Proposed Syllabus

For 3 Years Evening M.Tech in Illumination Technology & Design

PAPER–I:FUNDAMENTALS OF ILLUMINATION SCIENCE & TECHNOLOGY

Light and electromagnetic radiation, sources of light- thermal radiator-blackbody radiator, laws of thermal radiation, daylight and artificial light, spectral power distribution (SPD) of light sources.

Visual system-structure, external factors of vision, continuous adjustment- photopic, scotopic and mesopic capabilities, perception, CIE standard observer, Glare- discomfort & disability glare.

Colorimetry – trichromatic vision, RGB colour specification system, CIE 1931 XYZ colour specification system, source colour & object colour specification, CIE standard illuminant.

Radiometric and photometric quantities, relation between Lumen and Watt, photometric standards, Photometry – measurement of luminous flux, illuminance, luminance, luminous intensity distribution. Computation of lumen output from luminous intensity distribution of a source, computation of CCT and CRI from CIE 1931 chromaticity diagram.

Different types of Lamps– Its characteristics & Applications, Luminaire- its function and classification,Lamp and luminaire specifications.

Basic concepts of lighting design- design objectives, design parameters, qualitative & quantitative evaluation of lighting systems.

References :

1. Lamps and Lighting – Edited by J.R.Coaton and A.M.Marsden, 4th Edition

Arnold

2. The Scientific Basis of Illuminating Engineering – P.Moon

Dover Publications

3. Lighting for energy efficient luminous environments- Ronald N.Helms & M Clay Belcher.

Prentice Hall.

4. Fundamentals of Illumination Engineering – V.V.Meshkov , Mir Publication, Russia .

5. IES Lighting Handbook – IES North America.

6. Fundamentals of Illumination Engineering – V.V. Meshkov, MIR Publishers Moscow

7. Light Science – Rossing Chanerina, Springer

PAPER –II: LIGHT SOURCES AND LUMINAIRES

Theory of light generation from incandescent, discharge and solid state sources, Materials of Lamps, General classification of lamps & its electrical and photometric parameters, Variation of lamp parameters with supply voltage, temperature, humidity etc, Construction of different lamps.

Functions of ballast, starter/ ignitor, Different lamp circuits and their operations,Working principle of electronic ballast for FTL/CFL.

Luminaire- its function, mechanical stability and requirements,its enclosure and electrical, thermal, marking, luminaire photometry, luminaire materials and manufacturing process.

Design of luminaire optics, basic optical contour, faceted reflector- steps of design, refracting elements- lens, prisms etc.

References:

1. IES Lighting Handbook – IES North America.

2.Illumination Engineering from Edison lamp to the laser – J.B.Murdoch,

Macmillion Publishing company.

3.Lamps and Lighting – Edited by J.R.Coaton and A.M.Marsden, 4th Edition ,Arnold

4. Lighting, what everyone should know – M.S.N. Swamy (Pub –MSN Marketing)

5. Electric Discharge Lamps – John F. Waymouth (Pub – M.I.T. Press)

6. Designing With Light – Anil Valia.

PAPER – III: LIGHTING CODES & ENERGY EFFICIENT LIGHTING SYSTEM

Indian Standards & Codes on lighting products and lighting designs, Testing of lamp, control gear & luminaire- type test, performance test, acceptance test; electrical and photometric test of lamps and luminaries, Luminaire Testing-IP test, mechanical test & photometric test.

IEC standards on lamps and ballasts, CIE standards on lighting applications, electronic file format of luminaire intensity database- .ies file format.

National Lighting Code, Energy Conservation Building Code, Bureau of Energy Efficiency star- rating for lamps.

Basics of lighting control devices, their principles of operation, Concept of energy efficient lighting system design, design approaches & options, Lighting energy conservation measures, Concepts of daylight integrated artificial lighting design, different design considerations-thermal, colour, visual comfort, assessment of energy saving with daylight.

References :

1. Electrical Codes, Standards,Recommended Practices and Regulations – Robert J.Alonzo ,P.E.,Elsevier.

2. IES Lighting Handbook – IES North America.

3. National Lighting Code- Published by Govt of India,2011

PAPER –IV: LIGHTING ECONOMICS, AUDIT & MANAGEMENT

Cost estimation of lighting systems-initial cost, running cost; economic analysis,pay back method, life cycle cost; cost-benefit analysis of lighting system.

Fundamentals of lighting surveys and audits, measuring tools & instruments, types of surveys and audit, techniques of collecting building information, design and use of software of lighting survey and analysis.

