CENTRAL UNIVERSITY OF KARNATAKA
KALABURAGI

SCHOOL OF ENGINEERING

COURSE STRUCTURE AND SYLLABUS [Draft*]

For

B.Tech. Third Year - 2020 & 2021 Batches

(Common to both ELECTRONICS & COMMUNICATION ENGINEERING AND ELECTRICAL ENGINEERING)

Learning Outcomes-based Curriculum Framework

(Effective from the academic year 2020 –21)

Department of Electronics & Communications Engineering
and Electrical Engineering.
School of Engineering
Central University of Karnataka
Kalaburagi-585367

* To be approved by BOS

SCHOOL OF ENGINEERING

PROPOSED COURSE STRUCTURE [Draft*] - THIRD YEAR B. TECH

ELECTRONICS & COMMUNICATION ENGINEERING-2020 & 2021 Batches

V SEMESTER												
Course code	Course Type	Course Title	Teaching Hrs./Week				Examination				Credits
			Theory Lecture	Tutorial	Practical/ Drawing	Total	Duration in Hrs.	IA Marks	End Sem Marks	Total Marks	
			L	T	P						
UECTCC5001	CC	Advanced Signal Processing	3	1	-	4	2.5	30	45	75	3
UECTCC5002	CC	Dig. Commn. & Comp. Networks	3	1	-	4	2.5	30	45	75	3
UECTCC5003	CC	Embedded Systems Architecture	3	1	-	4	2.5	30	45	75	3
UECTCC5004	CC	Information Theory and Coding	3	1	-	4	2.5	30	45	75	3
UECPCC5005	CC	Dig. Commn. & Comp. Networks Lab	-	-	3	3	3	20	30	50	2
UECPCC5006	CC	Embedded Systems Architecture Lab	-	-	3	3	3	20	30	50	2
UECTDS5007	DS	Microwave Engineering	3	1	-	4	2.5	30	45	75	3
UECPCC5008	CC	Web Design Lab	-	-	3	3	3	20	30	50	2
		Total	**15**	**5**	**9**	**29**	**21.5**	**210**	**315**	**525**	**21**

Note: 1. CC-Core Course, DS-Discipline specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses
2. English Enhancement is a mandatory non-credit course. This course shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

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SCHOOL OF ENGINEERING

PROPOSED COURSE STRUCTURE [Draft*] - THIRD YEAR B. TECH

ELECTRONICS & COMMUNICATION ENGINEERING -2020 & 2021 Batches

VI SEMESTER

Course code	Course Type	Course Title	Teaching Hrs./Week				Examination				Credits
			Theory Lecture	Tutorial	Practical/ Drawing	Total	Duration in Hrs.	IA Marks	End Sem Marks	Total Marks	
			L	T	P						
UECTCC6001	CC	Microelectronics and VLSI	3	1	-	4	2.5	30	45	75	3
UECTCC6002	CC	IoT and Applications	3	1	-	4	2.5	30	45	75	3
UECTCC6003	CC	Antennas and Wave Propagation	3	1	-	4	2.5	30	45	75	3
UECTCC6004	CC	ML and Experts Systems	3	1	-	4	2.5	30	45	75	3
UECPCC6005	CC	Microelectronics and VLSI Lab	-	-	3	3	3	20	30	50	2
UECPCC6006	CC	IoT Lab	-	-	3	3	3	20	30	50	2
UECTCC6007	DS	Real Time Operating Systems	3	1	-	4	2.5	30	45	75	3
UECRCC6008	CC	Mini Project	-	-	3	3	3	20	30	50	2
UECICC6009	AE	Summer Internship	-	-	-	-	-	-	-	-	-
		Total	**15**	**5**	**9**	**29**	**21.5**	**210**	**315**	**525**	**21**

Note: 1. CC-Core Course, DS-Discipline specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses

2. Environmental Science is a mandatory non-credit course. This course shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

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CENTRAL UNIVERSITY OF KARNATAKA	**Central University of Karnataka** (Established by an Act of the Parliament in 2009) **School of Engineering**	**Dept.: ECE Dept.** **Curriculum** **Syllabus Contents** **w.e.f. 2022-23**

ADVANCED SIGNAL PROCESSING

Semester	**:**	**V**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UECTCC5001**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits : 03					

PREREQUSITES

Exposure to basic signal processing, Z-transform, and discrete Fourier transform.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Analyze the discrete time signals

CO2. Employ the modern digital signal processing algorithms and applications.

