SCHOOL OF ENGINEERING
SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
Outcome based Curriculum for Undergraduate Degree Courses in Engineering & Technology
Department of Electronics and Communication Engineering

Microwave Theory and Techniques
ECA-701

ECA-701	**Microwave Theory and Techniques**	**3L:0T:P**	**3 credits**	**3Hrs/Week**

Course Preambles:

1. To understand Analysis of Waveguides and gain complete knowledge about Microwave Components.
2. Design of Impedance Matching and Tuning using lumped and distributed elements for network.
3. To Analysis and study characteristics of microwave tube Generators and Amplifiers.
4. To Analysis and study characteristics of microwave Semiconductor of detector, switch, generator and amplifier.
5. Study different RADARs and its supporting systems.
6. Study various applications of microwave engineering.

Course Outcomes:

1. Understand various microwave system components their properties.
2. Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.
3. Design microwave systems for different practical application.

UNIT-I(10H)

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands;Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. Mathematical Model of Microwave Transmission-Concept of Mode, Features ofTEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangularwaveguide, Circular waveguide, Strip line, Micro strip line.

UNIT-II(10H)

Microwave Network Analysis- Equivalent voltages and currents for non-TEMlines, Network parameters for microwave circuits, Scattering Parameters. Passive and Active Microwave Devices-

Microwave passive components:Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

UNIT-III(10H)

Microwave Design Principles- Impedance transformation, Impedance Matching,Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas-Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

UNIT-IV(6H)

Microwave Measurements- Power, Frequency and impedance measurement atmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

UNIT-V(6H)

Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Text/Reference Books:

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

ECA-701	**Microwave Theory and Techniques**	**0L:0T:2P**	**1 credits**	**2 Hrs/Week**

List of Experiments

1.To study the microwave test bench and its components.

2.To Study the characteristics of Klystron Tube and to determine its electronic tuning range.

3. To determine the frequency and wavelength in a rectangular wave-guide working on TE10mode.

4. To study the V-I characteristics of Gunn Diode.

5. Study the function of Magic Tee by measuring the following parameters.

(a) Measurement of VSWR at different ports and

(b) Measurement of isolation and coupling coefficient.

6. Study the function of Isolator by measuring the following parameters.

(a) Input VSWR measurement of Isolator .

(b) Measurement of insertion loss and isolation.

7. Study the function of Attenuator (Fixed and Variable type) by measuring the following parameters.
(a) Input VSWR measurement.
(b) Measurement of insertion loss and attenuation.
8. Study the function of Two Hole Directional Coupler by measuring the following parameters.
(a) To measure main line and auxiliary line VSWR.
(b) To measure the coupling factor and directivity.
9. Study the function of Circulator by measuring the following parameters.
(a) Input VSWR measurement of Circulator.
(b) Measurement of insertion loss and isolation.
10. To determine the Standing Wave-Ratio and reflection coefficient

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Antennas and Propagation
ECA-702

ECA-702	**Antennas and Propagation**	**3L:0T:0P**	**3 Credit**	**3Hrs/Week**

Course Preambles:

1.Students will be introduced to antennas, their principle of operation
2. Antenna analysis and their applications.
3. Introduce the student to wave propagation over ground, through troposphere and ionosphere; diversity principles,
4. Propagation effects in microwave systems, satellite, space, and radar links

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Understand the properties and various types of antennas.
2. Analyze the properties of different types of antennas and their design.
3. Operate antenna design software tools and come up with the design of the antenna of required specifications

UNIT-I (10H)

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-andfar-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions. Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linearelements near conductors, dipoles for mobile communication, small circular loop.

UNIT-II(10H)

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangularand circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas. Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequencyindependent antennas, broadcast antennas.

UNIT-III (10H)

Micro strip Antennas- Basic characteristics of micro strip antennas, feedingmethods, methods of analysis, design of rectangular and circular patch antennas.

UNIT-IV (6H)

Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

UNIT-V (6H)

Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, fixedweight beam forming basics, Adaptive beam forming. Different modes of Radio Wave propagation used in current practice.

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw ill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Antennas and Propagation
ECA-701

ECA-702	**Antennas and Propagation**	**0L:0T:1P**	**1 Credit**	**2Hrs/Week**

List of Experiments

Following illustrative practical should be simulated with the help of any RF simulation software e.g. FEKO / HFSS / IE3D / Microwave Office / Microwave Studio or any other similar software:-

1. To Plot the Radiation Pattern of an Omni Directional Antenna.
2. To Plot the Radiation Pattern of a Directional Antenna.
3. To Plot the Radiation Pattern of a Parabolic Reflector Antenna.
4. To Plot the Radiation Pattern of a Log Periodic Antenna.
5. To Plot the Radiation Pattern of a Patch Antenna.
6. To Plot the Radiation Pattern of a Dipole/ Folded Dipole Antenna.
7. To Plot the Radiation Pattern of a Yagi (3-EL/4EL) Antenna.
8. To Plot the Radiation Pattern of a Monopole/ WHIP/ Collinear Antenna.
9. To Plot the Radiation Pattern of a Broad site Antenna.
10. To Plot the Radiation Pattern of a Square Loop Antenna

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Program Elective-IV

Satellite Communication
ECA-703(A)

ECA-703(A)	**Mixed Signal Design**	**3L:0T:0P**	**3 Credit**	**3Hrs/Week**

Course Preambles

1. To provide an in-depth understanding of different concepts used in a satellite communication system.

2. To explain the tools necessary for the calculation of basic parameters in a satellite communication system.

3. To get knowledge of every aspects of satellite communication like orbital mechanics, launching techniques, satellite link design, earth station technology and different access system towards a satellite.

