SCHEME OF EXAMINATION
&
SYLLABUS

M.Tech. In Optoelectronics & Laser Technology

(Semester systems)

UNDER

FACULTY OF SCIENCE

Approved by Joint Board of Studies in Electronics & Physics

EFFECTIVE FROM JULY – 2017

School of Studies in Electronics and Photonics
Pt. Ravishankar Shukla University
Raipur (C.G.) 492010
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PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)

SYLLABUS

M. Tech in Optoelectronics and Laser Technology

SESSION – 2017-2019

Photonics has been deemed the 21st century revolutionary technology that would create as enormous impact as electronics did in the 20th Century. Graduates with training in photonics and related technologies are in high demand. There is and will continue to be a big global demand for skilled people with photonics training. Optoelectronics and Laser technology has emerged as multidisciplinary subject of great breadth and richness attracting the interest of scientists, technologists and industrialists due to its manifold scientific and technological applications, it is worth-mentioning that in our country the number of postgraduate programmes on modern optics are a few, and in chhattisgarh state, none of institutes and universities has M.Tech programme in Optoelectronics and Laser Technology. This program is approved and supported by University Grants commission, New Delhi under its innovative Programme for Teaching and Research in Interdisciplinary and Emerging Areas.

This 4-semester interdisciplinary M.Tech. Programme between the S.O.S. in Electronics and S.O.S. in Physics aims at providing advanced training in the interdisciplinary areas of Optoelectronics Optical communication and laser Technology and to generate trained professionals in these areas with a strong background in both engineering and science. The programme covers fields like fiber optics, laser, semiconductor Optoelectronics, optical electronics, optoelectronics instrumentation, optical communication techniques and systems, photonic switching and guided wave optical components and devices for dense WDM applications, integrates optics etc.

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SYLLABUS

M. Tech in Optoelectronics and Laser Technology

SEMESTER – I

JULY – DECEMBER , 2017

Course Code	Subject	Marks
OE – 11	Modern Optics	100
OE - 12	Laser Technology	100
OE – 13	Optoelectronics	100
OE – 14	Optical Communication	100
OE – 15	Seminar	50
OE – 16	Comprehensive Viva voce	Grade
OE - 17	Fiber Optics, Laser and Optoelectronics and Communication Lab Course – I	150

SEMESTER – II

JANUARY - JUNE , 2018

Course Code	Subject	Marks
OE – 21	Physics of Advanced Materials	100
OE – 22	Fiber Optics & Laser Instrumentation and Solar Photovoltaic Technologies	100
OE – 23	Optical Networks	100
OE – 24	Advance Optical Communication	100
OE -25	Seminar	50
OE – 26	Comprehensive Viva voce	Grade
OE – 27	Fiber Optics, Laser and Optoelectronics and Communication Lab Course – II	150

SEMESTER – III

JULY – DECEMBER , 2018

Course Code	**Subject**	**Marks**
OE – 31	Minor Project and Industrial training	150
OE – 32	Dissertation (Phase – I)	200

SEMESTER – IV

JANUARY – JUNE - 2019

Course Code	**Subject**	**Marks**
OE – 41	Dissertation (Phase – II)	450
	Comprehensive Viva- voce	

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SYLLABUS

SEMESTER – I

July-Dec. 2017

OE-11-MODERN OPTICS

Unit I

Classification of optical processes, optical coefficients, complex refractive index and dielectric constant,

Optical materials : Crystalline insulators and semiconductor, glasses, metal, molecular materials, doped glass and insulator characteristics, Optical Physics in the Solid state, crystal symmetry, electronics bands, vibronic band, the density of state, delocalized states and collective excitation

Light propagation: Propagation of light in dense optical medium, Atomic oscillator, vibration oscillator, free electron **oscillation**, the Kramers – Kronig relationship, Dispersion, Optical anisotropy, birefringence. Matrix representation of polarization, Jones vector, Jones matrices, Jones calculus, orthogonal polarization. Reflection and refraction at a plane boundary, fresnel's equations.

Unit II

Excitons : Basic concept, free excitons in external electric and magnetic fields,

Free Excitions at light densities, frenkel excitons.

Luminescence : Light emission in solids, Interband luminescence, Direct and indirect gap materials, photoluminescence : Excitation and relaxation, degeneracy, Photoluminescence spectroscopy.