CO3. Use the digital systems in real time applications

CO4. Apply the algorithms for wide area of recent applications.

UNIT-I

Review of Discrete Time Signals and Systems: Frequency analysis of discrete time linear time invariant systems. Discrete time systems, analysis of discrete time linear invariant systems, implementation of discrete time systems, correlation of discrete time systems, z-transforms, linear time invariant systems as frequency selective filters, sampling, DFT, properties and applications of DFT**. RBT Levels: L1, L2, L3, L4**

UNIT-II

Multirate Digital Signal Processing: Decimation, interpolation, sampling rate conversion, filter design and implementation for multirate conversion, sampling rate conversion by an arbitrary factor, applications of multirate signal processing. **RBT Levels: L1, L2, L3, L4.**

UNIT-III

Linear Prediction and Optimum Linear Filters: Forward and backward linear prediction, solution of the normal equations, wiener filters. **RBT Levels: L1, L2, L3, L4.**

UNIT-IV

Power Spectrum Estimation: Non-parametric and parametric methods for power spectrum estimation. **RBT Levels: L1, L2, L3, L4.**

TEXT BOOKS

1. John G. Proakis, Digital Signal Processing Principles, Algorithms, and Applications, Prentice-Hall International.Inc, 4th Edition, 2012.
2. Lawrence R.Rabiner and Bernard Gold, Theory and Application of Digital Signal Processing, PHI.

REFERENCE BOOKS

1. Oppenheim, Alan V. Discrete-time signal processing. Pearson Education India, 1999.
2. Mitra, Sanjit Kumar, and Yonghong Kuo. Digital signal processing: a computer-based approach. vol. 2. New York: McGraw-Hill Higher Education, 2006.

ONLINE RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_ee20/preview

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two continuous assessments will be conducted with each one of 15 marks weightage
- **Remaining 10 marks** will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 15 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

CENTRAL UNIVERSITY OF KARNATAKA	**Central University of Karnataka** (Established by an Act of the Parliament in 2009) **School of Engineering**	**Dept.: ECE Dept.** **Curriculum** **Syllabus Contents** **w.e.f. 2022-23**

Digital Communication and Computer Networks

Semester	**:**	**V**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UECTCC5002**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits : 03					

PREREQUSITES

Exposure to Analog Communication and Digital Electronics.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Apply the concepts of Bandpass sampling to well specified signals and channels.

CO2. Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels.

CO3. Demonstrate that bandpass signals subjected to corruption and distortion in a bandlimited channel can be processed at the receiver to meet specified performance criteria.

CO4. Identify the protocols and services of different layers.

CO5. Distinguish the basic network configurations and standards associated with each network.

UNIT-I

Conversion of Analog waveforms into Coded Pulses

Introduction, Sampling Theory, Pulse-Amplitude Modulation, Quantization and its Statistical Characterization, Pulse-Code Modulation, Noise Considerations in PCM Systems, Differential Pulse-Code Modulation, Delta Modulation, Line Codes. **RBT Levels: L1, L2, L3.**

UNIT-II

Signaling over AWGN Channels

Introduction, Geometric Representation of Signals, Conversion of the Continuous AWGN Channel into a Vector Channel, Optimum Receivers Using Coherent Detection, Phase-Shift Keying Techniques Using Coherent Detection, M-ary Quadrature Amplitude Modulation, Frequency-Shift Keying Techniques Using Coherent Detection, Noncoherent Orthogonal Modulation Techniques, Binary Frequency-Shift Keying Using Noncoherent Detection, Differential Phase-Shift Keying, **RBT Levels: L1, L2, L3.**

UNIT-III

Signaling over Band-limited channels

Introduction, Error Rate Due to Channel Noise in a Matched-Filter Receiver, Intersymbol Interference, Ideal Nyquist Pulse for Distortionless Baseband Data Transmission, Raised-Cosine Spectrum, Square-Root Raised-Cosine Spectrum, The Eye Pattern, Adaptive Equalization, Signaling over Multiple Baseband Channels, Partitioning Continuous-Time Channel into a Set of Subchannels, Water-Filling Interpretation of the Constrained Optimization Problem. **RBT Levels: L1, L2, L3. L4**

UNIT-IV

Data communication

Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet, Network Models, Protocol Layering, Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite, Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. **RBT Levels: L1, L2, L3.**

TEXT BOOKS

1. Simon Haykin - Digital Communication Systems, Willy Publisher 2014 ISBN: 978-0-471-64735-5.
2. Forouzan, "Data Communications and Networking" , 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.