Energy management in illumination, Energy efficient illuminating system components, energy oriented new and retrofit installations, Power Quality, Demand side management (DSM).

Maintenance of lighting system-indoor and outdoor, maintenance schedule, scheme, Relamping-spot and group, Equipment and materials used for maintenance job, General guidelines on disposal of burnt out lamps.

References:

1.Energy Management in Illumination Systems – Kao Chen,CRC Press.

2.The Hand Book of Lighting Surveys and Audits – John L. Fetters, CRC Press.

3. Managing Energy from the Top down Christopher Russell, C.E.M., CRC Press.

4. Handbook on Energy Audit & Environment Management – P.Abbi, S. Jaia, Teri

5. The Lighting Management Hand book – Craig DiLouie

PAPER-V : Renewable Energy based Lighting System

Different Renewable Sources of Energy - Solar, Wind, Tidal, Biomass, Geo thermal, fuel cell, human - powered etc - Its Principles & Technical Description, Induction Generator Principle , Charging methods from different sources – Storage Battery Technologies, Charge control techniques, Principles of inverter, dc to dc converter, Load management - energy efficient discharge lamp and different types of electronic ballasts,LED lamps & its drivers, Wiring & Fittings, Lightning Protection, Installing, Managing, Maintaining & Servicing off-grid systems, Sustainability & Building Design & Lighting, Integration of different sources of Energy, Inter connection of Renewable Energy Sources with the grid.

References

1. Fundamentals of Solar Energy – H.P. Gary, John Wiley & Sons.
2. Integration of Alternative Sources of Energy – F.A. Farret, M. G. Simoes, IEEE Press
3. Solar Energy - S.P. Sukhatime, Tata Mc. Graw Hill
4. Renewable Energy – Technology, Economics & Environment – M. Kaltschmitt, W. Streicher, A. Wiese, Springer
5. Dictionary of Energy- Catler J. Cleveland & C. Morris.
6. Energy Today & Tomorrow – M. Dayal, Ministry of Information & Broadcasting, Govt. of India.
7. Storage Batteries, George Wood Vinal, John Wiky & Sons, Inc.
8. High Energ Density Lithium Batteries, Edited by K. E. Aifantis, S. A. Hackney, R.V. Kumar,ETC.
.Terrestrial Solar Photovoltaics – Tapan Bhattacharya, Narosa.
9. Generating Electricity in a Carbon Constrained World – Edited by Fereidoon P. Sioshansi, Academic Press.
10. Stand Alone Solar Electric System – Mark Hankins, Earthscar.
11. Solid state Ionics for Batteries – T. Minami, Springer
12. Building Integrated Photovoltaics a handbook – Simon Roberts, NicoloGuariento, Birkhauser.
13. Sustainable Building, Design Manual, 1 & 2 ICAEN
14. Ecohouse : A Design Guide – S. Roof, M. Fuentes & S. Thomas, Elseveir
15. Sustainable Energy Systems Engg. – Dr. P. Gevorkian, M.C. Graw
16. Environmentally conscious Alternative Energy Production – M. Kutz, John Wiley & SanInc
17. Prom Sunlight to Electricity – S. Sinha, A. Shukla, N. Hazarika, Winrock International
18. Participatory Rural Energy Planning – P. Malhotra, S. Dutta, V. Ramana, P. Teri
19. Industrial Applications of Batteries – M. Broussely & G. Pistoia, Elseveir. D. Meschede
20. Storage Batteries – G.W. VINAL, (Pub – John Willey & Sons, N.Y.

PAPER –VI: Indoor Lighting Design

Lighting Field of Luminaires ,Practical Coordinate System , Concept of Coefficients of Utilization (COU) in different luminaries,Calculation of COU by using COU table, Algorithm for development of COU tables, problems of COU calculations, Average illuminance calculations by Zonal Cavity Method, Determination of effective Cavity Reflectances and COU, Determination of effective Cavity Reflectance for non-horizontal ceilings & coffered ceilings, calculation of illuminance at a point from point source, linear source, area source , calculation of vertical surface illuminance at a point-,reflected illuminance calculation; introduction to basic lighting layout,Spacing Criteria,Problems on layout , Glare Calculation, Non-planar illuminance & its application in indoor lighting design.