Electroluminescence: General Principles of electroluminescence, light emitting diodes, diode laser.

Unit III

Electromagnetism in dielectrics, Electromagnetism fields and Maxwell equation. Electromagnetism waves, Quantum theory of radiative absorption and emission. Einstein coefficients, Quantum transition rates, selection rules. Basic concept of phonons, Polaritons and polarons.

Unit IV

Nonlinear optics : Non linear optics : Physical origin of optical nonlinearities, Non resonant and resonant nonlinearities, second order nonlinearities, Non liner frequency mixing, Crystal symmetry, Phase matching, Third order non linear media. Harmonic generation, mixing and parametric effects. multiphonon processes Two-photon absorption, saturated absorption, Spectroscopy Rayleigh, and Raman scattering. Stimulated Raman effect, Hyper Raman effect, Coherent Antistoke Raman scattering Self-focusing and self-phase modulation. Self-induced transparency. Solitons.

Unit V

Optical Design, Fourier Optics & Holography : Revision of geometrical optics. Fourier transforms. impulse response transfer function. Scalar diffraction, spatial and temporal coherence. Image forming systems, coherent and incoherent imaging. Spatial filtering. Holography (Fresnel, Fraunhofer, Fourier). Holographic techniques and applications. Fourier transforming property of thin lens.

REFERENCE BOOKS

1.Optical Electronics, A. Yariv Saunders

2.Optical Electronics, Ghatak & Thyagarajan, Cambridge U.K.

3.Essentials of Optoelectronics, A. Rogers (Chapman Hall)

4.Optical Properties of Solids Mark Fox

5.Jasprit Singh, Semi conductor Optoelectronics, McGraw Hill, 1995

OE-12 -LASER TECHNOLOGY

Unit I

Einstein Coefficients and Light Amplification

Introduction. The Einstein's coefficients, Quantum Theory for the Evaluation of the Transition Rates and Einstein Coefficients, Interaction with radiation having a broad spectrum, Introduction of a near monochromatic wave with an atom having a broad frequency response, More accurate solution for the two level system, Line broadening mechanisms, Saturation Behavior of homogeneously and homogeneously broadening transitions.

Unit II

Laser Rate Equations : Introduction, The three Level System, The Four level System, Variation of Laser Power around Threshold, Optimum Output coupling. Laser spiking.

Semi classical Theory of Laser: Introduction, Cavity Modes, Polarization of cavity medium : First order & Higher order theory.

Unit III

Optical Resonators: Introduction, modes of a rectangular cavity and the open planar resonator, The Quality factor, The ultimate line width of the laser, Transverse and longitudinal mode selection switching. Mode locking in Lasers Co focal Resonator system, Planar resonators, General Spherical Resonator.

Unit IV

Properties of Laser Beams and laser Structures

Coherence properties of Laser Light : Temporal Coherence, Spatial Coherence, Directionality

Semiconductor: Structure and properties, operating principle, Threshold condition, Power output.

Heterojunction Laser: Principle and structure, Losses in heterostructure laser, Heterostructure laser materials.

Distributed feedback lasers: Principle of working, Coupled mode theory.

Quantum well laser, Strained quantum well laser,

Unit V

Some important application of lasers :

Laser induced fusion: Introduction, The fusion process, laser energy requirements. The laser induced Fusion Reactors.

Lasers in Science: Harmonic Generation, Stimulated Raman Emission, Self focusing, Lasers in Chemistry, Rotation of the Earth, Lasers in isotope Separation.

lasers of light detection and ranging (LIDAR)

REFERENCE BOOKS

1.Lasers Theory and Applications : K. Thyagrajan and A.K. Ghatak, Macmillan Publication

2.W.T. Silfvast, Laser fundamentals, Cambridge University Press

3.Optical Electronics, Ghatak & Thyagarajan, Cambridge U.P. 0-521-31408-9

4.Essentials of Optoelectronic, A Rogers (Chapman Hall), 0-412-40890-2

5.Fowles G.R., Introduction to Modem Optics, 2nd Edition, Holt, Rienhart and Winston

OE-13- OPTOELECTRONICS, ORGANIC ELECTRONICS AND SEMICONDUCTOR DEVICE SIMULATION

Unit I

Optical process in Semiconductors

Electron hole pair formation and recombination, absorption in semiconductor, effect of electric field on Absorption, Franz-keldysh and stark effects, Absorption in Quantum wells and Quantum confined stark effect, relation between Absorption and emission spectra, Stokes shift in optical transition, Deep level transitions, Measurement of absorption and luminescence Spectra, Time resolved Photoluminescence.

