

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER VI

Name of Department: - Electronics and Communication Engineering

1. Subject Code: **TEC 601** Course Title: **Wireless Communication**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **Spring (Even)**
7. Subject Area: **Core Course**
8. Pre-requisite: **Communication Systems or equivalent**

9. Course Outcomes:	<ul style="list-style-type: none"> • Understanding of wireless systems and standards • Analysis and design of cellular system and mobile radio propagation models • Applying the concepts of radio propagation models to small scale fading • Understanding of GSM system • Analysis and design of traffic channel, control channel and multiple access system • Successful completion of this course enables students to apply concepts of Wireless Communications for secured high data rate communication
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10. Details of the Course:-

Sl. No.	Contents	Contact Hours
1	Wireless System and standards: 1G, 2G, 3G, 4G and standards. System design fundamental: Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.	10
2	Evolution of mobile radio Propagation fundamentals: Large scale path loss: propagation models, reflection, diffraction, scattering, practical link budget design using path loss model, outdoor Propagation models, Indoor Propagation Models.	8

3	Small scale fading & multipath: Types of small scale fading, factors influencing small scale fading, parameters of multipath channels. Diversity mechanisms, receiver diversity combining, RAKE receiver.	12
4	GSM system architecture and next generation system: Time frame, traffic channel, control channel, Introduction to LTE, LTE-A and Wi-Max.	6
5	Spread spectrum: Multiple access, Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum (FHSS).	6
Total		42

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
Text Books		
1.	T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson, 2 edition.	2006
Reference Books		
1.	William C. Y. Lee, "Mobile communication Design and fundamentals" 4 edition,	2006
2.	D. R. Kamilo Fehar, "Wireless digital communication",	2004
3.	Haykin S & Moher M., "Modern wireless communication", Pearson,	2005
4.	R. Pandya, " Mobile and personal communication system", PHI,	2008

12.	Mode of Evaluation.	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
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GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: - **Electronics and Communication Engineering**

1. Subject Code: **TEC 602** Course Title: **Microwave Engineering**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **Spring (Even)**
7. Subject Area: **Core Course**
8. Pre-requisite: **Communication**

9. Course Outcomes:	<ul style="list-style-type: none"> Understanding of waveguides characteristics, cavity resonators and its field expressions Analysis of different microwave components based on network parameters Understanding of microwave sources and their characteristics Design of microwave components and measurement of performance Implementation of Microstrip filters used in RF transmitter and receiver Successful completion of this course will be helpful in designing RF component, transmitter, receiver and RF communication link
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10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Waveguides and Transmission Line: Rectangular and Circular waveguide, Excitation of waveguides, Rectangular cavity resonators, Introduction to Microstrip line.	10
2	Passive microwave devices: Network parameter of microwave circuit, Scattering matrix Microwave T junctions, E plane TEE, H plane TEE, Magic TEE, Hybrid TEE, Hybrid ring, terminations, attenuators & phase changers, Isolator & circulators, directional couplers and power divider.	8
3	Microwave Sources: Klystron, Reflex Klystron, Magnetron (Conventional, linear), TWT, Gunn Diode, IMPATT, TRAPATT, Tunnel Diode -Operation & Characteristics, Basics of GaAs, FET.	8
4	Microwave measurements:	6

	Measurement of frequency, wavelength, Power, VSWR, Impedance determination, S-Parameter measurements, Spectrum analyzer, Network analyzer.	
5	Microwave Systems: Types of filter designing, Low-pass prototype filter design, filter transformations, filter implementation Richard transformation, Kuroda identities, Stepped-Impedance Low Pass Filters. Introduction to RFID, MMIC, RFMEMS, and Effect of microwave on human body.	8
	Total	40

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
	Text Books	
1.	Liao, Samuel., 'Microwave Devices & Circuits', PHI, Third edition.	2003
2.	Pozar, D.M., 'Microwave Engineering' John Wiley & sons, Third edition.	2010
	Reference Books	
1.	Collins, R.E., 'Foundations for Microwave Engineering', John Wiley & sons, 2 nd edition.	2009
2.	Bhal, I.J. Bhal & Bhartia, P., 'Microwave Solid state Circuit Design', John Wiley & sons, Inc. New York.	1988

12.	Mode of Evaluation.	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
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GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: - Electronics and Communication Engineering

1. Subject Code: **TEC 603** Course Title: **VLSI Design and Technology**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **Spring (Even)**
7. Subject Area: **Core Course**
8. Pre-requisite: **Electronic Devices and Circuits**

