

(13ME214) HYDRAULICS AND HYDRAULIC MACHINERY

Program : B.Tech
Year : II
Sem : II
Int. Max Marks : 30
Ext. Max Marks : 70

Lecture : 4/Week
Tutorial : 1/Week
Practical : -
Credits : 4

COURSE OBJECTIVES:

Students will be able to

1. Discuss the types of open channels and design the most economical sections.
2. Apply the methods of dimensional analysis & its importance.
3. Apply the momentum principles to calculate the forces expected by a liquid jet.
4. Classify and explain the working principles of turbines and pumps.
5. Sketch the general arrangement of hydro electric power plant in elevation

COURSE OUTCOMES:

Upon completion of this course, students will develop an ability to.....

1. Analyze the uniform and non uniform flows in open channels.
2. Design open channels for most economical sections like rectangular trapezoidal and circular sections
3. Discriminate the use of dimensional analysis in solving fluid problems and plan hydraulic similitude studies.
4. Explaining the basics of the hydro machinery and the components, functions and use of difficult types of turbines and pumps.
5. Estimation of hydro power potential.
6. Design of draft tubes and functions of draft tube.
7. Explain the working principles of all the turbines and pumps.
8. Compute efficient flow turbines.

Time Table:

Monday			Thursday	2	09:30 AM to 11:10 AM
Tuesday	2	02:30PM to 04:00PM	Friday	1	10:20 AM to 11:10 AM
Wednesday			Saturday		

LESSON PLAN

Name of the Faculty : M.Sravanthi

Academic Year: 2015 - 2016

Course Number : 13ME214

Course Name : H&HM

Program : B. Tech.

Branch : CE

Year/Semester : II/ II

Section : A

UNIT – I: Open channel flow

Learning Objectives: At the end of the unit, the students will be able to.....

- Classify the types of flows and types of channels
- Design of Most economical section
- Know computation of Critical depth in a flow
- Design of hydraulic jump in an open channel flow
- Distinguish between uniform flows and Non uniform flows

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Introduction to open channel flow, Types of flows	08/12/15
2	Type of flows and channels, explanation with figures	09/12/15
3	Chezy's, Manning's and Basin formulae for uniform flows and Problems	11/12/15
4	Most economical section of rectangular trapezoidal and circular sections	12/12/15
5	Problems on rectangular trapezoidal and circular sections	22/12/15
6	Flow through open circular channel and Problems	31/12/15
7	Most economical circular channel section derivation and Problems	05/01/16
8	Critical flow, specific energy- critical depth and computation of critical depth for various conditions	08/01/16
9	Problems on Critical depth, critical velocity, critical flow	08/01/16
10	Rapidly varied flow , Hydraulic jump	12/01/16
11	Derivation of hydraulic jump, energy dissipation	20/01/16
12	Problem on hydraulic jump and losses	21/01/16
13	Dynamic equation for G.V.F for steep, horizontal	21/01/16

UNIT-II: Hydraulic similitude

Learning Objectives: At the end of the unit, the students will be able to.....

- List out Dimensions of various physical quantities
- Compare Rayleigh's method and Buckingham's pi method
- Analyze the hydraulic model using dimensional analysis
- Analyze model and prototype relations

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Introductions of Dimensional analysis	22/01/16
2	Rayleigh's method	22/01/16
3	Problems on Rayleigh's method	28/01/16
4	Buckingham's pi method	28/01/16
5	Problems on Buckingham's pi method	29/01/16
6	Study of Hydraulic models	04/02/16
7	Geometric, kinematic and dynamic similarities	04/02/16
8	Dimensionless numbers	05/02/16
9	Model and prototype relations	09/02/16
10	Problems on dimensionless numbers	09/02/16

UNIT-III: Basic of turbo machinery

Learning Objectives: At the end of the unit, the students will be able to.....

- Analyze hydrostatic forces of jets on stationary and moving vanes
- Analyze hydrostatic forces of jets on inclined and curved vanes
- Explain velocity triangles at inlet and outlet
- Explain expression for work done and efficiency
- Apply angular momentum principle

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Hydrodynamic force of jets on stationary Flat blades	11/02/16
2	Hydrodynamic force of jets on stationary inclined blades	12/02/16
3	Hydrodynamic force of jets on stationary curved blades	16/02/16 18/02/16
4	Problems on stationary blades	18/02/16
5	Hydrodynamic force of jets on moving Flat and curved blades	19/02/16
6	Problems on moving Flat and curved blades	23/02/16

7	Jet striking centrally and at tip	23/02/16
8	Velocity triangles at inlet and outlet	25/02/16
9	Expressions for work done and efficiency	25/02/16
10	Problems on efficiency	26/02/16
11	Angular momentum principle	01/03/16
12	Applications to radial flow turbines	03/03/16
13	Problems of radial flow turbines	04/03/16

UNIT-IV: Hydraulic turbines and pumps

Learning Objectives: At the end of the unit, the students will be able to.....

