UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2018 SCHEME)

SYLLABUS FOR

VII SEMESTER

ELECTRONICS and COMMUNICATION ENGINEERING

SCHEME -2018

VII SEMESTER

ELECTRONICS and COMMUNICATION ENGINEERING (T)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/ P				
18.701	Nano electronics (T)	3	3	1	-	50	3	100	150
18.702	Optical Communication(T)	3	3	1	-	50	3	100	150
18.703	Microwave & Radar Engineering (T)	3	3	1	-	50	3	100	150
18.704	Information Theory & Coding (T)	4	3	1	-	50	3	100	150
18.705	Embedded Systems(T)	3	3	1	-	50	3	100	150
18.706	Elective III	3	3	1	-	50	3	100	150
18.707	Modeling & Simulation of Communication Systems Lab (T)	2	-	-	3	50	3	100	150
18.708	Seminar (T)	1	-	-	1	50	-	-	50
18.709	Project Design (T)	1	-	-	1	50	-	-	50
	Total	**23**	**18**	**6**	**5**	**450**		**700**	**1150**

18.706 Elective III

18.706.1	MEMS (T)
18.706.2	Intellectual Property Rights (T)
18.706.3	CDMA Systems (T)
18.706.4	Optoelectronic Devices(T)

18.701 NANOELECTRONICS (T)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

• Explain the fundamental science and quantum mechanical effects associated with low dimensional semiconductors.
• Identify the significance of Nano level fabrication of particles and layers and their characterization.
• Correlate the concept of quantum level transport and tunneling in similar structured Nano devices.
• Analyze nanoscale devices like SET, QW laser, CNT Transistors, RTD etc.

Module – I

Introduction to nanotechnology and nanoelectronics, Impacts, Limitations of conventional microelectronics.
Mesoscopic Physics and Nanotechnologies - trends in Microelectronics and Optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence, Quantum wells ,wires and dots, Density of states and dimensionality The physics of low dimensional structures - basic properties of two dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, quantum wires and quantum dots.

Module – II

Introduction to methods of fabrication of nanomaterials-different approaches. fabrication of nano-layers -Physical Vapor Deposition, Chemical Vapor Deposition, Epitaxy- Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide.
Fabrication of nanoparticle- grinding with iron balls, laser ablation, reduction methods, solgel, self-assembly, precipitation of quantum dots.
Introduction to characterization tools of nano materials-principle of operation of STM, AFM,SEM, TEM, XRD, PL & UV instruments.

Module – III

Semiconductor quantum nanostructures and super lattices, MOSFET structures, Heterojunctions, modulation doped quantum wells, multiple quantum wells. The concept of super lattices Kronig - Penney model of super lattice.
Transport of charge in Nanostructures under Electric field - parallel transport, perpendicular transport, quantum transport in nanostructures Transport of charge in magnetic field and quantum Hall effect - Effect of magnetic field on a crystal, the Aharonov-Bohm effect, the Shubnikov-de Hass effect, the quantum Hall effect.

Module – IV

Nanoelectonic devices and systems , MODFETS, heterojunction bipolar transistors, resonant tunnel effect, RTD, RTT, hot electron transistors, Coulomb blockade effect and single electron transistor, CNT transistors, heterostructure semiconductor laser, quantum well laser, quantum dot LED, quantum dot laser, quantum well optical modulator, quantum well sub band photo detectors, Infrared detector, nano switches, principle of NEMS.

References:

1. Martinez-Duart J. M., R. J. Martin Palma and F. Agulle Rueda, *Nanotechnology for Microelectronics and Optoelectronics*, Elsevier, 2006.

