POLYTECHNICS
MINISTRY OF HIGHER EDUCATION
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE : JJ309 FLUID MECHANICS
INSTRUCTIONAL DURATION : 15 WEEKS
CREDIT(S) : 2
PREREQUISITE(S) : NONE

SYNOPSIS
FLUID MECHANICS provides students with a strong fundamental understanding on fluid mechanics principles relating to basic foundation knowledge on fluid properties and behaviour in a number of static and dynamic situations.

COURSE LEARNING OUTCOMES (CLO)
Upon completion of this course, students should be able to:-
1. explain clearly the characteristics of fluid.(C2)
2. solve problems correctly related to fluid properties, fluid statics and fluid dynamics.(C3)
3. explain the theory of fluid mechanics related to engineering field in group.(A4)
SUMMARY

1.0 FLUID PROPERTIES

This topic covers characteristics of fluid, pressure Gauge measurements, physical properties of fluid, viscosity and compressibility.

2.0 FLUID STATICS

This topic introduces the relationship between pressure and depth. It also allows students to understand and analyze pressure head. It explains the Law of Pascal and its relationship with hydraulic jack application. This topic explains the methods in solving problems involving pressure measurement, buoyancy and pressure.

3.0 FLUID DYNAMICS

This topic covers flow, discharge, mass flow rate in pipe, continuity equation, Bernoulli equation and measurement of fluid in motion.

4.0 ENERGY LOSS IN PILELINES

This topic covers velocity profile in circular pipe, type of head loss in pipelines, flow characteristic, head loss equation for flow rate and pipelines problems.

5.0 NOZZLE

This topic covers types and shapes of nozzles, critical pressure ratio, changes in pressure, temperature, maximum mass flow and cross-sectional area.

RTA - Recommended Time Allocation

RTA

1.0 FLUID PROPERTIES (04:00)

2.0 FLUID STATICS (06:00)

3.0 FLUID DYNAMICS (08:00)

4.0 ENERGY LOSS IN PILELINES (08:00)

5.0 NOZZLE (04:00)
SYLLABUS

1.0  FLUID AND PROPERTIES

1.1  Explain fluid characteristics
1.1.1  Define fluid
1.1.2  Describe fluid terms
1.1.3  Compare the characteristics between liquid, gas and solid

1.2  Illustrate types of pressure gauge
1.2.1  Define
   a. Atmospheric pressure
   b. Gauge pressure
   c. Absolute pressure
   d. Vacuum pressure
1.2.2  Solve problems related to pressure gauge

1.3  Apply physical properties of fluid
1.3.1  Define
   a. Mass density and relative density
   b. Specific weight and specific volume
   c. Fluid compressibility
   d. Viscosity
1.3.2  Solve problems related to physical properties of fluid

2.0  FLUID STATICS

2.1  Show relationship between pressure and depth
2.1.1  write basic equation based on relationship pressure and depth
2.1.2  describe pressure at same and different depths
2.1.3  Solve problems related to relationship between pressure and depth

2.2  Apply Pascal’s Law and hydraulic jack
2.2.1  State Pascal’s Law
2.2.2  Describe hydraulic jack
2.2.3  Solve problems regarding Pascal’s Law and hydraulic jack

2.3  Apply concept of manometer, piezometer and barometer
2.3.1  Explain concept of manometer, piezometer and barometer
2.3.2  Solve problems regarding manometer;
   a. Simple U-Tube manometer
   b. Differential u-Tube manometer
   c. Inverted U-Tube manometer
2.3.3 solve problems regarding piezometer and barometer

2.4 Explain concept of a bourdon gauge
   2.4.1 Sketch important parts of bourdon gauge
   2.4.2 Explain mechanism of a bourdon gauge

2.5 Explain concept of buoyancy
   2.5.1 Define buoyancy force
   2.5.2 Solve problems related to buoyancy force

3.0 FLUID DYNAMICS

3.1 Describe difference types of flow
   3.1.1 Define types of flow
         a. Uniform flow
         b. Steady flow
         c. Unsteady flow
         d. Laminar flow
         e. Turbulent flow
   3.1.2 Describe different characteristics of laminar and turbulent flow

3.2 Describe flow rate
   3.2.1 Define volume flow rate and mass flow rate
   3.2.2 Find volume flow rate and mass flow rate

3.3 Apply continuity equation law
   3.3.1 State continuity equation law
   3.3.2 Solve problems related to continuity equation in single and branch pipe.