Unit II

Materials Growth & Fabrication Growth of optoelectronics materials by MBE, MOCVD, Plasma CVD, photochemical deposition. Epitaxy, interfaces and junctions (advantages/disadvantages of growth methods on interface quality, interdiffusion and doping. Quantum wells and band gap engineering

Equipments for Thin Film Deposition: Working principle of Vacuum Coating Unit , Spin Coating Unit and Spray pyrolysis apparatus and their specifications and features.

Unit III

Organic Electronics

Molecular materials, Electronic state in conjugated molecules, Optical spectra of molecules, Electronic vibration transitions, the Franck Condon principle hydrocarbons, conjugated polymer,

Organic Semiconductors: Conductivity and Mobility of nearly-fee Charge Carriers, Charge Carriers in Organic Semiconductors: Polarons, Shallow Traps and Deep Traps, Generation of Charge Carriers and Charge Transport: Experimental Methods. The TOF Method: Gaussian Transport. Space-Charge Limited Currents. Band or Hopping Conductivity, Electric-field Dependence, Charge Transport in Disordered Organic Semiconductors. The Bassler Model

Unit IV

Organic Optoelectronic Devices :

Organic Light-Emitting Diodes (OLEDs). The Principle of the OLED, Multilayer OLEDs. Structure, Fundamental processes Efficiency, Characterization of OLEDs

Organic photovoltaic diodes (OPVDs): Fundamental process, Exciton absorption, Exciton dissociation, Charge collection characterization of OPVDs, Relevant performance parameters

Unit V

Introduction to Semiconductor Device Simulation: Need of Simulation, Process Simulation, Device Simulation device simulation sequence, hierarchy of transport models, DD Model, Relationship between various transport regimes and significant length-scales.

Numerical Solution Methods - finite difference scheme, discretization of Poisson's and current continuity equations.

REFERENCE BOOKS

1. Organic Electronics: Materials, Manufacturing, and Applications Hagen Klauk Wiley-VCH; 1 edition
2. Organic Molecular Solids Markus Schwoerer (Author), Hans Christoph Wolf, Wiley-VCH; 1 edition (March 27, 2007)
3. Semiconductor Devices Modeling and Technology" by Nandita Das Gupta and Amitava Das Gupta, Prentice Hall of India Pvt.Ltd.
4. Computational Electronics :Dragica Vasileska and Stephen M. Goodnick, CRC Press
5. Semiconductor Optoelectronics Devices: Pallabh Bhattacharya. Pearson Education
6. Optical Electronics, A. Yariv Saunders.
7. Optical Electronics, Ghatak & Thyagarajan, Cambridge U.P. 0-521-31408-9
8. Essentials of Electronic & Optoelectronics properties of semi conductor, Jasprit Singh, Cambridge University Press
9. Hand book of thin film technology, by L. I. Maissel and R. Glang
10. Thin film phenomena, By K. L. Chopra

OE-14- OPTICAL COMMUNICATION

Unit I

Need for fiber optic Communication, evolution of light wave systems and its components. Optical

Fiber – their classification, essentials of electromagnetic theory – total internal reflection, Goos Hanchen shifts Dispersion in Single mode fiber, fiber losses, Non liner optical effects and polarization effect. Analysis of Optical fiber waveguides, electromagnetic mode. Theory for optical propagation attenuation and single distortion in optical waveguide. Characteristic equation of step-index fiber, modes and their cut-off frequencies, single-mode fibers, weakly guiding fibers, linearly polarized modes, power distribution. Graded-index fibers- WKB and other analysis, propagation constant, leaky modes, power profiles, dispersions – material, modal & waveguide, impulse response.

Unit II

Physics and Technology of Optical Fiber

Passive photonic components: FO cables, Splices, Connectors, Couplers, Optical filter, Isolator, Circulator and Attenuator, switches.
Fabrication of optical fibers: MOCVD, OVD, VAD, PCVD; measurement of RI, attenuation. Etc. Fiber devices, fiber Bragg gratings, long period gratings, fiber amplifiers and lasers. Application of optical fibers in science, industry, medicine and defense.