2. Fahrner W. R., *Nanotechnology and Nanoelectronics*, Springer, 2005

3. Chattopadhyay and Banerjee, *Introduction to Nanoscience & Technology*, PHI, 2012.

4. Poole, *Introduction to Nanotechnology*, John Wiley 2006.

5. George W. Hanson, *Fundamentals of Nanoelectronics*, Pearson Education, 2009.

6. Supriyo Dutta, *Quantum Transport- Atom to Transistor*, Cambridge, 2013.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note**: Question paper should contain 20 % Analysis/Numerical Problems.*

Course Outcome:

After the successful completion of the course the student will be able to

- *Explain the fundamental science of low dimensional semiconductors.*
- *Know the fabrication of nanoparticles and their characterization.*
- *Correlate the concept of quantum level transport and tunneling in nanodevices.*
- *Analyze nanoscale devices like SET, QW laser, CNT Transistors, RTD etc.*

18.702 OPTICAL COMMUNICATION (T)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 3

Course Objectives:

- *Explain mode theory and parameters of different types of optical fibers.*
- *Discuss principle, characteristics and applications of optical sources and detectors.*
- *Illustrate different types of optical amplifiers.*
- *Design optical link and analyze performance.*
- *Describe different types of optical measuring instruments.*
- *Discuss different optical components of WDM.*

Module – I

General light wave system, advantages, classification of Light wave systems. Fibers- types and refractive index profiles, Mode theory of fibers- modes in SI and GI fibers. Impairments in fibers, Dispersion- Group Velocity Dispersion, modal, wave guide and Polarization Mode Dispersion. Attenuation- absorption, bending and scattering losses, fiber materials, fabrication of fibers, photonic crystal fiber, index guiding fiber, photonic bandgap fiber, fiber cables.

Module – II

Optical sources, LEDs and LDs, Structures, Characteristics, Modulators using LEDs and LDs. Coupling with fibers. Noise in Laser diodes, Amplified Spontaneous Emission (ASE) noise, effects of Laser diode in optical communication. Optical detectors, types and characteristics, structure and working of PIN and APD, noise in detectors and comparison of performance.

Module – III

Optical receivers- Ideal photo receiver and quantum limit of detection. Digital transmission systems, Design of IMDD links- power and rise time budgets, Coherent Systems, sensitivity of a coherent receiver, comparison with IMDD systems. Optical Amplifiers- comparison of different types- doped fiber amplifiers, EDFA, structure and working, structure and working of semiconductor laser amplifier, amplifier configurations. Optical Time Domain Reflectometer (OTDR), fault detection, length and refractive index measurements.

Module – IV

The WDM concept, WDM standards, Couplers, circulator, Add/ Drop Multiplexers, gratings, tunable filters, MZ interferometer, system performance parameters. Introduction to soliton transmission, soilton links using optical amplifiers, GH effect, soliton-soliton interaction, amplifier gain fluctuations, design guide lines of soliton based links. Introduction to optical networks. Introduction to free space optics, LiFi technology and VLC.

References:

1. Gerd Keiser: *Optical Fiber Communications*, 5/e, McGraw Hill, 2013.
2. Mishra and Ugale, *Fiber optic Communication*, Wiley, 2013.
3. Joseph C. Palais – *Fiber Optic Communications*, 5/e, Pearson, 2013.
4. John M Senior- *Optical communications*, 3/e, Pearson, 2009.
5. Hebbar, *Optical Fiber Communication*, Elsavier,2014
6. Chakrabarthi, *Optical Fiber Communication*, McGraw Hill, 2015.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum *Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note**: Question paper should contain 20 % Analysis/Numerical Problems.*

Course Outcome:

After the successful completion of the course the student will be able to
- *explain mode theory and parameters of different types of optical fibers*
- *know principle, characteristics and applications of optical sources and detectors.*
- *Illustrate different types of optical amplifiers.*
- *design optical link and analyze the performance.*
- *explain different optical components of WDM and soliton-based system.*

18.703 MICROWAVE AND RADAR ENGINEERING (T)

Teaching Scheme: 3(L) - 1(T) - 0(P **Credits :3**

Course Objectives:

