Name of Institute: Institute of Technology & Engineering, Indus University
Name of Faculty: Mechanical Engineering

Course code: ME0404
Course name: Fluid Power Engineering
Pre-requisites:
Credit points: 05
Offered Semester: 4th

Full Name: Dr.Bansi D.Raja

- Department with seating location: 1st Floor, FM LAB, Bhanwar Building, IITE - IU
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- Consultation times: 9.00 am to 5.00 pm

Course Lecturer

- Full Name: Bhavin Khatri
- Department with seating location: Mechanical , seating :FPE lab
- Telephone: 9979895778
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- Consultation times: 9.00 am to 5.00 pm

Students will be contacted throughout the Session via Mail with important information relating to this Course.

Course Objectives

By participating in and understanding all facets of this Course a student will:

1. Provide the detailed understanding and application of fluid power and hydraulics of machines
2. Understand the different major equipments which can produce power from fluid

Course Outcomes (CO)

1. To formulate basic equations for impact of free jets
2. To understand construction and working & performance of various turbines
3. To understand construction and working & performance of various pumps
4. To solve and analyze a variety of fluid mechanics and fluid machinery related problems.

Course Outline

- Flow Through Pipes
- Impact of jet
- Impulse turbine (Pelton Wheel)
- Reaction Turbine (Francis and Kaplan Turbine)
- Centrifugal Pumps
- Hydraulic Ram
- Hydraulic Press

- Hydraulic Lift
- Hydraulic Crane
- Torque converter
- Hydraulic Intensifier

Method of delivery
Face to face Lecture and Practical Performance

Study time
14 Hrs per week including 10 hrs of practical

CO-PO Mapping (PO: Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	-	√	√	√	√	-	-	-	-	√	√
CO2	√	-	√	√	√	√	-	-	-	-	√	√
CO3	√	-	√	√	√	√	-	-	-	-	√	√
CO4	√	-	√	√	√	√	-	-	-	-	√	√

The objectives of the Mechanical Engineering undergraduate program are to produce graduates who have:

- **PO**1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO**2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO**3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO**4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO**5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO**6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO**7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO**8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO**9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- **PO**10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO**11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Blooms Taxonomy and Knowledge retention (For reference)

(Blooms taxonomy has been given for reference)

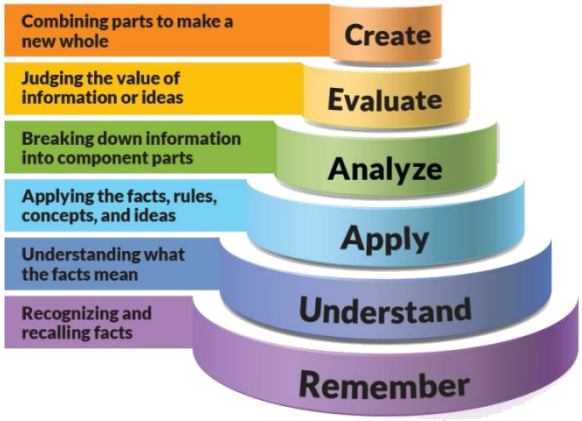

Figure 1: Blooms Taxonomy

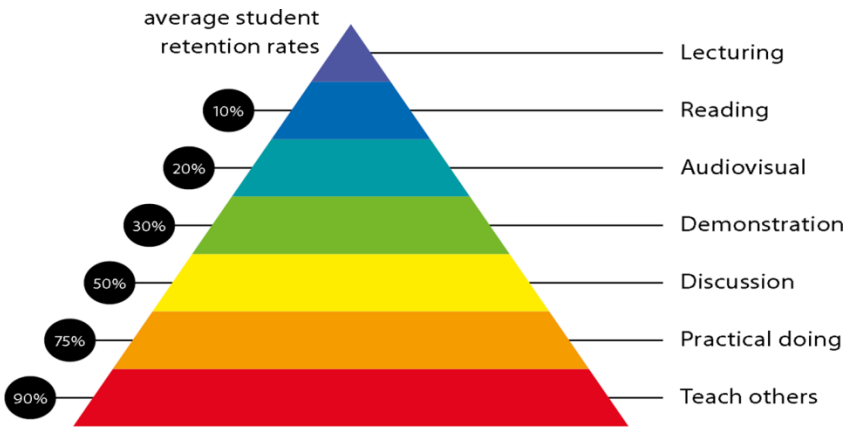

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of Mechanical Engineering Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, and innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication**
	6 Oral communication
	7 Teamwork
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

Sr.No	Title
1.	Performance practical on impact of jet.
2.	Performance practical on Centrifugal pump characteristics.
3.	Performance practical on Centrifugal pump characteristics (Double Stage).
4.	Performance practical on Centrifugal pump characteristics (Variable speed).
5.	Performance practical on Gear pumps characteristics.
6.	Performance practical on Francis Turbine.
7.	Performance practical on Pelton wheel turbine.
8.	Performance practical on Kaplan Turbine.
9.	Study of various hydraulic devices.