Unit III

Optical fiber systems, modulation schemes, Digital and analog fiber communication system, system design consideration, fiber choice, wavelength conversion, switching and cross connect Semiconductor Optical amplifier (SOA), characteristics, advantages and drawback of SOA, Raman amplifier, erbium doped fiber amplifier, gain and noise in EDFA, Brillion fiber amplifier, wideband Hybrid amplifier, noise characteristic, amplifier spontaneous emission, noise amplifier, noise figure, Cumulative and effective noise figure, Noise impairments, amplifier applications.

Unit IV

Optical Transmitters : Basic concepts, Light emitting diodes, Semiconductor laser, characteristics, Transmitter design, Optical Receivers; Basic concepts, P-n and pin photo detector. Avalanche photo detector MSM photo detector, Receiver design, Receiver noise, Receiver sensitivity, Sensitivity degradation, performance.
Electro-optic effect, electro optic retardation. Phase and amplitude modulators, transverse electro optic modulators, Acousto-optic effect, Raman-Nath and Bragg regime, acousto-optic modulators, magneto optic effects.

UNIT V

Wavelength division multiplexing (WDM): Multiplexing Technique, Topologies and architectures, Wavelength shifting and reverse, Switching WDM demultiplexer, optical Add/drop multiplexer. Dense wavelength division multiplexing (DWDM): System consideration, Multiplexer and demultiplexers, fiber amplifier for DWDM, SONET/SDH Transmission, Modulation formats, NRZ and RZ signaling, DPSK system modeling and impairments.

Text books :

[1] John. M. Senior, Optical fiber communication : principles, Prentice Hall of India.

[2] Gerd keiser, optical fiber communication, McGraw Hill, 3rd edition.

[3] D.K. Mynbaev, LL Scheiner, Fiber optic communication technology, Pearson Technology

[4] R.P. Khare, Fiber optic and optoelectronics, Oxford University press.

[5] John Gowar, Optical Communication Systems, Prentice Hall of India.

[6] Optical Electronics, A. Yariv, Saunders

REFERENCE BOOKS

1 Light wave Communication Systems : A practical prospective : R Papannareddy, Penrum International Publishing.

2 Fiber optic communication Systems: G.P. Agrawal, Hohnawian and Sons.

3 Bahaa E.A. Saleh & Malvin Carl Teich, Fundamentals of photonics, John Wiley & Sons, 1991

OE-17- Fiber Optics, Laser and Optoelectronics and Communication Lab- I

Experiments are to be performed in the Advance Photonics Laboratory of S. O.S. in Electronics Department.

L 1 Fiber Optics Lab :

1. Study of setting up a Optic Analog Link.
2. Study of setting up a fiber Optic Digital Link.
3. Study of Losses in Optical Fiber.
4. Measurement of Numerical aperture of a optical fiber.
5. Study of Manchester Coding & Decoding of optical Signal.
6. Study of Time Division Demultiplexing through fiber optic link – B.

7. Measurement of Bit Error Rate of an optical signal through fiber optic link – B.
8. Study of Eye Pattern of fiber through fiber optic ling – B.
9. Forming PC to PC Communication Link-using Optical Fiber & RS – 232 Interface.

L2 – Laser Lab :

1. Study of Diode Laser characteristic.
2. Construction of laser beam expander.
3. Measurement of screw parameter.
4. Measurement of electro-optic coefficient.
5. Magneto-optic effect (Faraday Rotation)
6. High voltage sensor based on electro-optic effect.
7. Molecular Weight Measurement.
8. Holography.

PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)

SYLLABUS

M. Tech in Optoelectronics and Laser Technology

SEMESTER – 2

JANUARY – JUNE, 2018

OE-21- PHYSICS OF ADVANCED MATERIALS

UNIT I

Nano Particles and Nano Structured Materials :

Properties of Individual Nano-Particle: metal nanoparticles, geometric and electronic structure, magnetic clusters, Semiconductor nanoparticles, optical properties, rare gas and molecular clusters, methods of synthesis of nanoparticles. Carbon nanostructure, C60 carbon nanotube and Application. **Bulk nano structured materials:** Solid disordered nanostructures, methods of synthesis, properties, metal nano-cluster composite glasses, porous silicon; Nano structured crystals.