REFERENCE BOOKS

1. H. Taub, D. Schilling and G. Saha, *Principles of Communications*, Mc-Graw Hill India, 2017.
2. James J Kurose, Keith W Ross, Computer Networks, , Pearson Education.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage
- Remaining 10 marks will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

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EMBEDDED SYSTEMS ARCHITECTURE

Semester :	**V**	**Internal Assessment** :	**30**
Course Code :	**UECTCC5003**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**2.5**
Credits : 03			

PREREQUSITES

It requires basic exposure to Micrroprocessors, Microcontroller, and C Programming.

COURSE OUTCOMES

After completing thisCourse,the students should be able to:

CO1. Evaluate the requirements of programming Embedded Systems.
CO2. Students can develop the hardware for embedded system application based on the processors.
CO3. Students can choose appropriate microcontroller for the design specification with reference to a real time problem.
CO4. Incorporate suitable microcontroller along with appropriate interfacing circuits and implement the same for an application with software programs.
CO5. Apply advanced level knowledge, techniques, skills and modern tools in the field of microcontroller and embedded system

UNIT-I

Introduction to Embedded Systems: Definition, Classification and Application of Embedded Systems. Purpose, Characteristics and Quality attributes of Embedded Systems.
Core of Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Microcontrollers, Commercial Off-The-Shelf Components (COTS).
Embedded Hardware-I
Intel MCS: Features of 8051, Architecture, Pin diagram, Prts, Internal Memory, Programming 8051.
RBT Levels: L1, L2, L3.

UNIT-II

Embedded Hardware-II
AVR: Introduction to AVR, Architecture, Pin Configuration, Registers, Addressing modes,Ports and DDR register and control operations.Programming with AVR.
ARM: Architecture & Organization of Cortex processor, Programming and Interfacing
RBT Levels: L1, L2, L3,L4.

UNIT-III

Embedded Software:
Embedded C: Introduction, Featuresand Advantages “C”.Differnce between normal and Embedded “C”. Storage classes, Structres and Unioins, Functions, Commandline arguments, File handling, Interrupts and Interupts Service Routines.
RBT Levels: L1, L2, L3,L4.

UNIT-IV

Embedded System Design Concepts: Challenges and issues in embedded software development, Embedded System life cycle, Characteristics and Quality Attributes of Embedded Systems, Hardware Software Co-Design, Embedded software development tools.

Embedded System case studies.

RBT Levels: L1, L2.

TEXT BOOKS

1. Shibu K V, Introduction to Embedded Systems, TMH Education Private Limited, 2009.
2. Rajkamal (2007), "Embedded Systems- Architecture, Programming &Design,TMH.
3. Kenneth Ayala, The 8051 Microcontroller: Architecture, Programming and Applications.

REFERENCE BOOKS

1. Joseph Yiu, The Definitive Guide to the ARM Cortex-M3, 2nd Edn, Newnes,(Elsevier), 2010.
2. Patrick R. Schaumont, A Practical Introduction to Hardware/Software Co-design, 2010
3. Danny Causey, Muhammad Ali Mazidi, and Rolin D. McKinlay, PIC Microcontroller and Embedded SystemsUsing Assembly and. C for PIC18. Pearson 2008.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108/102/108102045/
2. https://nptel.ac.in/courses/106/105/106105193/
3. https://nptel.ac.in/courses/106/105/106105159/

COURSE ASSESSMENT

A. **Internal Assessment** (Weightage **30 Marks**)

- Two internal assessments will be conducted with each one of 15 marks weightage
- Remaining 15 marks will be given for Assignments/Quiz/Seminar etc. based on the decision of subject incharge.
- If only Quizes (MCQ type) are preferred then minimum of two are to be conducted.
- If only assignments are considered then 4 assignments to be given from each unit.
- In case of seminar, student must give 10+5 minutes presentation and ppt file has to be submitted to the subject incharge & department.