- Classify the types of turbines
- Explain the working principles of various turbines
- Compare between impulse and reaction turbines
- Classify the types of pumps
- Compare between centrifugal and reciprocating pump
- Explain the expression for work done and efficiencies for turbines and pumps

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Layout of a typical Hydropower installation Heads and efficiencies	08/03/16
2	Classification of turbines- Pelton wheel, Francis, Kaplan	10/03/16
3	Working principles of Pelton wheel, Francis, Kaplan	10/03/16
4	Problems and design of Pelton wheel, Francis, Kaplan	11/03/16
5	Working proportions, velocity diagram, Work done and efficiency	15/03/16
6	Problems on Work done and efficiency	15/03/16
7	Hydraulic design, draft tube ,theory and function efficiency, Governing of turbines-surge tanks	17/03/16
8	Unit and specific turbines-unit speed-unit quantity-unit power	17/03/16
9	Pump installation details-classification-work done.	18/03/16
10	Manometric head-minimum starting speed, Losses and efficiencies, Specific speed	22/03/16
11	Multistage pumps-pumps in parallel	22/03/16
12	Performance of pumps-characteristic curves	24/03/16
13	NPSH- Cavitation , Problems on pumps	25/03/16

UNIT-V: Hydropower engineering

Learning Objectives: At the end of the unit, the students will be able to.....

- Classification of hydro power plants
- Sketch the general arrangement of hydroelectric power plant in elevation
- Computation of load factor, utilization and capacity factors
- Estimation of hydro power potential

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Hydropower Engineering: Classification of Hydropower plants.	29/03/16
2	Definition of terms – load factor, utilization factor.	29/03/16
3	Capacity factor & Problems.	29/03/16
4	Estimation of hydropower potential.	30/03/16
5	Problems on plant factors.	30/03/16
6	Previous papers discussion.	30/03/16
7	Tutorial.	30/03/16

Sr. No	Type of exam	Scheduled date (DD/MM/YY)
1	Mid semester exam - I	01/02/16 to 03/02/16
2	Mid semester exam - II	31/03/16 to 02/04/16
3	End semester exam (Regular)	04/04/16 to 30/04/16
4	End semester exam (Supplementary)	23/04/16 to 18/05/16

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Credits : 4

COURSE OBJECTIVES:

The Students will be able to

6. Discuss the types of open channels and design the most economical sections.
7. Apply the methods of dimensional analysis & its importance.
8. Apply the momentum principles to calculate the forces expected by a liquid jet.
9. Classify and explain the working principles of turbines and pumps.
10. Sketch the general arrangement of hydro electric power plant in elevation

COURSE OUTCOMES:

At the end of the course, students will develop an ability to.....

9. Analyze the uniform and non uniform flows in open channels.
10. Design open channels for most economical sections like rectangular trapezoidal and circular sections
11. Discriminate the use of dimensional analysis in solving fluid problems and plan hydraulic similitude studies.
12. Explaining the basics of the hydro machinery and the components, functions and use of difficult types of turbines and pumps.
13. Estimation of hydro power potential.
14. Design of draft tubes and functions of draft tube.
15. Explain the working principles of all the turbines and pumps.
16. Compute efficient flow turbines.

Time Table:

Monday	1	1:30P.M to 2:20P.M	Thursday		
Tuesday	2	11:10AM to 12:50PM	Friday		
Wednesday			Saturday	2	9:30AM to 11:10A.M

LESSON PLAN

Name of the Faculty : A. Ramya

Course Number : 13ME214

Program : B. Tech.

Year/Semester : II/ II

Academic Year: 2015 - 2016

Course Name : H&HM

Branch : CE

Section : B

UNIT – I: Open channel flow, Critical flow

Learning Objectives: At the end of the unit, the students will be able to.....

- Classify the types of flows and types of channels
- Design of Most economical section
- Know computation of Critical depth in a flow
- Design of hydraulic jump in an open channel flow
- Distinguish between uniform flows and Non uniform flows

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Introduction to open channel flow, Types of flows	07/12/15
2	Type of flows and channels, explanation with figures	08/12/15
3	Chezy's, Manning's and Bazin's formulae(derivations) for uniform flows and Problems	08/12/15 12/12/15
4	Problems on manning's, Bazin's formula on rectangular section	14/12/15
5	Problems on Chezy's of triangular, trapezoidal and channels	15/12/15
6	Most economical section-trapezoidal(derivation and problems) Flow through open circular channel and Problems	19/12/15 21/12/15
7	Most economical circular channel-derivation and Problems Critical flow, specific energy- critical depth, critical velocity	22/12/15 26/12/15
8	Computation of critical depth for various conditions and problems on Critical depth, critical velocity, critical flow	26/12/15 28/12/15
9	Non –uniform flows- Rapidly varied flow , Hydraulic jump	29/12/15
10	Hydraulic jump expression(full derivation) and expression for loss of energy due to hydraulic jump	02/01/16 04/01/16
11	Expression for depth of hydraulic jump in terms of upstream Froude number and problems	05/01/16 09/01/16 11/01/16
12	Problem on hydraulic jump and losses Dynamic equation for G.V.F for steep, horizontal	12/01/16 18/01/16 19/01/16

UNIT-II: Hydraulic similitude

Learning Objectives: At the end of the unit, the students will be able to.....