References:

1. Applied Illumination Engineering, Second Edition, Jack L Lindsey, Prentice Hall.
2. Lighting Engineering Applied Calculations – R. H. Simons & A.R. Bean, Architectural Press.
3. Philips Lighting Manual
4. Principles of Lighting Course 2000 – Julian (Department of Architecture & Design Science) University of Sydney
5. Interior Lighting – Boer, Fischer, Pub – Philips Technical Library

PAPER –VII Laser Animation & Creative Lighting

Fundamentals of Laser & its application , Laser Hazards , General Rules for Laser Safety, Laser Classifications , Laser Projection Systems ,Connecting Laser for Projection , Power Unit Connection , Water Connection , Connecting Laser to Animation Program , Laser Art, Animation and Atmospheric , Selecting a Theme, Building a Storyboard , Drawing Art – Graphics – Animation , Recording with Music or Sound Effects , Adding Atmospherics , Projecting on Flat Screen , Projecting on Water Screen , Diffraction Gratings , Projecting with Live Action , Water as Rear Projection 3D Screen , Projecting with Video Images , Laser Safety During Running a Show , Laser Maintenance.

Concepts and techniques of Creative Lighting ,Light & Perception , Conventional Lighting – Moving Luminaires, Lighting Consoles, Lighting Trusses & Grids ,Color Mixing, Practical Application of Colored Light , Style in lighting -Conceptualization, Design Research, Image of light & Lighting Key , Lighting System setup Procedure ,Plotting the Design.

References :

1 .Fundamentals of Light Sources and Lasers, Csele, Mark (2004) Wiley,. ISBN 0-471- 47660-9

2. Solid-State Laser Engineering, Koechner, Walter (1992). 3rd ed., Springer-Verlag. ISBN 0-387-53756-2

3 Lasers, University Science Books, Siegman, Anthony E. (1986). ISBN 0-935702-11-3

4.Laser Fundamentals, Silfvast, William T. (1996), Cambridge University Press.ISBN 0-521-55617-1

5.Lasers: Principles and Applications, Prentice Hall International Series in Optoelectronics, Wilson, J. & Hawkes, J.F.B. (1987). Prentice Hall. ISBN 0-13-523697-5

6.Laser Dynamics – Thomas Erneux & Pierre Glorieux, Cambridge.

7.The Light Fantastic - A Modern Introduction to Classical and Quantam Optics – Ian R. Kenyon, Oxford.

8.Designing with Light – J. M. Gillette, Mayfield Publishing Company.

9.Concert Sound and Lighting Systems – John Vasey, Focal Press.

10.Stage Lighting – Richard Dunham, Allyn & Bacen.

11.Concert Lighting – Dr. James L. Moody, ED. D. Focal Press.

12.Discovery Stage Lighting – Fancis Reid, Focal Press.

PAPER VIII: OUTDOOR & LANDSCAPE LIGHTING

Basic Parameters required for Road Lighting Design, calculation of illuminance at a point on road surface by using computer generated Iso-lux diagram of a luminaire , evaluation of a Road lighting design by using nine-point method ,Design basics of floodlighting of buildings and areas ,Role of Computer in Lighting design, advantages and limitations of Computer Aided Lighting design.

Roadlighting – road classifications according to BIS, pole arrangements, terminology, lamp & luminaire selection, calculation of road surface luminance, calculation of TI(Threshold increment), glare control mark, measure of visibility, tabular & graphical methods, isoluminance diagram different design procedures , beam lumen method, point-by-point method, isolux diagram method; tunnel lighting.

Arealighting- selection of floodlights, NEMA classifications, design procedure, Sportslighting- special lighting requirements for football, cricket, badminton ground , BIS recommendation, selection criteria of lamp and luminaire, design considerations, design procedure. Introduction to Facade & security Lighting.

Landscape Lighting -principles, concepts and techniques of landscape lighting- both exterior and interior, natural light & artificial light, landscape perception, selection of lamp and lighting equipment, luminous signal, operation & maintenance, creating nocturnal landscape, elements of landscape lighting design- plant materials, sculptures etc., Lighting and response of plants, terrarium lighting, environmental concerns in outdoor lighting.

Refernces:

1. Light Pollution Handbook (Part-I & II) – Kohei Narisada & Duco Schreuder , Springer
2. Lighting for Driving: Roads, Vehicles, Signs and Signals- Peter R. Boyce , CRC Press
3. Philips Lighting Manual
4. The Landscape Lighting Book – J.L. Moyer, John Wily & Sons
5. Lighting the Landscape – R. Narboni, Birkhanser
6. Lighting zone city – C. V. Santen, Birkhanser
7. Light for Cities – U. Brandi & G. Brandi, Birkhanser
8. Light Pollution : The global view – H.E. Schwarj, Kluber Academy, C Publisher
9. Automotive Lighting & Human Vision, B. Wordonweber, J. Walla – schek, P. Boyee, D.D. Hoffmen – Springer
10. Light Pollution Hand book(Part – I) & (Part – II) – Narisada, Schreuder, Springer (Publisher)