- *Differentiate between conventional tubes & microwaves tubes.*
- *Explain the principle of microwave amplifiers and oscillators and analyze their parameters.*
- *Describe the principle and characteristics of microwave solid state devices.*
- *Recognize various microwave components*
- *Discuss the methods to measure various parameters.*
- *Explain different types of radars*

Module – I

Microwaves: introduction, advantages, Cavity Resonators - Rectangular and Circular wave guide resonators- Derivation of resonance frequency of Rectangular cavity.
Microwave vacuum type amplifiers and sources**:** Klystron Amplifiers - Re-entrant cavities, Velocity modulation, Bunching (including analysis), Output power and beam loading.
Reflex Klystron Oscillators, Derivation of Power output, efficiency and admittance.

Module – II

Travelling Wave Tube - Slow wave structures, Helix TWT, Amplification process, Derivation of convection current, axial electric field, wave modes and gain. Magnetron oscillators - Cylindrical magnetron, Cyclotron angular frequency, Power output and efficiency.
Microwave hybrid circuits – Waveguide tees- Magic tees, Hybrid rings, Corners, Bends, Twists. Formulation of S-matrix.

Module – III

Directional couplers – Two hole directional couplers, S-matrix of a directional coupler. Circulators and isolators. Microwave measurements
Solid state microwave devices – Microwave bipolar transistors – Physical structures, Power frequency limitations equivalent circuit. Principle of Tunnel diodes and tunnel diode oscillators. Gunn diodes – Different modes, Principle of operation Gunn Diode Oscillators..

Module – IV

Radar-The simple Radar equation. Pulse Radar, CW Radar, CW Radar with non zero IF, Equation for doppler frequency FM-CW Radar using sideband super heterodyne receiver. MTI Radar-Delay line canceller, MTI Radar with power amplifier & power oscillator, Non coherent MTI Radar, Pulse Doppler Radar.Radar Transmitters: Radar Modulator-Block diagram, Radar receivers- noise figure, low noise front ends, Mixers, Radar Displays .

References:

1. Samuel Y. Liao, *Microwave Devices and Circuits*, 3/e, Pearson Education, 2003.

2. Robert E. Collin, *Foundation of Microwave Engineering*, 2/e, Wiley India, 2012.

3. Rao, *Microwave Engineering*, 2/e, PHI, 2012.

4. David M. Pozar , *Microwave Engineering*,4/e, Wiley India, 2012.

5. Merrill I. Skolnik, *Introduction to Radar Systems*,3/e, Tata McGraw Hill , 2008.

6. Kulkarni M, *Microwave and Radar Engineering*, 4/e, Umesh Publications, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum *Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note*: *Question paper should contain 15% Analysis/Numerical Problems.

Course Outcome:

After the studying the course the students will be able to

- *differentiate between conventional tubes & microwaves tubes.*
- *explain and analyze the microwave amplifiers and oscillators*
- *describe the principle and characteristics of microwave solid state devices.*
- *recognize various microwave components and the methods to measure various parameters.*
- *explain different types of radars*

18.704 INFORMATION THEORY AND CODING (T)

Teaching Scheme:3(L)-1(T)-0(P) **Credits**:4

Course Objectives:

- *To introduce the concept of information*
- *To introduce to various aspects of error controlling and coding techniques for communication.*
- *To have idea on the different coding techniques.*

Module – I

Introduction to Information Theory. Concept of amount of information, units – entropy, marginal, conditional and joint entropies – relation among entropies – mutual information, information rate. Source coding: Instantaneous codes – construction of instantaneous codes

Kraft's inequality, coding efficiency and redundancy, Noiseless coding theorem – construction of basic source codes – Shannon – Fano Algorithm, Huffman coding.

Module – II

Channel capacity – redundancy and binary symmetric channel (BSC), Binary erasure channel (BEC) – capacity of band limited Gaussian channels, Shannon – Hartley theorem – bandwidth – SNR trade off – capacity of a channel of infinite bandwidth, Shannon's limit.Information Capacity of Coloured noise channel, Water-Filling Interpretation of Information Capacity Theorem, Rate Distortion Theory.