UNIT II

Quantum Nanostructures and Nano-Machines/Devices :

Quantum wells, wires and dots, preparation, size & dimensionality effects, excitons, single electron tunneling, applications of quantum nanostructure. Super conductivity. Self assembly, process of self assembly, semiconductor islands, monolayers. Catalysis, surface area of nanoparticles, porous, and colloidal materials. Nanomachines and devices; microelectromechanical system (MEMSs), nanoelectromechanical system (NEMSs).

UNIT III

Material requirement for solid state lasers, Activator ions and centers, Material design parameters for semiconductor laser diode, choosing alloy composition and thickness, making ohmic contracts, Other III-V heterojunction laser materials. Introduction to organic laser. Material selection for light emitting diodes.

Electroluminescent materials:

Inorganic electroluminescence, AC powder EL, ACTFEL device, EL characteristics, EL excitation mechanism. Electroluminescence in Organic solids, Material useful for organic thin film EL devices, polymeric material for EL.

UNIT IV

Characterization of Materials : Introduction to emission and absorption spectroscopy: Nature of electromagnetic radiation, electromagnetic spectrum, atomic, molecular, vibrational and X-ray energy levels Basics of UV-VIS spectroscopy: Radiation sources, wavelength selection, Cells and sampling devices, Detectors, Basic ideal of IR spectrometry: Correlation of Infrared spectra with Molecular Structure.

Fundamental of X-ray diffraction, Powder diffraction method, Quantitative determination of phases; Structure analysis **Epitaxial thin film techniques :** Liquid phase epitaxy, vapour phase epitaxy, Metal Organic chemical vapour deposition, Atomic layer epitaxy.

UNIT V

Experimental techniques: High resolution X ray diffraction, Double Crystal diffraction, Drift mobility and Hall mobility, Hall effect for Carrier density and Hall mobility, Photoluminescence

(PL) and Excitation Photoluminescence (PLE) Optical pump probe experiments. Basic idea of Microscopic Techniques : optical microscope, Scanning Electron Microscope (SEM), Transmission Electron , microscope (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Thickness measurement – gravimetric method

Basics of Ellipsometry: optical parameter measurements (n and k)

TEXTS & REFERENCE BOOKS

[1] Introduction to Nanotechnology by Charles P. Poole Jr. and Frank J. Owens (Willey Inter. Science pub 2003).

[2] Nanostructures and Nanomaterials – Synthesis properties and Applications by Guozhong Cao (Empirical College Press World Scientific Pub. 2004).

[3] Physics of Semiconductor Devices by S. M. Sze(Willey Int., 1981)

[4] Instrumental methods of analysis, H. H. Willard, L. L. Merritt, J A Dean, F A Sellte, CBs Publishers New Delhi 1996.

[5] Scanning Electron Microscopy : OOtley

[6] Handbook of Electroluminescent Materials Ed. D. R. Vij Inst of Physics, Bristol and Philadelphia

[7] Electronic and Optoelectronic properties of Semiconductor, Jaspreet Singh, Cambridge University Press

OE-22- FIBER OPTICS LASER INSTRUMENTATION AND SOLAR PHOTOVOLTAIC TECHNOLOGIES

Unit I

OPTICAL FIBER AND THEIR PROPERTIES

Principle of light propagation through a fiber – Different types of fiber and their properties – Fiber materials and their characteristics – Transmission characteristic of fibers – absorption losses – scattering losses – Dispersion – measurement of optical fibers – optical sources – Optical detectors.

Unit II

FIBER OPTIC SENSORS IN MEASUREMENTS

Fiber optic instrumentation system – Fiber optic sensors ,Different types of modulators – Application in instrumentation – Interferometric method of length – Measurement of pressure, temperature, current, voltage, liquid level and strain.

Unit III

LASERS IN MEASUREMENTS AND TESTING

Laser for measurement of distance, length, velocity, acceleration, current, voltage, and atmospheric effect, Laser application in Spatial Frequency filtering**.**
Holography: Basic principle, methods; Holographic interferometry and applications; Holography for non – destructive testing – Holographic components

Unit IV

Lasers in Industry – Application in material processing, Laser Welding, Hole Drilling, Laser cutting, Laser Tracking
Medical Application of Lasers
Medical applications of lasers; laser and tissue interaction – Laser instrument of surgery.