9. Course Outcomes:	<ul style="list-style-type: none"> Understand the features and characteristics of MOS transistor Designing and analysis of Inverter circuits in terms of switching Characteristics and noise margin. Implementation of stick diagram and layout for NMOS, PMOS and CMOS circuits. Understanding of fabrication techniques Design steps of complete manufacturing flow for the MOS transistor. Successful completion of this course will create a base for the Modeling of Semiconductor Devices and VLSI Technology.
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10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Era of VLSI Design: Introduction to VLSI Design, Front End and Back End Design, Computer Aided Design Technology. MOS Transistor: MOS Structure, MOS system under external Bias, Threshold voltage, Structure and operation of MOS transistor, MOSFET device design equation, MOSFET scaling, MOSFET capacitances.	8
2	MOS Inverters: Static Characteristics, Resistive – Load Inverter, Inverters with n-type MOSFET Load, CMOS Inverter, Switching Characteristics of MOS Inverters, Delay-Time Definitions, Switching Power Dissipation of CMOS Inverters.	10

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3	Layout Design: Design rules, Stick Diagram, parasitic effects, Layout Design prospects, CMOS Basic Circuits Layout Design: NAND, NOR, AND, OR, AOI circuits.	8
4	VLSI Technology: Clean Room Technology, Crystal Growth and Wafer Preparation, Electronic Grade Silicon, CZ crystal growth technique, Silicon Shaping. Epitaxy: Vapor-Phase Epitaxy, Doping and Autodoping, Buried Layers. Oxidation: Importance, Deal and Grove's Model.	8
5	Diffusion: Models of diffusion in Solids, Fick's Law. Ion Implantation: Range Theory, Ion Stopping, Implantation Equipment, Annealing. Lithography: Types, Photoresist. Etching: Wet Etching, Ion Milling, Liftoff. Metallization: Applications, Choices, Deposition.	8
Total		42

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
Text Books		
1.	S. Kang and Y. Leblebici, CMOS Digital Integrated Circuits, Analysis and Design, 3rd Ed., Tata McGraw-Hill.	2003
2.	S. M. Sze, VLSI Technology (2/e) , McGraw Hill, 2 nd edition	1988
3.	James D. Plummer , Michael Deal , Peter D. Griffin, Silicon VLSI Technology: Fundamentals, Practice, and Modeling, 1e, Pearson Edition	2003
4.	VLSI Fabrication Principles Silicon And Gallium Arsenide, Sorab K.Ghandi, A Wiley Interscience Publications, 2e.	1994
Reference Books		
1.	D. A. Pucknell and K. Eshraghian, Basic VLSI Design, 3 rd Ed., Prentice-Hall of India..	1994
2.	Stephen A. Campbell, The Science and Engineering of Microelectronic Fabrication, 2 nd Ed., Oxford University Press.	2008

12.	Mode of Evaluation.	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
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GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: - Electronics and Communication Engineering

1. Subject Code: **TEC 604** Course Title: **Data Communication Networks**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **Spring (Even)**
7. Subject Area: **Core Course**
8. Pre-requisite: **Communication Theory**

9. Course Outcomes:	<ul style="list-style-type: none"> Understanding of OSI and TCP/IP network models and designing of physical layer. Understanding functions of data link layer and analyzing its protocols Understanding channel access techniques and IEEE LAN and MAN standards Analyzing performance of routing protocols and understanding of congestion control techniques, IPV4, TCP Understanding functions of presentation, session and application layer Successful completion of this course will enable student to analyze the heterogeneous packet switched network.
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10. Details of the Course: -

Sl. No.	Contents	Contact Hours
1	<p>Introduction to Data Communication: Goals and Applications of Networks, LAN, WAN, MAN, Wireless network. Reference Model: OSI, TCP/IP.</p> <p>Physical Layer: Data and signals, digital transmission, analog transmission, Bandwidth utilization- multiplexing and spreading, Wireless transmission, Circuit switching, Packet switching.</p>	8