B. **End Sem Examination** (Weightage **30 Marks**)

- Question Paper will have two parts: Part A and Part B.
- Part A will have short answer questions (total of 15 marks).
- In Part A, all questions are compulsory and covers all the units.
- Part B will have long answer questions (total of 30 marks).
- In Part B option will be given, howerver questions will be from each unit.

INFORMATION THEORY AND CODING

Semester	:	**V**	**Internal Assessment**	:	**30**
Course Code	:	**UECTCC5004**	**End Sem. Exam**	:	**45**
Teaching Hours/Week (L:T:P)	:	**3:1:0**	**Exam Duration (Hourse)**	:	**2.5**
Credits : 03					

PREREQUSITES

Basic exposure to linear algebra and probability theory, as well as, a course in digital communication.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Explain the concept of information and entropy

CO2. Apply Shannon's theorem to compute source codes.

CO3. Compute capacity of various information channels

CO4. Examine the performance of viterbi decoding technique.

UNIT-I

Basics of Information Theory: Introduction, Measure of information, Information content of message, Entropy of long independent sequences, Entropy of long dependent sequences, Markov statistical model of information sources, Entropy and information rate of Markoff sources**.** **RBT Levels: L1, L2.**

UNIT-II

Source Coding Techniques: Source coding theorem, Prefix codes, Kraft Mc-Millan Inequality property – KMI. Encoding techniques of discrete sources. **RBT Levels: L1, L2, L3.**

UNIT-III

Information Channels: Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels. **RBT Levels: L1, L2, L3.**

UNIT-IV

Error Correcting Codes: Binary cyclic codes, Golay codes, BCH Codes, Convolution codes; Time and Frequency domain approach, Code tree, Trellis and State diagram, The Veterbi algorithm. **RBT Levels: L1, L2, L3, L4.**

TEXT BOOKS

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. Information Theory and Coding, M. Kulkarni, K. S. Shivaprakasha, Wiley India Pvt. Ltd, 2015.
4. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007

REFERENCE BOOKS

1. Shu Lin and D. J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/117101053/
2. https://nptel.ac.in/content/storage2/courses/117108097/Learning%20Material%20-%20ITC.pdf

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage
- **Remaining 10 marks** will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 10/11 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory. (Note: Course teacher may change the pattern as applicable)

Digital Communication and Computer Networks Lab

Semester	:	**V**	**Internal Assessment**	:	**20**
Course Code	:	**UECPCC5005**	**End Sem. Exam**	:	**30**
Teaching Hours/Week (L:T:P)	:	**0:0:3**	**Exam Duration (Hours)**	:	**03**
Credits : 02					

PREREQUSITES

Exposure to digital communication engineering and Computer Network courses.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Design of Sampling and Detection

CO2. Design of Time Division Multiplexing and and Demultiplexing.

CO3. ASK and FSK generation and detection.

CO4. PSK generation and detection

CO5. Simulate point to point network and Ethernet LAN using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet or any other equivalent tool .

LIST OF EXPERIMENTS

PART-A:

1. Pulse sampling, flat top sampling and reconstruction. **RBT Level: L1 to L4**
2. Time Division Multiplexing and Demultiplexing of two bandlimited signals. **RBT Level: L1 to L6**
3. ASK generation and detection. **RBT Level: L1 to L4**
4. FSK generation and detection. **RBT Level: L1 to L4**
5. PSK generation and detection. **RBT Level: L1 to L4**

PART-B: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet or any other equivalent tool

6. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth. **RBT Level: L1 to L4**
7. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP. **RBT Level: L1 to L6**
8. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate. **RBT Level: L1 to L6**

TEXT BOOKS

1. Simon Haykins & Moher, *Communication Systems*, 5th Edition, John Willey, India Pvt. Ltd, 2010.
2. Forouzan, "Data Communications and Networking" , 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.

REFERENCE BOOKS

1. H. Taub, D. Schilling and G. Saha, *Principles of Communications*, Mc-Graw Hill India, 2017.
2. James J Kurose, Keith W Ross, Computer Networks, , Pearson Education.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage

B. **End Sem Examination** (Weightage **30 Marks**)

- An experiment (Hardware /Simulation) will be allotted and the same has to be performed by the student. For designing (theory part) 15 marks will be given and remaining 15 will be given for performing and showing the results.

