Date:	Examination No.: 15367	Version:1/9/2019	Start: 22/2/2021
Module Name - Code	Fluid Mechanics - 3106		
Module Language:	English		
Responsible:	Ms. Shivan Jawdat		
Lecture (s):	Ms. Khatoon Yaseen /MSc Mr. Abdulbasit Abdulqadir / MSc		
College:	College of Engineering – Salahaddin University		
Duration:	15 week – 1st semester		
Course outcomes:	This course is designed for undergraduate mechanical engineering students to develop an understanding of the behavior of fluids at rest or in motion and the subsequent effects of the fluids on the boundaries as mechanical engineers have to deal with fluids in various applications. This course will also develop analytical abilities related to fluid flow. It is expected that students will be able to have a conceptual understanding of fluids and their properties, apply the analytical tools to solve different types of problems related to fluid flow in pipes, design the experiments effectively, and do prototype studies of different types of machines and phenomena.		
Course Content:	**Chapter One: Fundamentals of Fluid Mechanics:** Introduction; Applications; Concept of fluid; Difference between solids, liquids, and gases; Concept of the continuum; Ideal and real fluids; Fluid properties: density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), vapor pressure, compressibility, bulk modulus, Mach number, surface tension, and capillarity; Newtonian and non-Newtonian fluids. Pressure and Flow Measurement: Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters. **Chapter Two: Fluid Statics:** Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane submerged surface (horizontal, vertical and inclined): resultant force and center of pressure; Force on a curved surface due to hydrostatic pressure; Buoyancy and flotation; Stability of floating and submerged bodies; Metacentric height and its determination; Periodic time of oscillation; Pressure distribution in a liquid subjected to : (i) constant acceleration along horizontal, vertical and inclined direction (linear motion), (ii) constant rotation. **Chapter Three: Fluid Kinematics:** Classification of fluid flows; Lagrangian and Euler flow descriptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; Flow rate and discharge mean velocity; One-dimensional continuity equation; Continuity equation in Cartesian (x,y,z), polar (r,θ) and cylindrical (r,θ,z) coordinates; Derivation of continuity equation using the Lagrangian method in Cartesian coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net. **Chapter Four: Fluid Dynamics:** Derivation of Euler's equation of motion in Cartesian coordinates, and along a streamline; Derivation of Bernoulli's equation (using principle of conservation of energy and equation of motion) and its applications to steady state ideal and real fluid flows; Representation of energy changes in fluid system (hydraulic and energy gradient lines); Impulse momentum equation;		

	Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions. **Chapter Five: Dimensional Analysis and Similitude:** Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - π-method for dimensional analysis; Dimensionless numbers (Reynolds, Froudes, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws. **Chapter Six: Internal Flows:** Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart.
Literature:	• C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Fluid Mechanics and Machinery, Oxford University Press. • Y• B.R. Munson, D.F. Young, T.H. Okiishi and W.W. Huebsch, Fundamentals of Fluid Mechanics, John Wiley and Sons. • J.F. Douglas and J.M. Gasiorek, J.A. Swaffield and L.B. Jack, Fluid Mechanics, Pearson. • V.L. Streeter, E.B. Wylie and K.W. Bedford, Fluid Mechanics, McGraw Hill. • Yunus A. Cengel and John M. Cimbala "Fluid Mechanics, Fundamentals and Applications" 3rd Edition
Type of Teaching:	4 hrs. in lectures. 2 hr. in Lab.
Pre-requisites:	Nil
Frequency:	Yearly in the Fall semester
Requirements for credit points:	For the award of credit points, it is necessary to pass the module exam. The module exam contains: - Homework and quizzes, mid-term exam, and final exam. **Student attendance is required in all classes**.
Credit point:	5
Grade Distribution:	The Grade is generated from the examination result(s) with the following weights (w): Continuous Exams 40% : 15% Prac. + 25% Theor. Final exams 60% : 10% Prac. + 50% Theor. Homework, quizzes, and other activities: 5% Mid-Term exam: 20%
Workload:	The workload is **135 hours**. It is the result of **90 hours** of attendance and **45hours** of self-studies.