BUILDING SCIENCE II

ENAR 252

Lecture : 3 **Year : II**
Tutorial : 1 **Part : II**
Practical : 0

Course Objectives:
The objective of this course is to provide fundamental concept of architectural lighting, acoustics and energy in relation to architectural design. It equips students with tools for providing comfort and security in building in relation to lighting, acoustics and energy.

1 Architectural Acoustics (2 hours)

1.1 Introduction and importance of architectural acoustics
1.2 History of architectural acoustics
1.3 Ancient open air theatre: Dabali of Nepal, Greek and Roman

2 Properties Acoustics (2 hours)

2.1 Fundamental of architectural acoustics
2.2 Sound properties and its reaction
2.3 Classification of sound (Air borne and impact)
2.4 Measure of sound intensity level, audible range of sound
2.5 Acceptable indoor noise level

3 Room Acoustics (4 hours)

3.1 Three reactions of sound in an enclose space
3.2 Mass law, vertical and horizontal barrier
3.3 Transmission loss, sound insulation
3.4 Common acoustic problems in a room: Echo, reverberation, sound foci, dead spots, insufficient loudness, external noise

4 Acoustical Materials (2 hours)

4.1 Absorption and reflection of materials
4.2 Types of acoustical materials: Prefabricated units, acoustical plaster and sprayed, acoustical blankets

5 Reverberation Time (3 hours)

5.1 Reverberation time

5.2 The Sabine-Eyring reverberation time equation
5.3 Calculation of optimum reverberation time (ORT)

6 Acoustical Design of an Auditorium (4 hours)

6.1 Auditorium, types of auditoriums
6.2 Requirements of good acoustics design in auditorium
6.3 Factors affecting acoustic design of an auditorium: Site selection and planning, shape and size, audience seating, treatment of interior surfaces, sound path and reverberation time
6.4 Sound reinforcement systems: Objectives, components and specifications (input devices, amplifier and controls, loudspeakers)

7 Noise Control (4 hours)

7.1 Noise and its types
7.2 Impact of noise to human beings
7.3 Noise control techniques
7.4 Noise control techniques for external noise: Urban planning according to noise level, orientation, planning and design of a building, noise screening (Natural and artificial, noise reduction by construction technology)
7.5 Noise control for internal noise

8 Architectural Lighting (4 hours)

8.1 Importance of architectural lighting
8.2 History of architectural lighting
8.3 Light, properties of daylight
8.4 Photometric quantities of light
8.5 Daylight factor, design sky concept
8.6 Light and glare

9 Daylight in Buildings (4 hours)

9.1 Objectives of day lighting in a building
9.2 Building shape and layout
9.3 Location, shape and size of openings
9.4 Orientation of buildings

10 Artificial Lighting in Buildings (6 hours)

10.1 Objectives of artificial lighting in a building
10.2 Electric light sources: Incandescent lamp, fluorescent lamp, CFL, LED, high-intensity discharge lamps, smart lighting

10.3 Interior lighting design
10.4 Introduction and types of interior lighting system: Direct, indirect, semi-direct, semi-indirect, diffused
10.5 Illumination design and calculation

11 Architecture Lighting Philosophy (2 hours)

11.1 Introduction to architectural lighting philosophy
11.2 Architectural lighting master pieces of Le Corbusier, Louis I. Kahn and Tadao Ando

12 Energy (8 hours)

12.1 Energy and it concepts
12.2 Sources of energy: Renewable and nonrenewable energy
12.3 Global energy scenario
12.4 Energy scenario in Nepal
12.5 Passive methods of energy conversion
12.6 Orientation, planning, color, texture, materials, technology
12.7 Direct, indirect and isolated gain
12.8 Active methods of energy conversion
12.9 PV cell, solar collector, solar water heater, dryer

Tutorial (15 hours)

1. Calculation of reverberation time of a hall
2. Acoustic design in a selected building (Observation, study and analysis)
3. Design and calculation of artificial illumination in a room
4. Day lighting and artificial lighting design in a selected building (Observation, study and analysis)

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1 and 2	4	6
3 and 4	6	6
5 and 6	7	12
7	4	6
8 and 9	8	12
10 and 11	8	6
12	8	12
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Koenigsberger, O.H. Ingersoll, T.G., Mayhew, A. (2020), “Manual of Tropical Housing and Building” – Universities Press (India) Private Limited.
2. David, M.E. (1972), “Concepts in Architectural Acoustics”, McGraw Hill book company, USA
3. Salvan G.S. (1999), “Architectural Utilities 3 - Lighting and Acoustics”, JMC Press Inc, Quezon City
4. Barron, M. (2010), “Auditorium Acoustics and Architectural Design”, Taylor & Francis, London and New York
5. Punmia, B.C. (2005), “Building Construction”, Laxmi Publication, New Delhi, India.