3.4 Apply Bernoulli Theorem
   3.4.1 State Bernoulli Theorem
   3.4.2 State the limits of Bernoulli Theorem
   3.4.3 Solve problems related to Bernoulli Theorem in:
         a. Horizontal pipe
         b. Incline pipe
         c. Horizontal venturi meter
         d. Incline venturi meter
         e. Orifice meter
         f. Pitot tube
   3.4.4 Illustrate the important parts of venturi meter
4.0 ENERGY LOSS IN PIPELINES

4.1 Explain the round pipe system
   4.1.1 Sketch the velocity distribution diagram in the round pipe system
   4.1.2 Explain the velocity distribution in the round pipe system

4.2 Trace the head loss in pipelines
   4.2.1 Analyze head loss caused by;
       a. Sudden enlargement and contraction
       b. Friction
       c. At the sharp inlet
       d. At the outlet
   4.2.2 Explain flow criteria at inlet and outlet
   4.2.3 Solve horizontal and incline pipeline problems

5.0 NOZZLE

5.1 Explain nozzle in engineering fields
   5.1.1 Explain nozzle uses in engineering fields:
       a. Steam turbine
       b. Gas turbine
       c. Jet turbine
       d. Flow measurement
       e. Rocket propulsion
       f. Steam injector
       g. Injector
   5.1.2 Explain types of nozzle
   5.1.3 Sketch shape of nozzle
   5.1.4 Define “critical pressure ratio” for nozzle
   5.1.5 Solve problems regarding to maximum mass flow rate in the nozzle
   5.1.6 Solve problems related to nozzle

5.2 Discuss the current technology of nozzle application
ASSESSMENT

The course assessment is carried out in two sections:

i.  **Coursework (CA)**
    Coursework is continuous assessment that measures knowledge, technical skills and soft skills.

ii.  **Final Examination (FE)**
    Final examination is carried out at the end of the semester.

The percentage ratio of FE to CA shall follow the guideline stated in the Arahan-Arahan Peperiksaan dan Kaedah Penilaian which is approved by the Lembaga Peperiksaan dan Penganugerahan Sijil/ Diploma Politeknik

### ASSESSMENT SPECIFICATION TABLE (AST)

<table>
<thead>
<tr>
<th>CONTEXT</th>
<th>ASSESSMENT METHODS FOR COURSEWORK (CA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CLO 1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid and Properties</td>
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<tr>
<td>Fluid Statics</td>
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<tr>
<td>Fluid Dynamics</td>
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<td>Energy Loss in Pipelines</td>
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<tr>
<td>Nozzle</td>
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</tbody>
</table>

**Remark:**

CLO1 : Explain clearly the characteristics of fluid.
CLO2 : Solve problems correctly related to fluid properties, fluid statics and fluid dynamics
CLO3 : Study the theory of fluid mechanics related to engineering field in group
REFERENCES


McGraw Hill, Singapore, 2002


### MATRIX OF COURSE LEARNING OUTCOMES (CLO) VS PROGRAMME LEARNING OUTCOMES (PLO)

<table>
<thead>
<tr>
<th>Course Learning Outcome (CLO)</th>
<th>Compliance to PLO</th>
<th>Recommended Delivery Methods</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PLO1</td>
<td>PLO2</td>
<td>PLO3</td>
</tr>
<tr>
<td>1. Explain clearly the characteristics of fluid</td>
<td>✓</td>
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<tr>
<td>2. Solve problems correctly related to fluid properties, fluid statics and fluid dynamics</td>
<td>✓</td>
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<tr>
<td>3. Study the theory of fluid mechanics related to engineering field in group</td>
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<td></td>
<td>✓</td>
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</tbody>
</table>

