INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

REVISION OF AN ELECTIVE COURSE

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| Course Title | Design of Heat Exchangers | Course No | ME5XXX | | | |
| Specialization | Mechanical Engineering | Structure (LTPC) | 3 | 1 | 0 | 4 |
| To be offered for | UG / PG | Status | Core ☐ | | Elective ■ | |
| Faculty Proposing the course | Dr. Shubhankar Chakraborty | Type | New ☐ | | Modification ■ | |
| Recommendation from the DAC | | Date of DAC | 1-06-21 | | | |
| External Experts(s): | Prof. SP Venkateshan (Prof. Emeritus IIT Madras), Prof PK Das (IIT Kharagpur) | | | | | |
| Pre-requisite | COT | Submitted for approval | 45th Senate | | | |
| Learning Objectives | • Familiarity with heat exchangers and its working principles<br>• Classification and constructions, and applications<br>• Analysis of heat exchanger performance<br>• Thermal Design | | | | | |
| Learning Outcomes | The students will be able to<br>• select type of heat exchanger, dimensions and material based on the required scenario.<br>• develop design methodology based on Matlab or Python programming. | | | | | |
| Contents of the course *(With approximate break up of hours)* | **Background:** Introduction, Heat transfer mechanisms, Heat transfer area, Heat transfer coefficient, Thermal resistances, overall heat transfer coefficient and their combination, Fouling (L4+T1)<br>**Classification of heat exchangers:** Based on direction of flow, geometry, type of contact, compactness, fluid used, etc., Steam generators, Recuperator & Regenerator(L4+T1)<br>**Thermal design of heat exchanger:** LMTD analysis and correction factor, Effectiveness and NTU method, Design parameters & procedure, Pressure drop, Fluids (liquid, gas and vapour) and their properties, Selection of Pump. (L6+T3)<br>**Design and construction of tube-in-tube and shell-and-tube heat exchangers:** Principal components, Tube distribution, tube to tube sheet joint, Multi-pass, Multi-shell, Heat transfer augmentation, Material, structural and thermophysical properties, Appropriate standards, Manufacturing processes, Testing. (L8+T3)<br>**Fin-tube and Plate-Fin heat exchangers:** Constructions, Series-parallel combination, Heat transfer and pressure drop correlations, LMTD corrections (L8+T2)<br>**Condensers and Evaporators:** Mechanism of condensation, Single-component vapour condenser, desuperheater condenser, use of steam as process heating medium, Mechanism of evaporation, Pool boiling, Flow boiling, Reboilers, Thermal analysis, contact condenser and cooling tower (L8+T2)<br>**Heat Transfer augmentation and micro-heat exchangers:** Heat Transfer for Gaseous and Liquid Flow in Microchannels, Single-Phase Convective Heat Transfer with Nanofluids. (L4+T2) | | | | | |
| Text Books | 1. Kakac, S., Liu, H. and Pramuanjaroenkij, A., 2020. Heat exchangers: selection, rating, and thermal design. CRC press.<br>2. Ramesh K. Shah, Dusan P. Sekulic, Fundamentals of Heat Exchanger Design, Wiley; ed-1 2002. | | | | | |
| Reference Books | 1. Eduardo Cao, Heat Transfer in Process Engineering, Mc Graw Hill, 2010<br>2. Kuppan T., Heat Exchanger Design Hand Book, Taylor & Francis, 2009<br>3. Kern, D.Q., 1997. *Process heat transfer*. Tata McGraw-Hill Education. | | | | | |