Module – III

Introduction to rings, fields, and Galois fields.ARQ:-Types of ARQ,Performance of ARQ, Codes for error detection and correction – parity check coding – linear block codes – error detecting and correcting capabilities – generator and parity check matrices – Standard array and syndrome decoding – perfect codes, Hamming codes – encoding and decoding, cyclic codes – polynomial and matrix descriptions – generation of cyclic codes, decoding of cyclic codes, BCH codes – description and decoding, Reed – Solomon Codes, Burst error correction.

Module – IV

Convolutional Codes – encoding – time and frequency domain approaches, State Tree & Trellis diagrams – transfer function and minimum free distance – Maximum likelihood decoding of convolutional codes – The Viterbi Algorithm. Sequential decoding,. Cryptography : Secret key cryptography, block and stream ciphers. DES, Public key cryptography.

References:

1. Simon Haykins: Digital *Communication Systems*, WileyIndia,2013.
2. Sathya Narayana P.S., *Concepts of Information Theory & Coding* , Dynaram Publications,2005
3. Ranjan Bose, *Information Theory, Coding and Cryptography*,2/e,TMH,2008.
4. Shu Lin and Daniel J. Costello Jr., *Error Control Coding : Fundamentals and Applications*,2/e,Pearson,2
5. *J S Chitode, Information Theory and Coding, Technical Publications, Pune, 2009*
6. Das Mullick Chatterjee , *Principles of DigitalCommunication*,WileyEasternLtd,2012

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30%-Assignments(minimum2)such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examinationduration:3hours *MaximumTotalMarks:100*

Thequestionpapershallconsistof2parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80Marks)-Candidates have to answer one full question out of the two from each module. .Each question carries 20marks.

Note: *Question paper should contain 20% Problems, derivations and proofs*

Course Outcome:

After the course the student will be able to

- *Apply the knowledge of Shannon's source coding theorem and Channel coding theorem for designing an efficient and error free communication link.*
- *Analyze various coding schemes*
- *Design an optimum decoder for various coding schemes used.*

18.705. EMBEDDED SYSTEMS (T)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

- *To have a thorough understanding of the basic structure and design of an Embedded System*
- *To study the different ways of communicating with I/O devices and standard I/O interfaces.*
- *To study the basics of RTOS for Embedded systems.*
- *To study the programming concepts of Embedded Systems*
- *To study the architecture of System-on-Chip and some design examples.*

Module I

Introduction to Embedded Systems– Components of embedded system hardware–Software embedded into the system – Embedded Processors - CPU architecture of ARM processor (ARM9) – CPU Bus Organization and Protocol.
Design and Development life cycle model - Embedded system design process – Challenges in Embedded system design

Module II

Serial Communication Standards and Devices - UART, HDLC, SCI and SPI.
Serial Bus Protocols - I2C Bus, CAN Bus and USB Bus. Parallel communication standards ISA, PCI and PCI-X Bus.
Memory devices and systems - memory map – DMA - I/O Devices – Interrupts - ISR – Device drivers for handling ISR – Memory Device Drivers – Device Drivers for on-board bus.

Module III

Programming concepts of Embedded programming – Features of Embedded C++ and Embedded Java (basics only). Software Implementation, Testing, Validation and debugging, system-on-chip. Design Examples: Mobile phones, ATM machine, Set top box.
Inter Process Communication and Synchronization -Process, tasks and threads –Shared data– Inter process communication - Signals – Semaphore – Message Queues – Mailboxes – Pipes – Sockets – Remote Procedure Calls (RPCs).

Module IV

Real time operating systems - Services- Goals – Structures - Kernel - Process Management – Memory Management – Device Management – File System Organization. Micro C/OS-II RTOS

- System Level Functions – Task Service Functions – Memory Allocation Related Functions – Semaphore Related Functions. Study of other popular Real Time Operating Systems.

