Semester III

SI. No.	Course Code	Course Title	Hours/ week			Total Credits	Theory Marks		Practical Marks
			L	T	P		ESE Marks	Internal Marks	
1.	M301	Optical Fiber Communication System	3	0	0	3	70	30	0
2.	M302	Software Engineering	3	0	0	3	70	30	0
3.	M303	Project Work and Seminar I	0	0	20	10	25	25	50
4.	ML301	Optical Fiber Communication System Laboratory	0	0	2	1	40	10	50
		Total	6	0	22	17	205	95	100

Third Semester

Course Code	**M301**
Course Title	**Optical Fiber Communication System**
Credits	**3-0-0:3**
Pre-requisutes	**Nil**

Objective

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors. Design optimization of SM fibers, RI profile and cut-off wavelength.
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
- To learn fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.
- To be able to design transmitter and receiver circuit of the optical fiber link.
- Should get aware of the criteria of selection of optical fiber cable in an optical link
- Should get the knowledge about difference in video, voice and data transmitter system.
- Should get the concepts of other optoelectronics techniques like acousto-optics, electro optics and Integrated Optics.

Syllabus:

- Introduction, Opto electronics sources and Detections, Opto Electronics Instructions, Laser system, Electro optics and non liner optics effects, Optical communication systems and design, Optical sensors and systems

Course Outcome

- After finishing the course student will become familiar with all components of optical fiber system like sources, detector and optical fiber
- Students will become knowledgeable about the working principal of above devices.
- Student will get knowledge about the construction mechanism and selection criteria of Optical fiber cables.
- The student will be able to design transmitter circuits, receiver circuit and selection of optical fiber cable for a given conditions of the optical fiber link.
- Will have the knowledge about selection of optical fiber and optical fiber cable for different type of an optical link, with having application for voice, video or data transmission.

- Will have knowledge of other optoelectronics techniques like acousto-optic acoustooptic , electro optics and Integrated Optics.

TEXT BOOKS:

1. J. Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.
2. Fiber optics by R. P. Khare, oxford university press

REFERENCES:

1. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd ed., 2000
2. J.Gower, "Optical Communication System", Prentice Hall of India, 2001
3. Fundamentals of Photonics 2nd ed., Saleh and Teich, (John Wiley & Sons, inc., 2007).
4. Fiber Optic Communication Systems – Govind P. Agarwal, John Wiley, 3rd Edition, 2004
5. Photonics: Optical Electronics in Modern Communications by Yariv, Pochi yeh

Course Plan:

Modules (Theory)	No. of Hours	%ESE marks
Module 1: Introduction: **Ray theory of transmission**, propagation of light in anisotropic media, light propagation in wave guides. Fiber optics-history, types of fibers, characteristics of optical fiber, fabrication.Fiber splicing-mechanical and fusion splicing and testing of optical fibers. **Laser Devices:** Historical introduction, emission and absorption of radiation, spontaneous and stimulated emission, population inversion, optical feedback, the laser resonator.	7	25
Module 2: Optical sources and detectors **Light emitting diodes:** LED of different colors, Materials used for emission of lightLED power and efficiency, irradiance, LED structures, Characteristics of LED. **LASER:** Injection laser diodes, Basic Homojunction laser, Double hetro-junction laser. Laser system, power supplies for laser, Various gas, solid state semiconductor lasers and their properties, application in brief. **Detectors:** Optical detection principle, Absorption, Quantum efficiency, Responsivity, Long-wavelength cutoff, Rise time and bandwidth. Photodiodes without internal gain- The PN photodiode, PIN photodiode- construction, speed of response. Photodiodes with internal gain- APD, silicon reach through avalanche photodiode. Photo detector Noise-Noise Sources, Signal-to-Noise Ratio, Noise-Equivalent Power.	10	25

Module 3: Optical communication system and design Optical fibers and other components for fiber optic communication, fiber optic communication system. System consideration- Wavelength, Photo detector, Optical source, optical fiber, Losses. Link power budget and rise time consideration, Transmitter & receiver circuits. WDM- working principle, Optical Amplifiers-Erbium Doped Fiber Amplifier, Semiconductor optical amplifier, Photonic switching, SONET/SDH.	10	20
Module 4Electro optics and non-linear optics effects: Design of A.O modulators and deflectors. Electro- optic effects-Pockels and Kerr effects: change in refractive index in KDP crystal. Design of electro optional modulators, switching, multiplexers and other devices. Integrated optical circuits. Nonlinear Effects: Effective Length and Area, Stimulated Raman Scattering (SRS), Stimulated Brillouin Scattering (SBS), Self-Phase Modulation (SPM), Cross-Phase Modulation, Four-Wave Mixing.	8	20
Module 5:Opto-electronic instructions: Laser interferometry and application to metrology and testing, Holography and holographic interferometry, speckle techniques. Digital speckle pattern interferometer, Laser gyro and Doppler velocimetry, OTDR, LIDAR applications,	5	10

Course Code	**M302**
Course Title	**Software Engineering**
Credits	**3-0-0:3**
Pre-requisites	**Nil**

Objective

- Understand basic SW engineering methods and practices, and their appropriate application.
- Understand u of software process models such as the waterfall and evolutionary models.
- Role of project management including planning, scheduling and, risk management.
- Discuss data models, object models, context models and behavioral models.
- Understand of different software architectural styles and Process frame work.
- Understand of implementation issues such as modularity and coding standards.