**Remark:**
- LD1 Knowledge
- LD2 Practical Skills
- LD3 Communication Skills
- LD4 Critical Thinking and Problem Solving Skills
- LD5 Social Skills and Responsibilities
- LD6 Continuous Learning and Information Management Skills
- LD7 Management and Entrepreneurial Skills
- LD8 Professionalism, Ethics and Moral
- LD9 Leadership and Teamwork Skills

**Recommended Delivery Methods:**
- Interactive Lecture, Discussion and Presentation
- Quiz, test, End Of Chapter and Final Exam.
- Case study
## DISTRIBUTION OF STUDENT LEARNING TIME
### ACCORDING TO COURSE LEARNING - TEACHING ACTIVITY

<table>
<thead>
<tr>
<th>No.</th>
<th>Learning and Teaching Activity</th>
<th>SLT</th>
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</thead>
<tbody>
<tr>
<td><strong>FACE TO FACE</strong></td>
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<tr>
<td>1.0</td>
<td><strong>Delivery Method</strong></td>
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</tr>
<tr>
<td>1.1</td>
<td>Lecture</td>
<td>2 hour(s) x 15 week(s)</td>
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<tr>
<td>1.2</td>
<td>Practical</td>
<td>0 hour(s) x 15 week(s)</td>
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<tr>
<td>1.3</td>
<td>Tutorial</td>
<td>0 hour(s) x 15 week(s)</td>
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<tr>
<td>2.0</td>
<td><strong>Coursework Assessment (CA)</strong></td>
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<tr>
<td>2.1</td>
<td>Lecture-hour-assessment</td>
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<td></td>
<td>- Test</td>
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<td></td>
<td>- Quiz</td>
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<tr>
<td></td>
<td>- Discussion</td>
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</tr>
<tr>
<td>2.2</td>
<td>Practical-hour-assessment</td>
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<tr>
<td></td>
<td>- Laboratory Exercises</td>
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<tr>
<td>2.3</td>
<td>Tutorial-hour-assessment</td>
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<td></td>
<td>- Tutorial Exercises</td>
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<tr>
<td><strong>NON-FACE TO FACE</strong></td>
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<tr>
<td>3.0</td>
<td><strong>Coursework Assessment (CA)</strong></td>
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<tr>
<td></td>
<td>- Case Study</td>
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<td></td>
<td>- End Of Chapter</td>
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<tr>
<td><strong>4.0</strong></td>
<td><strong>Preparation and Review</strong></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Lecture</td>
<td>2 hour(s) x 15 week(s)</td>
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<td></td>
<td>- Preparation before theory class eg: download lesson notes.</td>
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<tr>
<td></td>
<td>- Review after theory class eg: additional references, discussion group/discussion</td>
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<tr>
<td>4.2</td>
<td>Practical</td>
<td>0 hour(s) x 15 week(s)</td>
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<td></td>
<td>- checklist/labsheets and/or tools and equipment.</td>
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<tr>
<td></td>
<td>- Post practical activity eg: lab report, additional references and discussion session</td>
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<td>- Preparation before studio work presentation/critique.</td>
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<tr>
<td>4.3</td>
<td>Tutorial</td>
<td>0 hour(s) x 15 week(s)</td>
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<tr>
<td></td>
<td>- Preparation for tutorial</td>
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<td>4.4</td>
<td>Assessment</td>
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<tr>
<td></td>
<td>- Preparation for test.</td>
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<tr>
<td></td>
<td>- Preparation for quiz.</td>
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</tbody>
</table>

Total 92

Credit = SLT/40 2

### Remark:
1. Suggested time for:
   - Quiz : 10 - 15 minutes
   - Test (Theory) : 20 - 30 minutes
   - Test (Practical) : 45 - 60 minutes
2. 40 Notional hours is equivalent to 1 credit