Scheme & Syllabus of UG

Engineering Program

Bachelor of Technology

(B.Tech.)

Electronics & Communication Engineering

2022-23

IPS ACADEMY

INSTITUTE OF ENGINEERING & SCIENCE, INDORE

(A UGC Autonomous Institute affiliated to RGPV)

IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Scheme Based on AICTE Flexible Curriculum

Department of Electronics & Communication Engineering

Bachelor of Technology (B.Tech.) VII Semester

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem	Mid Sem Exam.	Quiz/ Assignment	End Sem	Term work / Lab Work & Sessional		L	T	P	
1.	PCC-EC15	PCC	Optical Fiber Communication	60	25	15	-	-	100	3	0	0	3
2.	PEC-EC03	PEC	Professional Elective Course-III	60	25	15	-	-	100	3	0	0	3
3.	PEC-EC04	PEC	Professional Elective Course-IV	60	25	15	-	-	100	3	0	0	3
4.	LC-EC16 (P)	LC	Optical Fiber Communication Lab	-	-	-	60	40	100	0	0	2	1
5.	LC-EC17 (P)	LC	Professional Elective Course-V	-	-	-	60	40	100	0	0	2	1
6.	PROJ-EC02	PROJ	Evaluation of Internship-Completed in Fifth/Sixth Semester	-	-	-	60	40	100	0	0	4	2
7.	PROJ-EC03	PROJ	Seminar I	-	-	-	-	50	50	0	0	2	1
8.	PROJ-EC04	PROJ	Project Phase - I	-	-	-	60	40	100	0	0	8	4
			Total	180	75	45	240	210	750	09	0	18	18

Professional Elective Courses-III	Professional Elective Courses-IV	Professional Elective Courses-V (LC-17(P))
PEC-EC03 (A) Microwave Engineering	PEC-EC04 (A) CMOS VLSI Design	PEC-EC05 (A) Microwave Engineering Lab
PEC-EC03 (B) Digital Image Processing	PEC-EC04 (B) Fuzzy Logic and its Applications	PEC-EC05 (B) CMOS VLSI Design Lab
PEC-EC03 (C) Wireless Sensor Network	PEC-EC05 (C) Nano Electronics	PEC-EC05 (C) Digital Image Processing Lab
PEC-EC03 (D) Quantum Computing & Communication	PEC-EC703 (D) SDR & Cognitive Radio	

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	1 Credit	1 Credit

PCC-EC15	Optical Fiber Communication	3L: 0T: 0P (03 hrs.)	Credits: 03

Recommended Prerequisite: Engineering Mathematics, Electronics

Course Objective: To expose the students to the fundamentals of optical fibers, fiber impairments, components and devices and system design.

MODULE I **(8 hrs.)**

Overview of Optical Fiber Communications (OFC): Motivation, optical spectral bands, key elements of optical fiber systems. Optical fibers: basic optical laws and definitions, optical fiber modes and configurations, mode theory for circular waveguides, single mode fibers, graded-index fiber structure, fiber materials, photonic crystal fibers, fiber fabrication, fiber optic cables

MODULE II **(8 hrs.)**

Optical sources: Light emitting diodes (LED): structures, materials, quantum efficiency, LED power, modulation of an LED. Laser diodes: modes, threshold conditions, laser diode rate equations, external quantum efficiency, resonant frequencies, structure and radiation patterns, single mode lasers, modulation of laser diodes. Power launching and coupling: source to fiber power launching, fiber to fiber joints, LED coupling to single mode fibers, fiber splicing, optical fiber connectors

MODULE III **(8 hrs.)**

Photo detectors: pin photo detector, avalanche photodiodes, photo detector noise, detector response time, avalanche multiplication noise. Signal degradation in optical fibers: Attenuation: MODULE-s, absorption, scattering losses, bending losses, core and cladding losses. Signal distortion in fibers: overview of distortion origins, modal delay, factors contributing to delay, group delay, material dispersion.

MODULE IV **(8 hrs.)**

Wavelength division multiplexing (WDM) concepts: operational principles of WDM, passive optical star coupler, isolators, circulators, active optical components: MEMS technology, variable optical attenuators, tunable optical filters, dynamic gain equalizers, polarization controller, chromatic dispersion compensators. Optical amplifiers: basic applications and types of optical amplifiers, Erbium Doped Fiber Amplifiers (EDFA): amplification mechanism, architecture, power conversion efficiency and gain. Amplifier noise, optical SNR, system applications. Performance Measurement and monitoring: measurement standards, basic test equipment, optical power measurements, optical fiber characterization, optical time-domain reflectometer.

MODULE V **(8 hrs.)**

Wavelength assignment strategies: random, first fit, least used, most used. Routing strategies: fixed, fixed alternate, dynamic. Routing and wavelength assignment in optical networks, Elasticity in optical network, routing and spectrum assignment, Physical constraints: wavelength continuity, contiguity constraints, spectrum assignment, maximum capacity constraint etc..