Unit V

Solar Photovoltaic Technologies

Generation of Photo voltage, Light Generated current,, I-V equation, Solar Cell Characteristics, parameters of solar cells, Relation of Voc and Eg
Design of solar cells: Upper limit of cell parameters, Losses in Solar Cell, Design for High Isc, Voc and FF Analytical Techniques: Solar Simulator-IV measurement, Quantum efficiency measurement, Minority carrier lifetime & diffusion length measurement.

REFERENCES

1. John and Harry, Industrial Laser and their applications, McGraw Hill
2. John F Ready, Industrial application of lasers. Academic press 1978
3. John Crisp, Introduction to Fibre Optics , an imprint of Elsevier Science 1996
4. Jasprit Singh, Semiconductor Optoelectronics, McGraw Hill 1995
5. Understanding Fiber Optics, 4th or 5th edition; Jeff Hech; Prentice Hall Publishers
6. Optical Fiber Communication Principles and Systems, A. Selvarajan, S. Kar and T. Srinivas TMH
7. Optical Fiber Communication, Keiser, G. McGraw Hill, Int. Student Ed.
8. Fiber Optic Communication System, G. P. Aggarawal, Willey Eastern
9. Introduction to Fiber Optics, A. Ghatak and K. Thyagrajan, Cambridge Univ. Press
10. Solar Photovoltaics: Fundamentals, Technologies and Applications, C. S. Solanki, 2nd Edition , Prentice Hall of India, 2011.

11. Solar cells: Operating principles, technology and system applications, by Martin A. Green, Prentice-Hall Inc, Englewood Cliffs, NJ, USA,

OE-23- OPTICAL NETWORKS

Unit I

WDM Technology and Issue in WDM Optical networks: Introduction – Optical networks – WDM – WDM optical network evolution- Enabling Technology for WDM optical networks – WDM optical network architecture – Issue in Wavelength routed networks – Next generation optical Internet networks

Unit II

Wavelength Routing Algorithms : Introduction – Classification of RWA algorithms – Fairness and Admission control – Distributed control protocols – Permutation routing and Wavelength requirements
Wavelength Rerouting algorithms : Introduction – benefits of wavelength routing – Issue in Wavelength routing – Light path Migration – Rerouting schemes – Algorithm AG – Algorithm MWPG – Rerouting in WDM networks with Sparse Wavelength conversion – Rerouting in Multifiber networks – Rerouting in Multifiber Unidirectional ring Networks .

Unit III

Wavelength Convertible networks : Introduction - need for Wavelength converters – Wavelength convertible switch architecture – routing in convertible networks – Performance evaluation of convertible networks – Networks with Sparse Wavelength conversion – Converter placement problem – Converter allocation problem.

Unit IV

Virtual topology Design : Introduction – Virtual Topology design problem – Virtual topology sub problems – Virtual topology design Heuristics – Regular virtual topology design – predetermined virtual topology and lightpath routes – Design of multi fiber networks.

Virtual Topology Reconfiguration : Introduction – Need for virtual topology reconfiguration – Reconfiguration due to Traffic changes – reconfiguration for fault restoration.

Unit V

Network Survivability and provisioning: Failures and Recovery – Restoration schemes – Multiplexing techniques – Distributed control protocols. Optical Multicast routing – Next generation optical Internet networks.

REFERENCES :

1. C. Siva Ram Murthy and Mohan Gurusamy, ”WDM Optical Networks : Concepts, Design and Algorithms “, Prentice Hall India 2002.
2. Rajiv Ramasami and Kumar N. Sivarajan, “ Optical networks : A Practical Perspective”, A Harcourt publishers international company 2000.

OE-24-ADVANCED OPTICAL COMMUNICATION

Unit I

Components

Introduction to optical components – optical amplifiers – types – issue in optical amplifiers – photonic switching – cross connect – wavelength conversion – multiplexer – demultiplexer – filters – tunable filters – introduction to OICs and its applications.

Unit II : First Generation optical Networks

SONET/SDH – multiplexing , element of a SONET/SDH infrastructure - SONET/SDH physical layer, Computer interconnects – ESCON, Fiber channel, HIPPI , Metropolitan area networks – FDDI, ATM, Layered Architecture - SONET/SDH layers – Second generation optical network layers.