EMBEDDED SYSTEMS ARCHITECTURE LAB

Semester :	**V**	**Internal Assessment** :	**20**
Course Code :	**UECPCC5006**	**End Sem. Exam** :	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours)** :	**03**
Credits : 02			

PREREQUSITES

Microprocessor and Microcontroller theoretical concepts

COURSE OUTCOMES

On the completion of this laboratory course, the students will be able to:

CO1. Storage classes, Files handling, Command line arguments, and Structures in "C"
CO2. Interfacing and testing various interface various IO devices with 8051.
CO3. Interfacing and testing various interface various IO devices with Atmega328P.
CO4. Interfacing and testing various interface various IO devices with Arduino platform

"C" programming on Linux / Windows: RBT Levels: L1, L2, L3, L4.

1. Experiments on storage classes
2. Basic calculator using command line
3. File copy programming using command line
4. Database maintain (Students or Books)

Embedded Programming on 8051 using Keil: RBT Levels: L1, L2, L3, L4.

1. Interfacing LED
2. Four bit binary UP/DOWN Counter
3. Interfacing SSD
4. UP/DOWN Counter using SSD
5. Interfacing Push Button and LED
6. Interfacing Buzzer and Relay
7. Interfacing DC motor

Embedded Programming on AVR / Arduino: RBT Levels: L1, L2, L3, L4.

1. Interfacing LED
2. Four bit binary UP/DOWN Counter
3. Interfacing SSD
4. UP/DOWN Counter using SSD
5. Interfacing Push Button and LED
6. Interfacing Buzzer and Relay
7. Interfacing DC motor
8. Interfacing 4x4 Keypad
9. Interfacing LCD

COURSE ASSESSMENT

A. **Internal Assessment** (Weightage **20 Marks**)

- One internal assessment will be conducted for 10 marks weightage
- Remaining 10 marks will be given for Assignments/Mini Project.

B. **End Sem Examination** (Weightage **30 Marks**)

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part be made zero.

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Microwave Engineering

Semester	**:**	**V**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UECTDS5007**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits : 03					

PREREQUSITES

Exposure to Electromagnetic Theory.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Describe the use and advantages of microwave transmission.

CO2. Analyze various parameters related to microwave transmission lines and waveguides.

CO3. Identify microwave passive devices for several applications.

CO4. Identify microwave Active devices for several applications.

CO5. Analyze various microwave oscillators and amplifiers for various applications.

UNIT-I

Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio.

Line Impedance and Admittance, Smith Chart, Impedance matching, Single Stub matching. **RBT Levels: L1, L2, L3.**

UNIT-II

Microwave waveguides and components: Rectangular Waveguides, Solutions of wave Equations in Rectangular Coordinates, TE Modes in Rectangular Waveguides, TM Modes in Rectangular Waveguides, Power Transmission in Rectangular Waveguides, Power Losses in Rectangular Waveguides, Excitations of Modes in Rectangular waveguides, Rectangular-Cavity Resonator.

RBT Levels: L1, L2, L3.

UNIT-III

Microwave Hybrid Circuits Waveguide Tees, Magic Tees (H ybrid Trees), Hybrid Rings (Rat-Race Circuits), Waveguide Corners, Bends, and Twists,

Directional Couplers Two-Hole Directional Couplers, S-Matrix of a Directional Coupler, Hybrid Couplers.

Circulators and Isolators Microwave Circulators, Microwave Isolators,

RBT Levels: L1, L2, L3.

UNIT-IV

Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curves, Two-cavity Klystron, Slow-wave structure, Traveling-wave Tube, Microwave crossed-field tubes, Magnetrons. **RBT Levels: L1, L2, L3.**

TEXT BOOKS

1. Microwave Devices and circuits- Samuel Y Liao, Pearson Education
2. Microwave Engineering – Annapurna Das, Sisir K Das, TMH, Publication, 2nd, 2010.

REFERENCE BOOKS

1. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
2. Microwave Engineering - David M Pozar, John Wiley India Pvt. Ltd., 3rd Edn, 2008.

