Mechanical Engineering S6

Données Générales			
Programme Académique	**Incoming Exchange Student Courses**		Responsable(s) Module HAJJAR Ahmad
Type de module : Unité d'Enseignement	**Mechanical Engineering S6** (LIIExp06UMEMechaEng)		
Crédits (ECTS)	8		
Effectif maximum	100		
Durée totale : 76h00	Periode Semester 6_Mechanical Engineering	Langue d'enseignement :	

- Incoming Exchange Student Courses
- Semesters
- Semester 6_Mechanical Engineering
- Mechanical Engineering S6
- Advanced Heat Transfer

Advanced Heat Transfer

Données Générales

Programme Académique	**Incoming Exchange Student Courses**
Type d'EC : Cours	**Advanced Heat Transfer** (LIIExp06EAdvHeatTransfMecha)

TD : 12h00 Cours : 12h00 Projet : 4h00 Travail personnel : 24h00 Durée totale: 52h00	Statut Obligatoire	Periode Semester 6_Mechanical Engineering	Langue d'enseignement : English

Acquis d'apprentissage

1) To extend the basic knowledge acquired in the introduction to heat transfer course and relate it to more advanced/practical application.
2) To identify the relevance of numerical methods in solving multidimensional and transient heat conduction problems.
3) To acquire a better insight into convection heat transfer mechanisms such as natural convection and boiling/condensation heat transfer.
4) To acquire essential knowledge for the design and sizing of a heat exchanger, which is one the most practical and interesting application of heat transfer.
5) To develop some understanding of radiation exchange between mulitple surfaces, which is a primary quantity of interest in most radiation problem.

Contenu

12 hours (lecture), 12 hours (tutorial)
- Steady Heat conduction : heat transfer in common configuration, conduction shape factors.
- Transient conduction : lumped system analysis, Biot number, transient heat conduction in large plane walls, long cylinders, and spheres with spatial effects, transient heat conduction in semi-infinite solids.
- Numerical methods in heat conduction : finite difference formulation of differential equations, two-dimensional steady heat conduction.
- Natural convection : physical mechanisms, equation of motion and the grashof number, natural convection over surfaces, natural convection inside enclosures, combined natural and forced convection.
- Boiling and condensation : boiling heat transfer, pool Boiling, flow boiling, condensation heat transfer, film condensation, dropwise condensation
- Heat exchangers : heat exchanger types, overall heat transfer coefficient, the log mean temperature difference, the effectiveness-NTU method, heat exchanger design and performance calculations.
- Radiation heat transfer : the view factor, view factor relations, black surfaces, diffuse and gray surfaces, radiation shields and the radiation effect.

Prérequis

Introduction to Heat Transfer

Bibliographie

Y. Çengel, “Heat and Mass Transfer, A practical approach”, 3nd Ed, McGraw Hill Higher Eduction.
F.P. Incropera and D.P. DeWitt, “Fundamentals of Mass and Heat Transfer”, 6th/7th Ed, John Wiley.
J. P. Holman, “Heat Transfer”, 7th Ed., McGraw-Hill, 1990.

- Incoming Exchange Student Courses
- Semesters
- Semester 6_Mechanical Engineering
- Mechanical Engineering S6
- Hydraulics

Hydraulics

Données Générales

Programme Académique	**Incoming Exchange Student Courses**		
Type d'EC : Cours	**Hydraulics** (LIIExp06EHydrMecha)		
TD : 10h00 Cours : 10h00 Travail personnel : 20h00 Durée totale: 40h00	Statut Obligatoire	Periode Semester 6_Mechanical Engineering	Langue d'enseignement : English

Acquis d'apprentissage

-To compute minor and major head losses in piping systems/hydraulic network (system head).
-To evaluate dynamic pumps performance using measured pump performance curves.
-To match a pump characteristic to a hydraulic network characteristic.
-To select an appropriate type and size of a dynamic pump for a specific application (use of specific speed).
-To predict pump performance or to adapt pump operation using similarity rules.
-To develop a fundamental and practical understanding of hydraulic power systems.
-To evaluate the performance of positive displacement pumps.
-To design a hydraulic circuit for a specific hydraulic power application.

Contenu

- Hydraulic networks: fundamentals of fluid flow in pipes, major and minor and head loss, system head, branches in parallel and series.
- Pumping systems: classification of pumps, operation of dynamic pumps, pump main parameters, pump performance curves, pumps combined in series and parallel, matching a pump to a piping system, cavitation and net positive-suction head, dimensionless pump performance, similarity rules, specific speed, adaptation of operating conditions.
- Hydraulic power systems: Fundamentals of Hydraulic Power Transmission, hydraulic power generation, positive displacement pumps (design and performance), hydraulic power distribution (hydraulic valves: types, design and function), hydraulic power deployment (hydraulic cylinders, hydraulic motors, hydrostatic transmission), hydraulic circuits.

Prérequis

Fluid Mechanics

Bibliographie

- Cengel, Y., & Cimbala, J. M. (2014), Fluid mechanics: Fundamentals and applications, 3th ed., McGraw-Hill Education.
- White F. (2016), Fluid Mechanics, 8th ed, McGraw- Hill.
- Zhang Q. (2018), Basics of Hydraulic Systems, 2nd ed., CRC Press.
- Esposito A. (2014), Fluid Power with Applications, 7th ed., Pearson Education Limited.

- Incoming Exchange Student Courses
- Semesters
- Semester 6_Mechanical Engineering
- Mechanical Engineering S6
- Materials 3

Materials 3

Données Générales

Programme Académique	**Incoming Exchange Student Courses**
Type d'EC : Cours	**Materials 3** (LIIExp06EMaterials3)

TD : 10h00 TP : 16h00 Cours : 10h00 Travail personnel : 40h00 Durée totale: 76h00	Statut Obligatoire	Periode Semester 6_Mechanical Engineering	Langue d'enseignement : English

Acquis d'apprentissage

Upon completion of this course, the students are expected to:
1. Apply heat treatment to steel and aluminum alloys.
2. Predict the microstructures and phases which occur in in steel and aluminum alloys during heat treatment.
3. Predict the forms of corrosion and decide how to prevent it.

Contenu

1. Introduction to Phase Transformation
• Processes and Types of Phase Transformation
• Types of Nucleation
• Phase Transformation Rate
2. Part 1: Heat Treatment
• Equilibrium and Non-equilibrium States
• Eutectoid, Hypereutectoid and Hypoeutectoid Points
• Martensite Transformation
3. Part 2: Heat Treatment
• Mechanical Properties of Martensite
• Tempering of Steel Alloys
• Continuous Cooling Transformation Diagrams
4. Structural Hardening of Aluminum
• Equilibrium Diagram of Aluminum Alloys
• Heat Treatments of Aluminum Alloys
5. Corrosion
• Redox Reactions
• Types of Corrosion
• Methods for Corrosion Prevention

Bibliographie

Essential resources:
Not required

Recommended resources:
Materials Science and Engineering, An Introduction, W.D. Callister.

Bibliographie

Materials Selection in Mechanical Design, M.F. Ashby.