Unit III : WDM Technology

Introduction – WDM optical networking evolution – enabling technologies for WDM optical networks – WDM optical network architecture – DWDM – issues in WRN

Unit IV

OTDM Technology

Important issues of OTDM – optical solitons – applications of solitons . Optical pulse compression – fiber grating compressor – soliton effect compressor.

Unit V : FTH and PON Technology

Proposed architecture and issues of Fiber to the home (FTH) – Passive Optical Network (PON) –

Near space communication – open air optical communication. Inter satellite link hops(ISL). Introduction to all optical networks(AON) , Military , Civil, consumer and industrial applications

REFERENCES BOOKS :

1. Rajiv Ramaswami and Kumar N. Sivrajan, " Optical networks – A practical perspective", A Harcourt Publishers International Company 2000
2. R. G. Junsperger, " Integrated Optics – Theory and Technology, Springer Series in Optical Sciences", 3rd Edition 1991
3. Gerd Keiser, " Optical Fiber Communications",McGraw Hill International Edition 191
4. G. P. Aggarawal," Non Linear Optics", Academic Press.
5. Stamations V. Kartalopoulos, "Understanding SONET/ SDH and ATM Communication network for Next Millennium", PHI 2000.
6. C. Sivaram and mohan Gurusamy, " WDM Optical Networks : Concepts, Design and Algorithms" PHI India 2002.

OE-27- FIBER OPTICS AND OPTICAL COMMUNICATION LAB – LAB II

Experiments are to be performed in the Advance Photonics Laboratory in S.O.S. in Electronics Department.

EXPERIMENTS

1) To calculate the wavelength of Laser using Michelson interferometer.
2) To determine the size of tiny particles using Laser.
3) To determine the grating pitch of transmission grating.
4) To determine the wavelength of a Laser using meter scale ruling.
5) To find the refractive index of glass (transparent materials) by measuring Brewster angle.
6) To determine the bending losses that occurs in a multimode fiber when it is bent along various radii.
7) To determine the absorption coefficient of transparent materials (glass slide).
8) To study the variation of splice losses due to transverse offset, angular tilt and longitudinal separation.
9) To observe the refraction of light in liquid and to calculate its refractive index.
10) To study the wavelength dependence of attenuation in the given optical fiber.
11) To determine insertion loss of each channel of WDM mux, loss uniformity and optical cross talk in channels.
12) To setup optical Add/Drop multiplexer (OADM) using fiber Bragg grating .
13) To setup the WDM link with the given components and determine the total loss for each wavelength.
14) To find the refractive index of transparent Bar using diode Laser.

15) To observe the absorption of Laser light when various colors are introduced in its path.
16) Preparation of thin films with the help of Vacuum Coating Unit and resistance/impedance measurement using Source measuring unit.
17) Preparation of thin films with the help of Spray pyrolysis method and resistance/impedance measurement using Source measuring unit.
18) Preparation of thin films with the help of Vacuum Coating Unit and optical constant measurement using ellipsometer

Note Students have to perform at least 15 experiments

SEMESTER III (July – December, 2018)
&
SEMESTER IV (January – June , 2019)

Project Work Scheme

The problem may be selected form an appropriate Industry or Institution. The candidate is expected to work under the guidance of a project guide for at least for a period as decided. In case the project work is taken up in an external Industry/Institution, the project shall have two guides: one in the participating organization (Industry/Institution) who is the external guide and the other shall be one of the faculty members form Department who is the internal guide. The dissertation should be submitted within tow calendar years form the starting date of the third semester, Six copies of the dissertation have to be submitted to the M.Tech Course Coordinator. These copies shall be distributed to the External examiner, Internal Examiner, Project guide (Faculty), Department Library and University Library and the Candidate.

Evaluation of Project Work

The project evaluation committee shall be responsible for the project work evaluation The project evaluation committee will be consisting of Chairman, Course Coordinator, an internal examiner and external examiner. The Chairman of the project evaluation committee shall be the Chairman

Departmental Committee constituted as per norms of UGC. The project guide (faculty from department) shall be the internal examiner. The external examiner shall be a technical expert in the concerned subject form any organization other than that of the project guide and is selected form the panel of experts submitted by the Course Coordinator. The project work shall be evaluated through presentations and viva voice. The grade/marks shall be given to the students according to the level and quality of work and presentation/documentation.