ONLINE RESOURCES

https://ocw.mit.edu

https://nptel.ac.in

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage
- Remaining 10 marks will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

WEB DESIGN LAB

Semester	:	**V**		**Internal Assessment**	:	**20**
Course Code	:	**UECPCC5008**		**End Sem. Exam**	:	**30**
Teaching Hours/Week (L:T:P)	:	**0:0:3**		**Exam Duration (Hours)**	:	**03**
Credits : 02						

PREREQUSITES

Fundamentals of Computing and Programming , Knowledge of basic HTML tags.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Analyze a web page and identify its elements and attributes.
CO2. Design and develop static web pages using HTML with good aesthetic sense of designing.
CO3. Build dynamic web pages using HTML and JavaScript (Client side programming).
CO4. Create web pages using Cascading Style Sheets (CSS).
CO5. Create XML documents and Schemas.

LIST OF EXPERIMENTS

1. Develop a HTML file to implement the basic HTML tags like heading tags, paragraph tags, Line break tag, ordered list tag, hyperlink tag, image tag and footer tag. **RBT Level: L1 to L3**
2. Create a static HTML "registration form "with the following fields
   a) Name (Text field)
   b) Password (password field)
   c) E-mail id (text field)
   d) Phone number (text field)
   e) Sex (radio button)
   f) Date of birth (3 select boxes)
   g) Languages known (check boxes – English, Hindi, Kannada, Telugu, Tamil, Malayalam)
   h) Address (text area) **RBT Level: L1 to L3**
3. Using the HTML table tags create a time table to show your class time table.
   RBT Level: L1 to L4
4. Develop a HTML file to implement the frames using HTML <frameset> and <frame> tags. Use frames such that page is divided into 3 frames 25% on left , 50% in center and remaining on right. **RBT Level: L1 to L4**
5. Develop a HTML form to contain the form fields Username and Password and validate the form using JavaScript.
   Username should contains alphabets and the length should not be less than 6 characters.
   Password should not be less than 6 characters length. **RBT Level: L1 to L4**
6. Use HTML and Javascript to design a simple calculator to perform the following operations: sum, product, difference and quotient. **RBT Level: L1 to L4**
7. Write a HTML page that contains a selection box with a list of 5 countries, when the user selects a country, its capital should be printed next to the list. Use JavaScript to display the

capital for selected country. Add Cascading Style Sheets (CSS) to customize the properties of the font of the capital (color, bold and font size). **RBT Level: L1 to L4**

8. Design a XML document to store information about a student in Central University of Karnataka. The information must include USN, Name, Name of the School, Name of the Department, Year of Joining, and email id. Make up sample data for 3 students.
   Create a CSS style sheet and use it to display the XML document. **RBT Level: L1 to L4**

REFERENCE BOOKS

1. Uttam K Roy, Web Technologies, Oxford University Press, 1st Edition, 2010.
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.
3. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1stEdition, Pearson Education India. (ISBN:978-9332575271)
4. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage

B. **End Sem Examination** (Weightage **30 Marks**)

- An experiment will be allotted and the same has to be designed and performed by the student. For designing (theory part) 15 marks will be given and remaining 15 will be given for performing the experiment and showing the output.

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MICROELECTRONICS AND VLSI

Semester	**:**	**VI**	**Internal Assessment**	**:**	**35**
Course Code	**:**	**UECTCC6001**	**End Sem. Exam**	**:**	**40**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits : 03					

PREREQUSITES

Fundamental of semiconductor physics and electronics circuits.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Explain the concept of MOSFETs

CO2. Identify and illustrate the single, differential and multi-stage MOS amplifiers

CO3. Show the design process of MOS and bi-MOS circuits

CO4. Illustrate the design of FPGA systems.

UNIT-I

MOSFETs: Device Structure and Physical Operation, V-I Characteristics, MOSFET Circuits at DC, MOSFET as an amplifier and as a switch, Biasing in MOS amplifier Circuits, Small Signal Operation and Models, basic MOSFET amplifier, MOSFET internal capacitances, frequency response of CS amplifier, Discrete circuit MOS amplifiers. **RBT Levels: L1, L2, L3.**

UNIT-II

Single, Differential, and Multi-stage MOS Amplifiers: Common source (CS) and common gate single stage MOS amplifier, The MOS differential pair, small signal operation of MOS differential pair, Differential amplifier with active loads, and frequency response of the differential amplifiers. Multistage amplifiers. **RBT Levels: L1, L2, L3, L4.**

UNIT-III

MOS and Bi-CMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout. Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads. **RBT Levels: L1, L2, L3.**

