# Ch. Ranbir Singh State Institute of Engineering & Technology, Jhajjar

**DEPARTMENT OF MECHANICAL ENGINEERING**

III Yr. V Semester (Mechanical Engineering)

### LESSON PLAN

Program : **B. Tech**

Year & Sem. :  **III / V**

Course No : PCC **ME-309G**

Course Title : **Fluid Machines**

Max Marks **: 75**

No. of Total Lecture **: 52**

Schedule : **3L+0T= 3**

Lecturer : **Satyapal Yadav**

**Recommended Books:**

1. Fluid Mechanics and Hydraulic Machines – Mahesh Kumar, Pearson Indian Education Service Pvt. Ltd. India.

2. Hydraulics & Fluid Mechanics – Modi & Seth, Pub. - Standard Book House, N.Delhi

3. Hydraulic Machines – Jagdish Lal, Metropolitan

**Lesson Plan:**

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| Lect. No(s) | Ref. No. | Topics to be covered |
|  |  | Unit I: |
| 1-2 | 1.1 | Impact of free jets: Impulse – momentum principle |
| 3 | 1.2 | jet impingement - at the center of a stationary vane |
| 4-5 | 1.3 | jet impingement - on a moving flat plate, inclined plate |
| 6 | 1.4 | jet impingement - a moving vane and a series of vanes |
| 7-8 | 1.5 | Jet striking tangentially at the tip of a stationary vane and moving vane(s) |
| 9 | 1.6 | jet propulsion of ships, Problems. |
| 10 | 1.7 | Classification – impulse and reaction turbines, water wheels |
| 11 | 1.8 | component parts, construction, operation and governing mechanism of a Pelton wheel, work done, |
| 12 | 1.9 | effective head, available head and efficiency of a Pelton wheel, design aspects, speed ratio, flow ratio |
| 13 | 1.10 | jet ratio, number of jets, number of buckets and working proportions, Performance Characteristics, governing of impulse turbines, |
| 14 | 1.11 | Problems |
|  |  | Unit II: |
| 15 | 2.1 | Component parts, construction and operation of a Francis turbine |
| 16 | 2.2 | Governing mechanism, work done by the turbine runner |
| 17 | 2.3 | working proportions and design parameters |
| 18 | 2.4 | slow, medium and fast runners |
| 19 | 2.5 | degree of reaction, inward/outward flow reaction turbines |
| 20 | 2.6 | Performance Characteristics, Problems |
| 21 | 2.7 | Component parts, construction and operation of a Propeller |
| 22 | 2.8 | Kaplan turbine, differences between the Francis and Kaplan turbines |
| 23 | 2.9 | draft tube - its function and different forms, |
| 24 | 2.10 | Performance Characteristics, Governing of reaction turbine |
| 25 | 2.11 | Introduction to new types of turbine, Deriaz ( Diagonal ), Bulb, Tubular turbines |
| 26 | 2.12 | Problems |
|  |  | Unit III: |
| 27 | 3.1 | Dimensional homogeneity, Rayleigh’s method and Buckingham’s πtheorem, model studies and similitude |
| 28 | 3.2 | Dimensionless numbers and their significance. Unit quantities, specific speed and model relationships for turbines |
| 29 | 3.3 | scale effect, cavitation’s – its causes, harmful effects and prevention |
| 30-31 | 3.4 | Thomas cavitation factor, permissible installation height, |
| 32 | 3.5 | Problems |
| 33-34 | 3.6 | Classification, velocity vector diagrams and work done, manometric efficiency, vane shape, |
| 35 | 3.7 | head capacity relationship and pump losses, pressure rise in impeller |
| 36 | 3.8 | minimum starting speed, design considerations, multi-stage pumps |
| 37 | 3.9 | Similarity relations and specific speed, net positive suction head, |
| 38 | 3.10 | cavitation and maximum suction lift, performance characteristics |
| 39 | 3.11 | Brief introduction to axial flow, mixed flow and submersible pumps, |
| 40 | 3.12 | Problems |
|  |  | Unit IV: |
| 41 | 4.1 | Construction and operational details, discharge coefficient, volumetric efficiency and slip, work and power input |
| 42 | 4.2 | effect of acceleration and friction on indicator diagram (pressure – stroke length plot), |  |
| 43 | 4.3 | separation, air vessels and their utility, rate of flow into or from the air vessel, |
| 44-45 | 4.4 | maximum speed of the rotating crank, characteristic curves, centrifugal vs reciprocating  pumps, |
| 46 | 4.5 | brief introduction to screw, gear, vane and radial piston pumps, and Problems |
| 47 | 4.6 | Function, construction and operation of Hydraulic accumulator |
| 48 | 4.7 | Hydraulic intensifier, hydraulic crane, |
| 49 | 4.8 | hydraulic lift and hydraulic press, |
| 50 | 4.9 | Fluid coupling and torque converter, |
| 51 | 4.10 | Hydraulic ram, |
| 52 | 4.12 | Problems |

**(Satyapal Yadav)**

Department of ME

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