References:

1. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
2. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers - Elsevier 3ed, 2008
3. Frank Vahid and Tony Givargis, Embedded Systems Design – A Unified Hardware / Software Introduction, John Wiley, 2002
4. Iyer - Embedded Real time Systems, 1e, McGraw Hill Education New Delhi, 2003
5. K.V. Shibu, Introduction to Embedded Systems, 2e, McGraw Hill Education India, 2016.
6. Lyla B. Das, Embedded Systems: An Integrated Approach, 1/e , Lyla B. Das, Embedded Systems, 2012

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the course the student will be able to

- *Understand the basics of an embedded system*
- *Develop program for an embedded system.*
- *Design, implement and test an embedded system.*

18.706.1 MEMS (T) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

- *To introduce MEMS and micro fabrication.*
- *To study the essential electrical and mechanical concepts of MEMS.*
- *To understand the unique demands, environments and applications of MEMS devices.*
- *To know about the polymer and optical MEMS*

Module – I

MEMS and Microsystems: Applications – Multidisciplinary nature of MEMS – principles and examples of Micro sensors and micro actuators – micro accelerometer –comb drives - Micro grippers – micro motors, micro valves, micro pumps, Shape Memory Alloys.
Review of Mechanical concepts: Stress, Strain, Modulus of Elasticity, yield strength, ultimate strength – General stress strain relations – compliance matrix.
Overview of commonly used mechanical structures in MEMS - Beams, Cantilevers, Plates, Diaphragms – Typical applications

Module – II

Actuation and Sensing techniques : Thermal sensors and actuators, Electrostatic sensors and actuators , Piezoelectric sensors and actuators, magnetic actuators.Scaling laws in miniaturization - scaling in geometry, scaling in rigid body dynamics, Trimmer force scaling vector, scaling in electrostatic and electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection.Materials for MEMS – Silicon – Silicon compounds – Silicon Nitride, Silicon Dioxide, Silicon carbide, Poly Silicon, GaAs , Silicon Piezo resistors

Module –III

Polymers in MEMS -PMMA, PDMS.Micro System fabrication – Photolithography – Ion implantation- Diffusion – Oxidation – Chemical vapour deposition – Etching
Overview of Micro manufacturing – Bulk micro manufacturing, Surface micro machining , LIGA process . Micro system Packaging: general considerations in packaging design – Levels of Micro system packaging

Module –IV

Bonding techniques for MEMS : Surface bonding , Anodic bonding , Silicon - on - Insulator , wire bonding , Sealing – Assembly of micro systems Overview of MEMS areas : RF MEMS, BioMEMS, MOEMS, NEMS.

References:-

1. Chang Liu, Foundations of MEMS, Pearson Indian Print, 1st Edition, 2012.
2. Tai-Ran Hsu, MEMS and Microsystems Design and Manufacture, TMH, 2002
3. Chang C Y and Sze S. M., VLSI Technology, McGraw-Hill, New York, 2000
4. Julian W Gardner, Microsensors: Principles and Applications, John Wiley & Sons, 1994
5. Mark Madou, Fundamentals of Micro fabrication, CRC Press, New York, 1997
6. Stephen D. Senturia, Microsystem design, Springer (India), 2006.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30%- Assignments (minimum2)such as homework, problem solving ,quiz, literature survey seminar ,term-project ,software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examinationduration:3hours *MaximumTotalMarks:100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80Marks)-Candidateshavetoansweronefullquestionoutofthetwofromeach module. Each question carries 20 marks.

Note: *Question paper should contain minimum 10 % problems, derivations and proof*

Course Outcome:

At the end of the course, students will be able

- *To explain the principle of MEMS and micro fabrication.*
- *To know the essential electrical and mechanical concepts of MEMS.*
- *To study various sensing and actuating technique.*
- *To know about the polymer and optical MEMS*

18.706.2 INTELLECTUAL PROPERTY RIGHTS(T) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 3

Course Objectives:

- *To study general features of intellectual property rights.*
- *To study IPR acts of patents, trademarks, design ,copyright, layout design of ICs*
- *To know Indian position in the global IPR structure.*
- *To know the features of TRIPS, PCT, WIPO, EPO, WTO etc.*

Module – I

Intellectual property rights-Introduction, importance, need of IPR, forms of IPR-Trade mark, Patent, Copyright, Design, Semiconductor IC layout design, geographical indication of goods, Trade secret, Protection of plant varieties and farmers rights, biodiversity and traditional knowledge, Indian position in global IPR structure.

