Hydraulics
BEG262CI

YEAR-II **SEMESTER-II**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory Marks	Practical Marks	
L	P	T	Duration	Marks	Duration	Marks			
3	2/2	2	3	80	-	-	20	25	125

Course Objective:

Course Contents:

1 Pipe Flow (6 hrs)

1.1 Introduction
1.2 Continuity and Bernoulli's Equations
1.3 Laminar and Turbulent Flow, Reynolds' Equation
1.4 Head loss, Hazen Poisseuile Equation
1.5 Hydraulic and Energy Grade lines
1.6 Darcy-Weisbach's formula, Colebrooke-White's Equations and its Development. Use of Moody's Chart
1.7 Types of pipe flow problems and their solutions.

2. Pipe Networking (5 hrs)

2.1 Short and Long Pipes with constant diameters
2.2 Pipes in Series and Parallel
2.3 Equivalent Pipe
2.4 Pipe network by Hardy-Cross method
2.5 Three Reservoir Problem and its solution

3. Syphon (2 hrs)

3.1 Definition and condition of application
3.2 Conditions for continuous supply
3.3 Syphon problem and its solution

4. Unsteady Flow in Pipes (4 hrs)

4.1 Water Hammer and its effects in pipes and Penstock
4.2 Water Hammer due to gradual closure of valve
4.3 Variation of pressure due to sudden closure of valve for the cases of rigid and elastic pipes
4.4 Relief devices against action of water hammer

5. Open Channel Flow (3 hrs)

5.1 Open Channel as mode of Water Transportation
5.2 Differences between pipe flow and open channel flow
5.3 Classifications and shapes of open channel

5.4 Geometric properties of channel: Area of Flow, Wetted Perimeter and Hydraulic Radius

5.5 Classification of open channel by time, space and hydraulic regime

6. Uniform Flow (6 hrs)

6.1 Condition of uniform flow in prismatic channel

6.2 Shear stress and velocity Distribution

6.3 Chezy's and Manning's equations

6.4 Relationship between Chezy's, Manning and Darcy's coefficient

6.5 Most economic rectangular, triangular, trapezoidal and circular section

6.6 Types of uniform flow problemsand solutions

7. Flow over Notches and Weirs (4 hrs)

7.1 Types of weirs

7.2 Discharge equations for Rectangular, Triangular and Trapezoidal weirs, Francis' formula

7.3 Consideration of approach velocity and notch ventilation

7.4 Advantage of notches

8. Non-Uniform Flow in Open Channel (4 hrs)

8.1 Energy and Momentum Principles for open channel flow

8.2 Specific energy, critical depth, alternate depths of flow and depth-discharge relationship

8.3 Use of specific energy concept in analyzing flow over broad-crested weir, flumes and Venturi flume.

8.4 Concept of specific force

9. Gradually Varied Flows (4 hrs)

9.1 Description of water surface profiles for variousWater Retaining Structures

9.2 Governing equation of gradually varied flow and assumptions in their Derivations

9.3 Classification of slopes

9.4 Solution of Gradually varied flow Equations by Graphical and Numerical methods

10. Hydraulic Jump and its Analysis (3 hrs)

10.1 Flow conditions and applications

10.2 Hydraulic Jump equation

10.3 Energy Loss in Hydraulic Jump

10.4 Practical Examples of Jump

11. Flow in Non-rigid Boundary Channel (2 hrs)

11.1 Non-rigid Boundary channel - Difference from Rigid Boundary Channel

11.2 Effects of shear stress and incipient motion, Critical tractive stress

11.3 Shield's approach of predicting critical tractive stress

11.4 Various types of Bed forms

12. Similitude and Physical Modeling (2 hrs)

12.1 Definition and Types of Similarities

12.2 Definition and Types of Models, Necessity of model Studies

12.3 Modeling Criteria

12.4 Introduction to Distorted and Undistorted Models

12.5 Introduction to Scale Effects in Model Studies

Laboratories:

(i) Reynolds' Experiment
(ii) Head Loss in a pipe line
(iii) Flow through sluice gate
(iv) Hydraulic Jump in open channel
(v) Flow over Broad-crested Weir, Triangular Notch and Rectangular Notch

References:

- VenTe Chow, Open Channel Hydraulics, McGraw Hill Book Co. Ltd., 1973 4. P. N. Modi & S.M. Seth, Fluid Mecha11ics & Hydraulics, standard Book House,200
- K. Subramanya, Flow in Open Channels, Tara McGra w H publishing Co. Ltd.,2000
- J Lal Fluid Mechanics & Hydraulics, Metropolitan Books Co. Ltd., New Delhi, India
- K. G. Ranga Raju, Flow through Open Channel, Tata McGraw Hill Publishing Co. Ltd.New Delhi, India