objective of this course is to equip students with the basic principles of hydropower development and preliminary design of component structures in a hydropower scheme.   |          |               |            |
| Course Description/Course Contents             | Introduction: sources of energy; hydropower & its development; Estimation of water power potential: firm & secondary power load prediction and demand assessment. Classification and types of hydropower development: selection of site; layouts for each type & capacity computations. Water conveyance structures: intakes, canals & tunnels; fore bay & surge tanks (water hammer analysis); penstocks; anchor blocks. Powerhouse: classification of different types; turbines-types & selection governing mechanism; cavitations, generators and other equipments selection of suitable equipment & compatibility: operation and organization; draft tubes and tailrace. Status, potential and study of hydropower development in Ethiopia. Alternative energy sources: Wind energy, solar energy and Technology for Biogas |          |               |            |
| Pre-requisites                                 | Dam Engineering I   |          |               |            |
| Status of Course                               | Core  |          |               |            |

### Schedule/Syllabus

| Week | Contents  | Teaching Materials |
|------|---|--------------------|
|      | <b>1. Introduction(Lec=2hrs)</b><br>1.1.sources of energy   |                    |
|      | <b>2. small scale hydropower(Lec=8hrs, Tut=10hrs)</b><br>2.1 status of small hydropower<br>2.2 place of small hydro power in a power system<br>2.3 Estimation of small hydropower potential at different locations in Ethiopia.<br>2.3.1 Flow duration curve<br>2.3.2 firm power<br>2.3.3 secondary power<br>2.3.4 load factor,<br>2.3.5 capacity factor<br>2.3.6 Utilization factor. |                    |

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| <p><b>3. Small, mini, and micro hydro schemes(Lec=5hrs, Tut=5hrs)</b></p> <p>3.1 Identification of civil works for Small, mini, and micro hydro schemes for various head.</p> <p>3.2 Location of civil works for small, mini, micro hydro schemes for various head.</p> <p>3.3 Layout of civil works for small, mini, micro hydro schemes for various head.</p> <p>3.4 Design of civil works for small, mini, micro hydro schemes for various head.</p> <p>3.5 Construction of civil works for small, mini, micro hydro schemes for various head.</p> <p>3.6 Maintenance of civil works for small, mini, micro hydro schemes for various head.</p> |   |
| <p><b>4. Turbine and Generators for small hydro plants (Lec=5hrs, Tut=5hrs)</b></p> <p>4.1 Design of turbine for small hydro plants</p> <p>4.2 Operation of turbine for small hydro plants</p> <p>4.3 maintenance and working details of turbine for small hydro plants</p> <p>4.4 Design of generator for small hydro plants</p> <p>4.5 Operation of generator for small hydro plants</p> <p>4.6 maintenance and working details of generator for small hydro plants</p> <p>4.7 Details of other equipment needed for small hydropower schemes</p> <p>4.8 Portable equipment for tapping small hydro power from transient sources.</p>            |   |
| <p><b>5. Policy for small hydro power generation and utilization in Ethiopia(Lec=3hrs)</b></p> <p><b>5.1.</b>Case studies for small hydro power generation in other countries..</p>  |   |
| Teaching & Learning Methods  | Lecture, tutorials, discussion, individual work, problem solving, project work  |
| Assessment   | <p>10% Quizzes = Chapter 1,2&amp;3</p> <p>20% Tests = All Chapter</p> <p>10% assignments = Chapter 2,3,4&amp;5</p> <p>10% project work</p> <p>50% Final-exam = Chapters 4,5&amp;6</p>   |
| Attendance Requirements  | A student must attend at least 75 % of the classes  |
| Literature   | <ul style="list-style-type: none"> <li>• Small and Mini Hydropower System Fritz New York 1984</li> <li>• Hydraulic structures by Novak P</li> <li>• Water power engineering B.B Lal</li> <li>• Solar Energy Conversion Solar Cell NevilleAmsterdam 1995</li> <li>• Solar Energy Utilization. Rai D.G Khanna,2004</li> <li>• Non-Conventional Energy Sources Rai G.D. North America, 2004</li> <li>• Wind Energy Basics: A Guide to Small and Micro Wind System Gipe Paw U.S.A 1999</li> </ul> |