- List out Dimensions of various physical quantities
- Compare Rayleigh's method and Buckingham's pi method
- Analyze the hydraulic model using dimensional analysis
- Analyze model and prototype relations

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Introductions of Dimensional analysis	23/01/16
2	Rayleigh's method	23/01/16
3	Problems on Rayleigh's method	30/01/16
4	Buckingham's pi method	06/02/16
5	Problems on Buckingham's pi method	06/02/16
6	Study of Hydraulic models	06/02/16
7	Geometric, kinematic and dynamic similarities	08/02/16
8	Dimensionless numbers	09/02/16
9	Model and prototype relations	09/02/16
10	Problems on dimensionless numbers	09/02/16

UNIT-III: Basic of turbo machinery

Learning Objectives: At the end of the unit, the students will be able to.....

- Analyze hydrostatic forces of jets on stationary and moving vanes
- Analyze hydrostatic forces of jets on inclined and curved vanes
- Explain velocity triangles at inlet and outlet
- Explain expression for work done and efficiency
- Apply angular momentum principle

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Hydrodynamic force of jets on stationary Flat blades	13/02/16
2	Hydrodynamic force of jets on stationary inclined blades	13/02/16
3	Hydrodynamic force of jets on stationary curved blades	15/02/16
4	Problems on stationary blades	16/02/16
5	Hydrodynamic force of jets on moving Flat and curved blades	16/02/16
6	Problems on moving Flat and curved blades	20/02/16

7	Jet striking centrally and at tip	20/02/16
8	Velocity triangles at inlet and outlet	20/02/16
9	Expressions for work done and efficiency	22/02/16
10	Problems on efficiency	23/02/16
11	Angular momentum principle	23/02/16
12	Applications to radial flow turbines	23/02/16
13	Problems of radial flow turbines	29/02/16

UNIT-IV: Hydraulic turbines and pumps

Learning Objectives: At the end of the unit, the students will be able to.....

- Classify the types of turbines
- Explain the working principles of various turbines
- Compare between impulse and reaction turbines
- Classify the types of pumps
- Compare between centrifugal and reciprocating pump
- Explain the expression for work done and efficiencies for turbines and pumps

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Layout of a typical Hydropower installation Heads and efficiencies	29/02/16
2	Classification of turbines- Pelton wheel, Francis, Kaplan	01/03/16
3	Working principles of Pelton wheel, Francis, Kaplan	01/03/16
4	Problems and design of Pelton wheel, Francis, Kaplan	08/03/16
5	Working proportions, velocity diagram, Work done and efficiency	12/03/16
6	Problems on Work done and efficiency	14/03/16
7	Hydraulic design, draft tube ,theory and function efficiency, Governing of turbines-surge tanks	15/03/16
8	Unit and specific turbines-unit speed-unit quantity-unit power	15/03/16 19/03/16
9	Pump installation details-classification-work done.	19/03/16
10	Manometric head-minimum starting speed, Losses and efficiencies, Specific speed	21/03/16
11	Multistage pumps-pumps in parallel	22/03/16
12	Performance of pumps-characteristic curves	22/03/16
13	NPSH- Cavitation , Problems on pumps	26/03/16

UNIT-V: Hydropower engineering

Learning Objectives: At the end of the unit, the students will be able to.....

- Classification of hydro power plants
- Sketch the general arrangement of hydroelectric power plant in elevation
- Computation of load factor, utilization and capacity factors
- Estimation of hydro power potential

Lect. No.	Topic of the lecture	Schedule Date DD/MM/YY
1	Hydropower Engineering: Classification of Hydropower plants.	28/03/16
2	Definition of terms – load factor, utilization factor.	28/03/16
3	Capacity factor & Problems.	28/03/16
4	Estimation of hydropower potential.	29/03/16
5	Problems on plant factors.	29/03/16
6	Previous papers discussion.	29/03/16

Sr. No	Type of exam	Scheduled date (DD/MM/YY)
1	Mid semester exam - I	01/02/16 to 03/02/16
2	Mid semester exam - II	31/03/16 to 02/04/16
3	End semester exam (Regular)	04/04/16 to 30/04/16
4	End semester exam (Supplementary)	23/04/16 to 18/05/16