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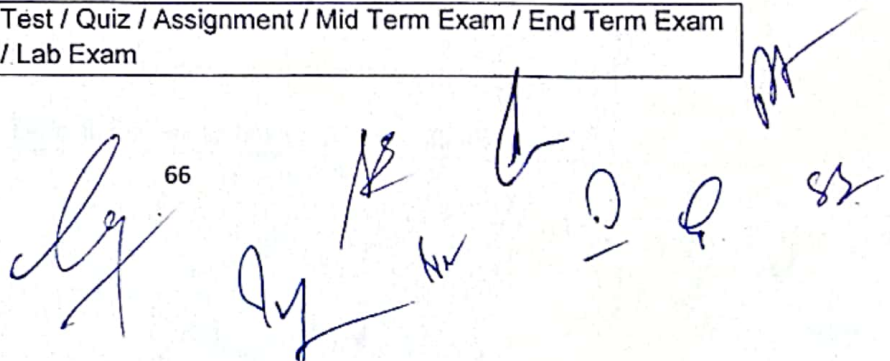
2	Data Link Layer: Data link layer design issues, services provided to network layers, Framing, Error control, Flow control, Error detection and correction, Elementary data link protocols, An unrestricted Simplex protocol, A Simplex Stop-and-Wait protocol, Simplex Protocol for a noisy channel, Sliding Window protocols, A protocol using go-back-N, A protocol using selective repeat, Example data link protocol-HDLC and PPP.	7
3	Medium Access Sub layer: Channel Allocations, Static and dynamic allocation in LAN, Multiple Access protocols, ALOHA, Carrier Sense multiple access protocols, Collision free protocols, Limited contention protocols, IEEE standard 802.3-Ethernet, IEEE standard 802.4- Token bus, IEEE standard 802.5-Token Ring, IEEE standard 802.6- FDDI, bridges.	7
4	Network and Transport Layer: Network Layer design issues, Concept of virtual circuit and datagram subnet, Routing algorithms, Congestion Control Algorithms, Internetworking, IP protocol and addressing. Transport services, Design issues, elements of transport protocols, simple transport protocols, Connection management, TCP, UDP.	7
5	Presentation and Application Layer & Security: Presentation Layer: Design issues, Data compression techniques, cryptography. Application Layer: Domain Name System (DNS), File Transfer (FTP), Access and Management, Electronic mail (SMTP), Virtual Terminals, Network Security: Security services, message confidentiality, integrity And Authentication. Other topics: Integrated and differentiated services internet model, Multi protocol label switching (MPLS).	12
Total		41

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
Text Books		
1.	A.S. Tanenbaum, Computer Networks, 3rd Edition, Prentice Hall India.	2010
2.	Forouzen, Data Communications and Networking, TMH.	2007
Reference Books		
1.	S. Keshav, An Engineering Approach on Computer Networking, Addison Wesley.	2008
2.	W. Stallings, Data and Computer Communication, Macmillan Press.	2009

12.	Mode of Evaluation.	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
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GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Electronics and Communication Engineering**

1. Subject Code: **XCS 600** Course Title: **Career Skills**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **Spring (Even)**
7. Subject Area: **HUSS**
8. Pre-requisite: **Communication.**

9. Course Outcomes:	<ul style="list-style-type: none"> • It will enhance the numerical ability of the student related to computation and estimation, and other concepts like ratio, clock and time and probability concept etc. • It will enhance the knowledge of the students related to the quadratic equation concepts. • Along with it the knowledge of puzzles and different methods to solve the puzzles in an easier way is also included. • It also includes the methods to solve the complicate puzzle and problems and improve the technical skills of the students. • It covers the various approaches to improve the reasoning ability of the students by using the different methods. • Successful completion of this course will provide the foundation for the students to develop the basic skills of aptitude and logical reasoning.
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10. Details of the Course:

Sl.No	CONTENT	CONTACT HOURS
1.	Building Advanced Vocabulary: Sentence completion: Single and double vocabulary Job Application: Personal Interviews and C.V Writing Essential parts - Cover Letter and the 'resume'. Types of 'resumes' (<i>Curriculum Vitae</i>) Chronological 'resume', functional 'resume'.	5
2.	Aptitude Section: Number system, P& C, Probability, Log.	8
3.	Aptitude Section: Time & Work, S.I & C.I, Time & Distance, Mixture, Chain Rule, Pipes &	6

	Cisterns	
4.	Advanced Grammar: Spotting errors, subject verb agreement based errors.	5
	Total	24

11. Suggested Books:

Sl. No.	Name Of Authors/Books/Publishers	Year Of Publication/Reprint
	For Verbal Section:	
1.	Spoken English for India by R.K.Bansal and J.B. Harrison- Orient Longman	
2.	A practical English Grammar by Thomson and Martinet-Oxford University Press	
3.	Professional Communication by Malti Aggarwal	
4.	English grammar, composition and correspondence by M.A.Pink and A.E.Thomas –S.Chand and Sons.Word Power by Blum Rosen-Cambridge University Press	
5.	A Dictionary of Modern Usage-Oxford University Press	
	For Aptitude Section:	
1.	Quantitative aptitude by R.S Agarwal	
2.	Verbal and Non Verbal Reasoning by R.S Agarwal	
3.	All books of puzzles to puzzle to puzzle you by Shakuntala Devi.	
4.	Question Bank on the practice exercise (Created for internal use)	