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
3. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

UNIT-I (10H)

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

UNIT-II (6H)

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

UNIT-III (6H)

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

UNIT-IV (10)

Typical Phenomena in Satellite Communication:Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

UNIT-V (10)

Modulation and Multiple Access Schemes:Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Text /Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

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Mixed Signal Design
ECA-703 (B)

ECA-703(B)	**Mixed Signal Design**	**3L:0T:0P**	**3 Credit**	**3Hrs/Week**

Course Preambles

1. Importance of CMOS and Mixed Signal VLSI design in the field of Electronics and Telecommunication.
2. Underlying methodologies for analysis and design of fundamental CMOS Analog and Mixed signal Circuits like Current and Voltage references, Single stage Amplifiers, Operational Amplifiers, Data Converters.
3. The issues associated with high performance Mixed Signal VLSI Circuits

Course Outcomes:

1. Understand the practical situations where mixed signal analysis is required.
2. Analyze and handle the inter-conversions between signals.
3. Design systems involving mixed signals

UNIT-I (10H)

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

UNIT-II(10H)

Switched-capacitor filters- Non-idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

UNIT-III(10H)

Basics of data converters; Successive approximation ADCs, Dual slope ADCs ,Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

UNIT-IV(6H)

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

UNIT-V(6H)

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

Text/Reference Books:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008

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Open Core Elective - III

Wireless Sensor Networks
ECA-704(A)

ECA-704(A)	**Wireless Sensor Networks**	**3L:0T:0P**	**3 Credit**	**3Hrs/Week**

Course Preambles

1.Introduction to planning and design of wireless networks
2. Introduction to HSPA systems
3. To study emerging technologies like Bluetooth, zigbee, Wimax
4. Understanding the wireless sensor network architecture and the protocol stack and WSN applications.

Course Outcomes:

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

UNIT-I (10H)

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

UNIT-II(10H)

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

UNIT-III(10H)

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

UNIT-IV(6H)

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT-V(6H)

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text/Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
4. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

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High Speed Electronics
ECA-704(B)

ECA-704(B)	**High Speed Electronics**	**3L:0T:0P**	**3 Credit**	**3Hrs/Week**

Course Preambles

To give a fundamental understanding of the new high speed semiconducter circuits which are now being developed and forms a basis for the developement of high capacity cost efficient interactive multimedia system operated above 20 GHz.

Course Outcomes:
1. Understand significance and the areas of application of high-speed electronics circuits.
2. Understand the properties of various components used in high speed electronics
3. Design High-speed electronic system using appropriate components.

UNIT-I(10H)

Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery. methodologies for design of high speed buses; radiated emissions and minimizing system noise; Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Intermodulation,Cross-modulation, Dynamic range

UNIT-II(10H)

Devices: Passive and active, Lumped passive devices (models), Active (models,low vs highfrequency)

UNIT-III(10H)

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages

UNIT-IV(6H)

Mixers – Upconversion Downconversion, Conversion gain and spurious response. Oscillators Principles. PLL Transceiver architectures

UNIT-V(6H)

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

Text/Reference Books:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press
2. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", CambridgeUniversity Press, 2004, ISBN 0521835399.
3. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
4. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall

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Outcome based Curriculum for Undergraduate Degree Courses in Engineering & Technology
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Project Stage-I

ECA-705

ECA -705	**Project-I**	**0L:0T:10P**	**5 credits**	**8Hrs/Week**

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Design and validate Electronics algorithms for optimum solution
2. Analyze the dynamic response and the calibration of few instruments
3. Build projects as per industry and society demands.

Guidelines:

1. The Major-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The Major project may be a complete hardware or a combination of hardware and software.The software part in Minor project should be less than 50% of the total work.
3. Minor Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and Preambles of Minor project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

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Self Study / GD/Seminar

ECA-706

ECA-706	**Self-Study/GD/Seminar**	**0L:0T:2P**	**1 credits**	**1Hrs/Week**

Course Preamble:

The main Preamble is to improve the mass communication and convincing/understanding skills of students .And to give the students an opportunity to exercise their rights to express themselves. The evaluation will be done based on their presentation work and group discussion.

Couse Outcomes:

In terms of **content**, students will be able to

Presentation Skills

They will be able to make use of visual, audio and audio-visual material to support their presentation, and will be able to speak cogently with or without notes. Students will present either in groups or as individuals.

Discussion Skills

Students will be able to judge when to speak and how much to say, speak clearly and audibly in a manner appropriate to the subject, ask appropriate questions, use evidence to support claims, respond to a range of questions, take part in meaningful discussion

Listening Skills

Students will demonstrate that they have paid close attention to what others say and can respond constructively. Through listening attentively, they will be able to build on discussion fruitfully, supporting and connecting with other discussants. They will be able to follow academic discussions, infer meanings that are not overt, and take notes from a discussion or presentation.

Argumentative Skills and Critical Thinking

Students will develop persuasive speech, present information in a compelling, well-structured, and logical sequence, respond respectfully to opposing ideas, show depth of knowledge of complex subjects, and develop their ability to synthesize, evaluate and reflect on information.

Questioning

Through asking appropriate questions, students will demonstrate their understanding of discussions and spark further discussion.

Interdisciplinary Inquiry

Students will be able to reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem.

Engaging with Big Questions

Students will engage with important questions that stimulate discussion and debate.

Studying Major Works

Students will engage with works that are widely held to be significant in the field of study, while recognizing cultural diversity and the ever-changing nature of what is regarded as important