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

1. Illustrate and Review Fundamentals of the basics of optical fibers.
2. Learn different types sources used for transmissions in fiber.
3. Understanding the working of photo detector in optical fiber communication.
4. Learning of different types of optical receivers.
5. Understanding of optical network components.

Text /Reference Books:

1. Keiser, "Optical Fiber Communications", 3rd Edition, TMH, 2008.
2. Senior, "Optical Fiber Communication- Principles and Practices", 3rd Edition, Pearson Education, 2010.
3. Agarwal, "Fiber Optic Communication Systems", 3th Edition, Wiley India, 2007.
4. Palais, "Fiber Optics Communications",5th Edition, Pearson Education, 2005.
5. SatishKumar, "Fundamentals of optical Communications", 2th Edition, PHI Learning, 2014.

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PEC-EC 03(A)	Microwave Engineering	3L: 0T: 0P (03 hrs.)	Credits: 03

Prerequisite: Electromagnetic fields, Antenna and wave propagation.

Course Objective: Objective of the subject is to have understanding of Microwave Circuits & Devices.

MODULE I **(7 hrs.)**
Introduction to Microwave, History of Microwave, Microwave Band Designation, Application, Advantages of Microwave and Review of Electromagnetic. Transmission Lines: Two Wire Parallel Transmission Lines, Voltage Current Relationship, Characteristic Impedance, Reflection Coefficient, Input Impedance, Standing Waves.

MODULE II **(8 hrs.)**
Microwave Transmission Lines: Multi conductor Transmission Lines like Coaxial Lines, Breakdown Power of a Coaxial Cable, Strip Lines, Micro Strip Line and Its types. Microwave Components using Strip Line: Design Consideration of a Micro Strip Line, Microwave waveguide, Rectangular waveguide and its analysis, Circular Waveguide, modes of propagation, dominant modes, cut off wavelength, mode excitation

MODULE III **(8 hrs.)**
Microwave Generators and Amplifiers: Limitations of conventional tubes at Microwave Frequency Reflex Klystron, two and Multi Cavity Klystron Amplifiers, Oscillators and their analysis, Basics of Magnetrons, Traveling Wave Tube and their applications.

MODULE IV **(8 hrs.)**
Microwave Solid-State Devices: Gunn diode and its modes of operation, Avalanche: IMPATT Diode, TRAPATT Diode, operations and V-I characteristics of Tunnel Diode, Schottky Diode, Backward Diode, Varactor Diode, PIN Diode and its applications.

MODULE V **(9 hrs.)**
Microwave Components: Scattering (S) Parameters, Analysis and design of Dielectric resonators; Design of RF and Microwave low noise, Power Amplifiers, Oscillators using S-parameter techniques, Microwave T Junctions, Directional Couplers, Scattering matrix, S-parameters & its applications in Network analysis. Microwave Measurements: Measurements of Standing Wave ratio, Wavelength, Frequency, Power and radiation pattern of Antenna, CST/ ADS/ AFHSS software.

Course Outcome:
1. Understanding of Microwave Signals and Transmission Line.
2. Understanding of various types of Microwave Transmission Line and its Design Consideration.
3. Understanding of various types of Microwave Generators and Amplifiers.
4. Understanding of various types of Microwave Solid State Devices.
5. Design and analyze of High Frequency Circuits and Systems.

Text/Reference Books:
1. Robert E. Collins, "Foundations for Microwave Engineering", International student 2nd edition, McGraw Hill Publication, 1992.

2. David M. Pozar, "Microwave Engg", 2nd Edition, Jhon Wily Publication, 1998.
3. M Kulkarni "Microwave Engg", 3rd edition, Umesh Publication, 2003
4. Samuel Y Liao "Microwave Devices and Circuits", 3rd edition", Pearson, 2003.

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PEC-EC04(A)	CMOS VLSI Design	3L: 0T: 0P (03 hrs.)	Credits: 03

Course Objective: The course is designed to give the student an understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon and the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes.

MODULE I **(8 hrs.)**
CMOS circuits: MOS Transistors: Operating principle of MOS transistor, Channel Length Modulation, CMOS logic, CMOS inverter- DC characteristics, Switching Threshold, Noise in MOS, Dynamic behavior of CMOS inverter, computing capacitances, propagation delay, power consumption, stick diagram, IC layout design.

MODULE II **(8 hrs.)**
Practical Consideration and Technology in VLSI Design: Introduction, Size and complexity of Integrated Circuits, The Microelectronics Field, IC Fabrication Process, Crystal Growth and wafer preparation, Epitaxial growth methods, oxidation, Metallization, Physical Vapor Deposition and Sputtering. Patterning: Lithography, Photo masking steps, Diffusion, Ion Implantation

MODULE III **(9 hrs.)**
CMOS Technology: Basic CMOS Technology, A Basic n-well CMOS Process, Twin Tub Processes, CMOS Process Enhancement, Interconnects and Circuit Elements, Layout Design Rules, Latch up, Physical Origin, Latchup Triggering, Latch up Prevention, Internal Latch up Prevention Techniques.