PAPER-IX Lighting Power Conditioning Monitoring & Control

Lighting Control Strategies, Techniques & Equipments; Sensors & Timers; Switching Controls, Lighting Panels, Dimmable ballast – Dimming Methods & Controls, Switches vs dimming control algorithm , Impact of Lighting Control, Protocols for Lighting Control (Analog, DALI, DMX, ACN, RDM)and Ancillary Enablers, Lighting Control Consoles, Lighting Control by computer ,simple multichannel control and large multichannel control, Architectural Building lighting Control System , Centralized vs Distributed system , Status monitoring, fault monitoring, electrical Load monitoring and Lamp Life monitoring system , Applications, Daylight Harvesting Control System, Harmonics , Electromagnetic Interference in Lighting Systems , its measurement & suppression techniques,

References

1. Electricity for the Entertainment Electrician & Technician – Richard Cadena, Focal Press.
2. Automated Lighting – Richard Cadena, Focal Press.
3. Lighting Control Hand book – Craig Dilovie, CRC Press.

Or

Paper-IX Daylighting Design and Analysis

The daylight and sunlight resource, Day-lighting concepts, designing side-lighting concepts, designing top-lighting concepts,designing atria, light courts and sun control , planning for daylight. Daylight availability data, Daylighting analysis, lumen input method, daylight factor method, flux transfer method, physical scale model study,Lighting integration-daylighting / electric lighting integration.

References:

1. Daylight Design of Buildings - Nick Bakes, Koen Stemers , Pub – James & James (Science Publishers) Ltd.

2. Daylight Performance of Buildings – Edited by Marc Fontoynout

3. Daylighting – Natural Light in Architecture, Derek Philips – Architectural Press

4. Dynamic Daylighting Architecture : Basics, Systems, Projects – Helmut Koster

5. Daylight Science & Daylighting Technology – Kitter, Richard, Koafay, Miroslow, Springer.

PAPER –X: Lighting & Architecture

Functional and aesthetic aspects of lighting - Offices, Residences, Hotels, Hospitals, Restaurants, Malls, Museum Lighting, Heritage buildings and sensitive areas like artifacts and fragile paintings, Project scope, Spatial factors, Psychological & Psychological factors, Task factors, Lighting patterns and forms, Human reaction to light, Color application, Environmental impression, Daylight Technology, Task – Ambient lighting, Systems of Lighting Guidance, New Retro Technology, Night time Architecture, Design Tools, Schematic Layout for the typical cases.

References:

1. Architectural Lighting - by Prafulla C. Sorcar
   For Commercial Interiors - A Wiley - Interscience Publication - John Wiley & Sons
2. International Lighting Design - Jeremy Myerson
   - Lawrence King (Jennifer Hudson)
3. Architectural Lighting Design
   - 2nd Edition by Gary Steffy
4. Lighting Modern Buildings - Derek Phillips - Architectural Press
5. The Art of Light & Architecture - M. Major, J. Speirs, A. Tischhanser – Birkhanser
6. Light book – U. Brandi, C.G. Brandi, Birkhanser
7. Dynamic Day lighting Architecture – Basics, Systems Projects – H. Koster, Birkhanser

Or

PAPER –X: LIGHTING & BIOLOGICAL FACTORS

Optical Radiation- Ultra Violet(UV), Visible(VIS), Infrared(IR); Effects of UV,VIS and IR on human eye, skin, practical considerations; bio-optical properties of human skin; simulations in health & life sciences, phototherapy with non-lighting lamps.

Biological, physiological, and psychological aspects of light, the impact of light on human life-cognitive science.

The circadian system-its structure, characteristics, effects of light exposure on it, effect of light on human alertness, effect of dynamic lighting on productivity, shift work, jetlag.

Light operating through visual system and through circadian system.

Effects on Microorganism- germicidal UV radiation. Insect response - Decoy lamp and Insect trap,effect on plant- plant response, plant lighting, green house and growth room photoperiod lighting, maximum lighting.

References:

1. Human Factors in Lighting – Peter R. Boyce, Taylor & Francis.
2. Light & Skin Interactions – Gladimir V.G. Baranoski Aravind Krishna swami, Morgan Kaufun.
3. Lighting for health and safety – N.A.Smith, Butterworth-Heimann.
4. Luminescence – (Science for Every one) – N.N. Barashkov, MIR Publishers, Moscow