12.	Mode of Evaluation	of	Test / Assignment / Mid Term Exam / End Term Exam / Lab Exam
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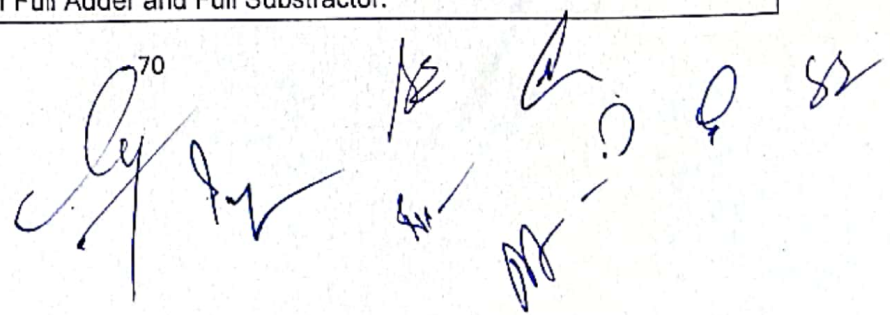
Name of Department: **Electronics and Communication Engineering**

1. Subject Code: **PEC 601** Course Title: **CAD using CADENCE Tool**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs): Theory **0** Practical **3**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **1**
6. Semester: **Autumn (Odd)**
7. Subject Area: **Core Course**
8. Pre-requisite: **Digital Electronics**

9. Course Outcomes:	<ul style="list-style-type: none"> A good experience of working on the tool. Knowledge of basic combinational and sequential programming. Knowledge about designing the combinational circuits. Successful completion of this lab will provide good understanding of microwave devices and its measurement.
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10. Details of the Course: -

Sl. No.	Contents
1.	Design and simulation of various gates.
2.	Design and simulation of XOR gate using NAND gate only.
3.	Design and simulation of comparator.
4.	Design and simulation of Full Adder and Full Subtractor.
5.	Design and simulation of Multiplexer and Demultiplexer.
6.	Design and simulation of Encoder and Decoder.
7.	Design and simulation of Flip-Flops.
8.	Design and simulation of UP-DOWN counter/Decade counter.
9.	FPGA Implementation of Full Adder and Full Subtractor.



10.	FPGA Implementation of Flip-Flops.
Innovative Experiment:	
1.	FPGA Implementation of Binary Multiplier.
2.	As suggested by staff/ lab incharge.

11.	Mode of Evaluation	Viva / Quiz / Mid Term Lab Exam / End Term Lab Exam
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GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

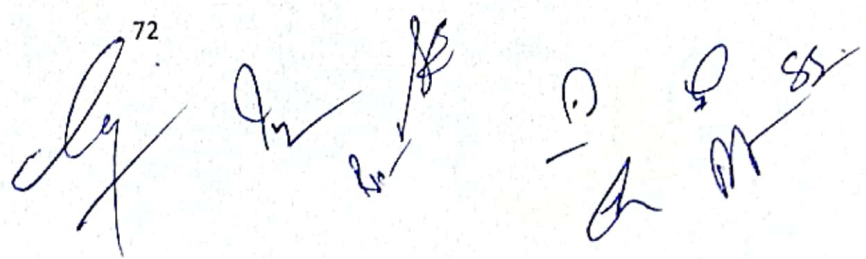
Name of Department: **Electronics and Communication Engineering**

1. Subject Code: **PEC 602** Course Title: **Microwave Lab**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs): Theory **0** Practical **3**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **1**
6. Semester: **Spring (Even)**
7. Subject Area: **Core Course**
8. Pre-requisite: **Knowledge of EMFT and Microwave**

9. Course Outcomes:	<ul style="list-style-type: none"> • Understanding of microwave bench and related component. • Measurement of basic parameters of microwaves and analysis of S-parameters for various microwave devices. • Understanding of different microwave sources. • Successful completion of this lab will provide good understanding of microwave devices and its measurement..
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10. Details of the Course:

Sl. No.	Contents
1.	To measure the Guide Wavelength and Frequency of the signal in a rectangular waveguide, working on TE ₁₀ mode.
2.	Measurement of VSWR using slotted line, introduced by the wave guide in dominant mode.
3.	To measure the S-Parameters of given Magic TEE.
4.	Measurement of characteristics of a given Circulators.
5.	To measure the characteristics of given directional coupler.
6.	To draw the mode characteristic of Reflex Klystron.
7.	To draw the characteristic of Gunn Oscillator.
8.	Measurement of Microwave Power using power meter.
9.	To draw the Polar pattern and measure the Gain of waveguide Horn Antenna.
10.	To verify the characteristic of Low Pass filter (S-Band and C-Band).
11.	To measure the impedance using Smith Chart.
Innovative	
1.	To measure the characteristics of given E, H-TEE.
2.	To measure the characteristic of Power Divider and Power Combiner (S-Band and C-



Band).

11	Mode Evaluation	of	Viva / Quiz / Mid Term Lab Exam / End Term Lab Exam
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