MODULE IV **(8 hrs.)**
Device Modeling: Dc Models, Small Signal Models, MOS Models, MOSFET Models in High Frequency and small signal, Short channel devices, Sub threshold Operations, Modeling Noise Sources in MOSFET's, Diode Models, Bipolar Models, Passive component Models.

MODULE V **(7 hrs.)**
Circuit Simulation: Introduction, Circuit Simulation Using Spice, MOSFET Model, Level 1 Large signal model, Level 2 Large Signal Model, High Frequency Model, Noise Model of MOSFET, Large signal Diode Current, High Frequency BJT Model, BJT Noise Model, temperature Dependence of BJT, Designing of MOS Transistor on Simulator.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:
1. Explain the basic structure and principle of MOS and the working of various modes of MOS and IC fabrication basics.
2. Analyze the models of MOS in high frequency & small signals.
3. Formulate value of drain current with maximum accuracy using successive models.
4. Design various logic circuits using, standard circuits such as register, PLA etc. and method of designing a processors.
5. Explain IC fabrication techniques and production process constrains.

Text/References Books:

1. Geiger, Allen and Strader, "VLSI Design Techniques for Analog and Digital Circuits", International Edition, TMH Publication, 1990.
2. Sorab Gandhi, "VLSI Fabrication Principles", 2nd Edition, Wiley-Interscience Publication, 1994.
3. Weste and Eshraghian, "Principles of CMOS VLSI design", 2nd Edition, Pearson Education, 1993.
4. Weste, Harris and Banerjee, "CMOS VLSI Design", 3rd Edition, Pearson Education, 2007.
5. Pucknell and Eshraghian, "Basic VLSI Design", 3rd Edition, PHI Learning, 1995.
6. R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation" 2nd Edition, Wiley India, 2011.
7. S. M. Sze, "VLSI Technology", 2nd Edition, TMH Publication, 201

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LC-EC16 (P)	Optical Fiber Communication Lab	0L: 0T: 2P (02 hrs.)	Credits: 01

Recommended Prerequisite: Engineering Mathematics, Electronics

Course Objective: To expose the students to the fundamentals of optical fibers, fiber impairments, components and devices and system design.

List of Experiments:
1. To perform and analysis measure of 650 NM Fiber Optic Analog Link
2. To study of Optical Fiber connectors and splices
3. To study source of light for optical fiber
4. To perform and analysis intensity modulation of analog transmission
5. To perform and analysis propagation and attenuation loss
6. To measure frequency modulation using 650 nm fiber optic link
7. To perform and analysis measured pulse width modulation
8. To study EDFA
9. To perform and analysis optical power using optical power meter
10. To perform and analysis bending loss
11. To perform and analysis WDM
12. To perform and analysis numerical aperture(NA)

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz, and End-of-semester exam.

Course Outcomes:
Students earning credits will develop ability to:
1. Illustrate and Review Fundamentals of the basics of optical fibers.
2. Learn different types sources used for transmissions in fiber.
3. Understanding the working of photo detector in optical fiber communication.
4. Learning of different types of optical receivers.
5. Understanding of optical network components.

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1. Keiser, “Optical Fiber Communications”, 3rd Edition, TMH, 2008.
2. Senior, “Optical Fiber Communication- Principles and Practices”, 3rd Edition,Pearson Education, 2010.
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LC-EC17(P)	**Microwave Engineering Lab**	**0L: 0T: 2P (02 hrs.)**	**Credits: 01**

Prerequisite: Electromagnetic fields, Antenna and wave propagation.

Course Objective: Objective of the subject is to have understanding of Microwave Circuits & Devices.

List of Experiments:

1. To study the characteristics of the Reflex klystron Tube and to determine its electronic tuning range.
2. To study the V-I characteristics of Gunn Diode.
3. To determine the Standing Wave-Ratio and Reflection Coefficient.
4. To determine the operating frequency & guide wavelength in a rectangular waveguide working on TE10 mode.
5. To Study the function of multi-hole directional coupler by measuring the following parameters.
6. To Study the Isolator and Circulators.
7. To study the working of Magic Tee.
8. To measure unknown impedance with smith chart.
9. To Study the working of Resonant Cavity.
10. To measure the attenuation of attenuator.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course Outcome:

1. Understanding of Microwave Signals and Transmission Line.
2. Understanding of various types of Microwave Transmission Line and its Design Consideration.
3. Understanding of various types of Microwave Generators and Amplifiers.
4. Understanding of various types of Microwave Solid State Devices.
5. Design and analyze of High Frequency Circuits and Systems.

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