Module – II

Trademarks-Introduction, condition and procedure for registration, rights and limitations of registration, infringement of trade mark, remedies against infringement, offences and penalties.

Patents- Meaning and purpose of patent , advantage of patent to inventor, invention not patentable, application for patent, provision for secrecy of certain inventions, grant of patent, rights of patent holder, infringement of patent, offences and penalties, international arrangements.

Module – III

Copyrights- introduction, meaning of copyrights ownership, rights of owner, subject matter of copyrights, international copyrights, infringement, offences and penalties.

Industrial design- Introduction, registration of design, copyrights in registered design Industrial and international exhibitions, infringement, offences and penalties.

Semiconductor IC layout design- Introduction, condition and procedure for registration, Effects of registration, offences and penalties.

Module – IV

IPRs in cyber space, IT related IPR, Computer software and IPR, database and protection, domain name protection, IPRs in pharmaceutical sector, IPRs in fashion industry, IPRs in biotechnology sector. International treaties- Introduction, TRIPS, PCT, WIPO, EPO, WTO.

References:

1. Sople, Managing Intellectual Property, PHI, 4th edition, 2014.
2. Acharya N. K., Text book on Intellectual Property Rights, Asia Law House, Hyderabad, 2002.
3. Ganguli, Intellectual Property Rights, TMH, Delhi, 2001. 4 Bare acts of (i)The Trademarks Act 1999 (ii) The patents acts 1970 (iii) The copyright act 1957 (iv) Design act 2000 (v)The semiconductor IC layout design act 2000.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, students will be able to

- *Explain the importance of IPR.*
- *Practice in filing trademarks, patents, copyrights, industrial designs and semiconductor IC layout design applications.*
- *Explain the situations of infringement of rights and penalties and other legal aspects.*
- *Write the importance of IT related IPR like domain name and data base protection etc*

18.706.3 CDMA SYSTEMS (T) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 3

Course Objectives:

- *To impart knowledge about CDMA and its evolution.*
- *Acquire the basic concepts and architecture of a CDMA network.*
- *Study the security processes and mobile identification parameters used in CDMA.*
- *Learn the concepts related to the quality of service in CDMA*

Module – I

Introduction to CDMA, Direct Sequence (DS)- Frequency Hopped(FH)- Pulse Position Hopped(PH) Spread Spectrum(SS) Communication. Modulation Schemes for SS, Generation of -DS SS and FH SS Signals. Orthogonal and Quasi-Orthogonal expansion of SS signals. Reception of SS signals in AWGN channel-. Coherent Reception of DS CDMA (uplink and downlink) and FH SS signals.

Module – II

Forward Error Control Coding in SS systems. Non coherent Reception of encoded DS CDMA Systems. convolutional coding in DS CDMA, orthogonal convolutional coding. Coding in FH CDMA Systems Pseudo Signal Generation- Pseudorandom sequences- ML Linear shift register-Randomness property.

Module – III

Generation of pseudorandom signals from pseudorandom sequences. Synchronisation of Pseudorandom signals, acquisition process. Shannon Capacity of DS CDMA , FH CDMA Systems. CDMA Networks- hand off strategy, Power control, erlang capacity of CDMA System. Interference Cancellation -SIC and PIC Multiuser Detection: Single user matched filter-hypothesis testing.

