**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE – PILANI, HYDERABAD CAMPUS**

**INSTRUCTION DIVISION,**

**SECOND SEMESTER 2019-2020**

**(COURSE HANDOUT: PART**-**II)**

**Date: 03/04/2020**

In addition to Part-I (a general handout for all courses appended to the time-table), this handout provides the specific details of this course.

**Course No. : ME G513**

**Course Title : HEATING AND COOLING OF BUILDINGS**

**Instructor-in-charge : SANDIP S. DESHMUKH**

**Instructor : M SRINIVAS & GVN TRIVEDI**

1. **Course Description**

Introduction to HVAC design, basic scientific principles, climatic conditions, building heat transmission surfaces, infiltration and ventilation, heating loads, heat gains and cooling loads, HVAC psychometrics, codes and standards for HVAC systems design, acoustics and vibration, human comfort, air distribution, duct system design, fans and central air systems, air system heating and cooling, air cleaning and filtration, introduction to electrical systems, controls for air distribution systems.

1. **Scope and Objective**

The purpose of this course is to provide introductory knowledge and a state-of-the-art learning of different HVAC systems including their design aspects pertaining to the real-world heating and cooling applications in buildings. Besides the theoretical knowledge, emphasis will also be provided on interactive approach to analyze the design aspects of a variety of HVAC systems. The course will certainly interest students aiming to build-up a career in building services engineering through energy efficient design of HVAC systems in buildings.

1. **Text Books:**
2. Jan F. Kreider, Peter S. Curtiss, Ari Rabl, Heating and Cooling of Buildings: Design for Efficiency, Revised Second Edition, CRC Press, 2010.
3. Robert McDowall, Fundamentals of HVAC Systems, SI Edition, Elsevier, 2009.

**Reference Books:**

1. W.P. Jones, Air Conditioning Engineering, Fifth Edition, Butterworth Heinemann, 2005.
2. D R Oughton, S L Hodkinson, Faber & Kell’s Heating and Air-Conditioning of Buildings, Tenth Edition, Butterworth Heinemann, Elsevier, 2008.
3. **Course Plan**

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| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Book** |
| 1-3 | Introduction to HVAC systems design in buildings | Brief history of HVAC, energy efficiency in buildings, role of HVAC engineers, phases of building design procedure | T1, T2 |
| 4-7 | Building physics and elements of heat transfer | Basic terms and definitions, climatic design conditions, comfort criteria, methods of measurement, heat transfer through building elements, evaporation and moisture transfer | T1, R1, R2 |
| 8-11 | Psychrometrics, thermal comfort and ventilation | Psychrometric processes and chart, thermal comfort factors and conditions, thermal balance, air change rates, ventilation methods, acceptable air quality, decay equation and applications | T1, T2, R1 |
| 12-15 | Heating and cooling loads | Air exchange, principles of load calculations, zones, heating methods, methods for cooling load calculations, Standards and Codes of practices | T1, T2, R1 |
| 16-17 | Research seminars | | |
| 18-21 | Heat generation and cooling equipments | Boilers, furnaces, heat exchanger and heat pumps selection, refrigeration systems, chillers, evaporative coolers, performance aspects | T1, R1 |
| 22-23 | Acoustics and vibration | Sound pressure, sound power, measurement of sound, room acoustics, noise and vibration control | R2 |
| 24-26 | Hydronic systems and architecture | Terminal units, panel heating and cooling, fan coils, hot water systems, chilled water systems, piping design and pressure loss calculations | T1, T2 |
| 27-33 | Air conditioning systems | All-air systems, air-water systems, HVAC system design sizing and energy calculations | T1, R2 |
| 34-35 | Research seminars | | |
| 36-37 | Air distribution systems design | Ventilation rates, airflow in ducts, basic sizing and duct design, total and static pressure calculations, fan laws, pressure loss calculations, performance of air handling units | T1, R1 |
| 38-39 | Air cleaning and filtration | Particle sizes, behaviour and collection, efficiency, filter types and safety aspects | R1 |
| 40-42 | HVAC control systems | Controls basics, design considerations, DDC of air handling units, intelligent controllers, building management systems | T1, T2, R2 |

1. **Evaluation Scheme**

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| --- | --- | --- | --- | --- |
| **Evaluation Component** | **Duration** | **Weighting (%)** | **Remarks** | **Nature of Component** |
| Mid-Term Test | 90 min | 20 | **Conducted** | **Closed Book** |
| Lab-based experiential learning through:  Case study I  Case study II  **Quiz** | **---** | 6  6  **8** | **Changed**: Simulation and field exercises will be conducted either online or offline mode  Quiz will be conducted, once the Institute Reopens or online mode | Open Book |
| Literature survey seminars | **---** | 10  10 | **No Change**: One research seminar was conducted before mid-term and the other will be conducted between 3rd to 15th April |
| Comprehensive Exam | 180 min | 40 | **To be conducted** | **Closed Book** |

1. **Chamber Consultancy Hour:** To be announced in the class room.
2. **Notices:** All notices concerning this course shall be displayed only on the Mechanical Engineering Notice Board. Besides this, students are advised to visit regularly CMS (the Institute’s web based course management system) for latest updates.
3. **Make-up Policy:** Make-up shall be given only to the genuine cases with prior confirmation. Request for the make-up tests, duly signed by the students, should reach the under signed well before the scheduled test.
4. **Academic Honesty and Integrity Policy**:

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

##### Instructor-in-Charge, ME G513