Syllabus:

- System Analysis and Design: Overview of System Analysis & Design , Business System Concept, System Development Life Cycle ,System Design – Problem Partitioning, Top-Down And Bottom-Up design ;Decision tree, Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control. Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring and Mobile application security

Course Outcome

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- Describe software engineering layered technology and Process frame work.
- A general understanding of software process models such as the waterfall and evolutionary models.
- Understanding of software requirements and the SRS documents.
- Understanding of the role of project management including planning, scheduling, risk management, etc.
- Describe data models, object models, context models and behavioral models.
- Understanding of different software architectural styles.
- Understanding of implementation issues such as modularity and coding standard should get the concepts of other optoelectronics techniques like acoustic-optics, electro optics and Integrated Optics.

TEXT BOOKS:

1. 1. R. G. Pressman – Software Engineering, TMH

REFERENCES:

1. IEEE Standards on Software Engineering. Kane, Software Defect Prevention, SPD
2. Behforooz, Software Engineering Fundamentals, OUP
3. Ghezzi, Software Engineering, PHI
4. Object Oriented & Classical Software Engineering(Fifth Edition), SCHACH,TMH
5. Vans Vlet, Software Engineering, SPD
6. Uma, Essentials of Software Engineering, Jaico
7. Sommerville, Ian – Software Engineering, Pearson Education
8. Benmenachen, Software Quality, Vikas

Course Plan:

Modules (Theory)	No. of Hours	%ESE marks
Module 1: System Analysis and Design : Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost-Benefit Analysis, COCOMO model.	10	25
Module 2: Design related issues: System Requirement Specification – DFD, Data Dictionary, ER diagram, Process Organization & Interactions. System Design – Problem Partitioning, Top-Down And Bottop-Up design ;Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.	8	25
Module 3: Coding & Documentation: Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.	10	25
Module 4: User Interface : Module Introduction, Objectives of Usability, How to Approach Usability, Designing with Usability in mind, Measuring Usability, Guidelines for User Interface Design, User Interface Elements.	6	10
Module 5: Software Project Management & Software security : Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring , Software security life cycle Software quality attributes Security requirement gathering principles and guidelines A case Study (Mobile application security) Mobile application security Malware classification and analysis Module 4 (Design and testing for security, best practices) Secure software design principles Static analysis techniques Security testing (black	**7**	15

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Course Code	**M303**
Course Title	**Project Work and Seminar I**
Credits	**0-0-10:10**
Pre-requisites	**Nil**

Objective:

- To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

Syllabus:

The project work can be a design project/experimental project and/or computer simulation project on any of the topics in electronics design related topics. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to continue their project outside the parent institute, subject to the conditions of M.Tech regulations. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee shall be headed by the head of the department with other faculty members in the area of the project.

The student is required to undertake the Project Work and Seminar I during the third semester and the same is continued in the 4^{th} semester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester.

Course Outcome:

After successful completion of the project phase I, students should be able to:

- Formulate a research problem and perform literature review
- Systematically carrying out a research and write technical reports

Evaluation/ Assessment:

Guide (25 marks)	Evaluation Committee (25 marks)

Course Code	**ML301**
Course Title	**Optical Fiber Communication System Laboratory**
Credits	**0-0-1: 1**
Pre-requisutes	

Objective:

- To Train students practically in the field of optical communication so that they can relate theory with elements of design and applications.
- To understand different kinds of losses, signal attenuation in optical fibers.
- To make students familiarize with different types of connectors.
- To make student familiar with different splicing techniques.
- To train students by giving practical exposure on fiber optic splicing machine following proper methods for good splicing.
- To make students understand the use of OTDR and study various losses in the optical fiber.
- To make students interpret the trace in OTDR.

Syllabus:

- Different types of fiber cables, connectors, LED and Photo detectors. Establishment of analog and digital link, intensity modulation techniques, attenuation loss, Numerical Aperture, bending loss, OTDR.

Course Outcome:

- Students will be able to classify different types of fiber optic cable and their components.
- Students will be able to identify different types of fiber optic connectors.
- Students will get knowledge about different types of LED and Photodetectors.
- Students will be able to calculate losses.
- Students will learn proper methods to be followed for optical fiber splicing and joining.
- Students will be able to handle OTDR and interpret the traces plotted in OTDR.

Course Plan:

SI. No.	Practicals (at least 10 nos)	No. of Hours	% ESE marks
1.	Demonstration of different types of fiber cables and connectors.	2	10
2.	To study the characteristics of given LED and Photo detector.	2	10
3.	To Establish Analog and Digital link using optical fiber cable.	2	10
4.	Study of Intensity Modulation Technique using Analog input signal.	2	10

5.	To measure propagation or attenuation loss in optical fiber.	2	10
6.	To Study Bending Loss in fiber optic communication.	2	10
7.	To measure the Numerical Aperture (N.A.) of the fiber optic cable.	2	10
8.	To establish Fiber optic voice link.	2	10
9.	To study the Optical time Domain reflectometer and interpret the trace generated in OTDR.	2	10
10.	To Study the Fiber Optic Splicing and Joining.	2	10