Module – IV

Optimal receiver- matched filter in CDMA Channel, Coherent single user matched filter in Rayleigh fading channel. Optimum detector for synchronous channels- (Two-user and Kuser) and asynchronous channel. Decorrelating Detector (DD)- DD in synchronous and asynchronous channels. . Non Decorrelating linear multiuser detection- optimum linear multiuser detection. MMSE Linear multiuser detection.

References:

1. Kamil Sh Zigangirov, Theory of Code Division Multiple Access Communication, IEEE Press, Wiley InterScience, 2004.
2. Sergio Verdu, Multiuser Detection, Cambridge University Press, 1998.
3. Samuel C. Yang, CDMA RF System Engineering, Artect House Inc.,1998.
4. Don Torrieri, Principles of Spread Spectrum Communication Systems, Springer 2005.
5. Andrew J. Viterbi, CDMA: Principles of spread Spectrum Communication, Addisson Wisley, 1996.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note*:** Question paper should contain minimum 20% problems, derivations and proof.

Course Outcome:

- *Upon successful completion of this course, students will be able to:*
- *Describe CDMA and its evolution.*
- *Explain the basic concepts and architecture of a CDMA network.*
- *Describe the security processes and mobile identification parameters used in CDMA.*

18.706.4 OPTOELECTRONIC DEVICES (T) (Elective III)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *Explain the physics of absorption, recombination and photoemission from semiconductors.*
- *Analyse different types of photo detectors based on their performance parameters.*
- *Discuss different LED structures with material properties and reliability aspects.*
- *Explain optical modulators and optical components*
- *Illustrate different types of lasers with distinct properties.*

Module – I

Optical processes in semiconductors – electron hole recombination, absorption, FranzKeldysh effect, Stark effect, quantum confined Stark effect, deep level transitions, Auger recombination. Lasers – threshold condition for lasing, line broadening mechanisms, axial and transverse laser modes, heterojunction lasers, distributed feedback lasers, quantum well lasers, modulation of lasers, nitride light emitters.

Module – II

Franz-Keldysh and Stark effect modulators, quantum well electro-absorption modulators, electro-optic modulators, quadratic electro-optic effect quantum well modulators, RamNath modulators, optical switching and logic devices.

Module – III

Optical detection – PIN, APD, modulated barrier photodiode, Schottky barrier photodiode, wavelength selective detection, microcavity photodiodes.

Optoelectronic ICs – hybrid and monolithic integration, integrated transmitters and receivers, guided wave devices.

Module – IV

Introduction to optical components, directional couplers, multiplexers, attenuators, isolators, circulators, tunable filters, fixed filters, add drop multiplexers, optical cross connects, wavelength convertors, optical bistable devices.

References:

1. *Pallab Bhattacharya: Semiconductor Optoelectronic Devices, 2/e; Pearson Education,2002.*
2. *Yariv, Photonics Optical Electronics in Modern Communication, 6/e, Oxford Univ Press,2006.*
3. *Saleh B. E. and M. C. Teich, Fundamentals of Photonics, Wiley-Interscience, 1991.*
4. *Bandyopadhay, Optical Communication and Networks, PHI, 2014.*
5. *Mynbaev and Scheiner, Fiberoptic Communication Technology, Pearson, 2001.*
6. *Piprek, Semiconductor Optoelectronic Devices, Elsevier, 2008.*

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: Question paper should contain 20% problems, derivations and proof

Course Outcome:

After completion of the course the student will be able to

- *Explain the property of absorption, recombination and photoemission in semiconductors.*
- *Illustrate different types of lasers with distinct properties*
- *Explain different LED structures with material properties*
- *Analyze different types of photo detectors*
- *Explain optical modulators and optical components.*

18.707 MODELLING AND SIMULATION OF COMMUNICATION SYSTEMS LAB (T)

Teaching Scheme:0(L) - 0(T) - 3(P) **Credits**:2

Course Objective :

- *To generate digital modulated signals, detect and evaluate their performance.*
- *To study the performance of error checking and correcting code.*
- *To Simulate AM, FM, PM and other digital modulation schemes and estimate their performance*

List of Experiments:

Part A: Hardware Experiments:

1. Delta Modulation & Demodulation.
2. PCM (using Op-amp and DAC).
3. BASK (using analog switch) and demodulator.
4. BPSK (using analog switch).
5. BFSK (using analog switch).
6. Error checking and correcting codes.
7. 4 Channel digital multiplexing (using PRBS signal and digital multiplexer).