Lecture/tutorial times

As per the Time Table.

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, Tutorials, seminars and practical work as stipulated in the Course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for mid and end semester examinations.

Details of referencing system to be used in written work

1. Class work in lectures
2. Assignment from Book R.K.Bansal
3. Examples from different reference books and question papers

Text books

1. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd., Delhi
2. Mechanics of Fluid – B.S. Massey – English Language Book Society (U.K.)
3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas- TMH, Delhi

4. Hydraulics and Fluid Mechanics Including Hydraulic Machine- PN Modi, & SM Seth- Standard, Delhi
5. Hydraulic Machines: Fundamentals of Hydraulic Power Systems – P. Kumar – BSP Books

Additional Materials

Web resources: http://nptel.ac.in

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

CIE Theory 60 Marks Bifurcation		Tentative Duration
10 Marks	Attendance	Academic Session
20 Marks	Two Quiz/Class Test (20 Marks) Consider marks of best of 2 quiz only	Week 4 ,6,9
20 Marks	Theory Assignments/ Tutorials (one for each Unit)	Week 3,6,9
10 Marks	Class Participation/Group Presentation (Max. 3 students)	Week 4,6,8
CIE Practical 60 Marks Bifurcation		**Tentative Duration**
10 Marks	Attendance	Academic Session
20 Marks	File work/ Journal write up – calculation etc. in lab. itself	After completion of experiment
20 Marks	Practical Performance /Lab Participation	Week 4,6,8
10 Marks	Question Answer	After completion of experiment

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in mid semester or end semester will be considered for supplementary assessment in the respective components (i.e. mid semester or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (mid semester or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

Course schedule (subject to change)

(Mention quiz, assignment submission, breaks etc as well in the table under the Teaching Learning Activity Column)

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Course schedule (subject to change)

Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
Weeks 1	**Flow Through Pipes** Loss of energy in pipes, Hydraulic gradient and total energy line, Examples	CO 1	Assignment submission, Quiz
Weeks 2	**Flow Through Pipes** Pipe in series, parallel, compound pipes, examples Assignment-1	CO 1	Assignment submission, Quiz
Week 3	**Flow Through Pipes** Examples	CO 1	Assignment submission, Quiz
Week 4	**Impulse Turbine:** classification, working, work done, efficiency Examples Assignment-2	CO 2	Assignment submission, Quiz
Week 5	**Reaction Turbines** Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over Pelton wheel. And Examples	CO 2	Assignment submission, Quiz
Week 6	**Reaction Turbines** Axial flow reaction turbine Propeller and Kaplan turbine, bulb or tubular turbine, draft tube, specific speed, unit quantities, cavitation, performance characteristics, governing of reaction turbine. Examples Assignment-3 Classtest-1	CO 2	Assignment submission, Quiz
Week 7	Centrifugal Pumps: Classification of Pumps, Centrifugal pump, Construction, working, work done, heads, efficiencies, Examples	CO 3	Assignment submission, Quiz
Week 8	Classification of Pumps, Centrifugal pump, Construction, working, work done, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, cavitation. Examples, Assignment-4	CO 3	Assignment submission, Quiz
Week 9	Compressors Reciprocating Compressors: Construction and working, Multistage conditions for minimum work, Interco ling, Efficiency of air compressors Rotary Compressors: Introduction, Classification.	CO 4	Assignment submission, Quiz
Week 10	Centrifugal Compressors: Essential parts, Static and total head properties, Velocity diagram.	CO 4	Assignment submission, Quiz
Week 11	Miscellaneous Machines Construction and working of hydraulic press, Hydraulic accumulator, Hydraulic	CO 4	Assignment submission, Quiz

	intensifier Classtest-2		
Week 12	Hydraulic crane, Hydraulic jack, hydraulic lift, Hydraulic ram.	CO 4	Assignment submission, Quiz

B.TECH MECHANICAL ENGINEERING (2019)