Part B: Matlab Experiments:

1. Simulate Analog modulation schemes like AM, FM and PM
2. Sampling and reconstruction of signals in time domain and frequency domain
3. Implementation of LMS algorithm.
4. Time delay estimation using correlation function.
5. Simulate Delta modulation and demonstrate the effect of step size for avoiding slope overload error and granular noise
6. Study of eye diagram of PAM transmission system.
7. Generation of QAM signal and constellation graph. 8. Mean Square Error estimation of a signal.

Internal Continuous Assessment (Maximum Marks-50)

40% - Test

40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*
Questions based on experiments prescribed in the list.

The following guidelines should be followed regarding award of marks

Circuit and design – 25 % (Logical design and flow diagram in case of software experiments.)
Implementation - 10% (Coding in case of Software experiments.)
Result - 40% (Including debugging of Program in case of Software experiments.)
Viva voce - 25%
Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome

After completion of the course student will be able to

- *detect and evaluate the performance of digital modulated signals generated.*
- *study the performance of error checking code.*
- *estimate the performance of simulated AM, FM and other digital modulation schemes.*

18.708 SEMINAR (T)

Teaching Scheme: 0(L) - 0(T) - 1(P) **Credits:** 1

Course Objective :

- *To do a detailed study of a selected topic based on current journals or published papers and present a seminar based on the study done.*
- *The seminar provides students adequate exposure to public presentations to improve their communication skills.*

The student is expected to present a seminar in one of the current topics in Electronics, Communication, Electronic Instrumentation and related areas based on current publications. The student will undertake a detailed study on the chosen subject and submit a seminar report in a soft bound form at the end of the semester. While preparing the report, at least three cross references must be used. This report shall be submitted for evaluation for the viva-voce in 8th semester. The report shall be endorsed by the Guide, Seminar coordinator and the HOD. Evaluation of presentation and report shall be conducted by a committee of the **Seminar coordinator, Guide and a senior faculty.**

Internal Continuous Assessment (*Maximum Marks-50*)

40% - 20 Marks is to be awarded for the presentation
40% - 20 marks is to be awarded for the report.
20% - 10 marks for the attendance.

Course Outcome:

At the end of the course, the students would have acquired the basic skills to for performing literature survey and paper presentation. This course shall provide students better communication skills.

18.709 PROJECT DESIGN (T)

Teaching Scheme: 0(L) - (T) - 1(P) **Credits**: 1

Course Objective :

- *To identify a problem for the final-year project, outline a solution, and prepare a preliminary design for the solution.*
- *To improve the ability to perform as an individual as well as a team member in completing a project work.*

The student is expected to select a project in one of the current topics in Electronics, Communication, Electronic Instrumentation and related areas based on current publications. He /She shall complete the design of the project work and submit the design phase report. This shall be in soft bound form. This report shall be submitted for evaluation in 7th semester as well as for the viva-voce in 8th semester. The report shall be endorsed by the Guide, Project coordinator and the HOD. Evaluation of report and viva will be conducted by a committee consisting of the **Project coordinator, Guide and a senior faculty**. The number of students in a project batch shall be limited to a **maximum of four.**

Internal Continuous Assessment (Maximum Marks-50)

50% - 20 Marks is to be awarded for the Viva Voce
50% - 20 Marks is to be awarded for the report.
20% - 10 marks for the attendance

Course Outcome:

At the end of the course, the students would have acquired the basic skills to for performing literature survey and paper presentation. This course shall provide students better communication skills and improve their leadership quality as well as the ability to work in groups, and thus aid them in building a successful career as an engineer.