UNIT-IV

Scaling and Subsystem Design Processes: Scaling Models & Scaling Factors for Device Parameters; Some General considerations, An illustration of Design Processes, Illustration of the Design Processes- Regularity, Design of an ALU subsystem, The Manchester Carry-chain and Adder Enhancement Techniques. FPGA Based Systems: Introduction, Basic concepts, Digital design and FPGA's, FPGA based System design, FPGA architecture. **RBT Levels: L1, L2, L3, L4.**

TEXT BOOKS

1. Sundaram Natarajan, Microelectronics – Analysis and Design, Tata McGraw-Hill, 2007.
2. Behzad Razavi Fundamentals of Microelectronics, , John Wiley India Pvt. Ltd, 2008.
3. Douglas A. Pucknell & Kamran Eshraghian, Basic VLSI Design, PHI 3rd Edition.
4. Neil H.E. Weste, David Harris, Ayan Banerjee, CMOS VLSI Design- A Circuits and Systems Perspective-, 3rd Edition, Pearson Education.

REFERENCE BOOKS

1. Adel Sedra and K.C. Smith, Microelectronic Circuits, 6th Edition, Oxford University Press, International Version, 2009.

ONLINE RESOURCES

1. NA

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **40 Marks**)

- Two continuous assessments will be conducted with each one of 15 marks weightage
- **Remaining 10 marks** will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **60 Marks**)

- One full question carries 15 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

INTERNET OF THINGS AND APPLICATIONS

Semester :	**VI**	**Internal Assessment** :	**30**
Course Code :	**UECTCC6002**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**2.5**
Credits : 03			

PREREQUSITES

Basic exposure to microcontroller and interfacing, communication protocols.

COURSE OUTCOMES

After completing thisCourse,the students should be able to:

- CO1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- CO2. Appraise the role of IoT protocols for efficient network communication.
- CO3. Design the advanced hardware and software for IoT system.
- CO4. Incorporate long lifetime of IoT network using energy harvesting technologies.
- CO5. Employ advanced level knowledge, techniques, skills and modern tools in the development of the IoT system.
- CO6. Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

UNIT-I

Introduction to Internet of Things: Definition IoT, History of IoT, Basic Architecture and working of IoT. Chellanges, Applications, Current Status and Future Prospect of IoT.
Sensing, Actuation, Basics of Networking, Communication protocols, Sensor networks, Machine-to-machine (M2M) Communications.

RBT Levels: L1, L2, L3.

UNIT-II

Introduction to Arduino Programming: Integration of Sensors and Actuators with Arduino.
Introduction to Raspberry Pi: Implementation of IoT with Raspberry Pi.
Introduction to SDN: SDN for IoT, Data Handling and Analytics, Cloud Computing, Sensor-Cloud, Fog Computing, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring.

RBT Levels: L1, L2, L3,L4.

UNIT-III

IoT System Design: Power supply, Processor, Memory Sensor Interface, Wireless Interface- LAN, BLE, Wi-Fi, RFID, LP WA-LORA, LTE-M, Sigfox, NB-IoT, Power Supply Design-LDOs, Swithing regulators-BuckBoost. Energy Measurments, Energy Harvesting and Battery Life Calculation-PV, RF, Kinetic Energy, TEGs aeroelastic. Flutter, Harvesting Iss in silicon

RBT Levels: L1, L2, L3,L4.

UNIT-IV

Protocols- IoT MAC, REST Based COAP, Publish subscribe- MQTT, AMQP, MDNS, Building of IoT System- Case Studies-Joule, Jotter, chhaya..

Embedded System case studies.

RBT Levels: L1, L2.

TEXT BOOKS

1. 1. Arshdeep Bahga, and Vijay Madisetti, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCE BOOKS

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
2. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

ONLINE RESOURCES

1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
2. https://nptel.ac.in/courses/108/108/108108098/

COURSE ASSESSMENT

A. **Internal Assessment** (Weightage **30 Marks**)

- Two internal assessments will be conducted with each one of 15 marks weightage
- Remaining 15 marks will be given for Assignments/Quiz/Seminar etc. based on the decision of subject incharge.
- If only Quizes (MCQ type) are preferred then minimum of two are to be conducted.
- If only assignments are considered then Four Assignments are to be given with one each from respective units.
- In case of seminar, student must give 10+5 minutes presentation and ppt file has to be submitted to the subject incharge & Department.

B. **End Sem Examination** (Weightage **45 Marks**)

- Question Paper will have two parts: Part A and Part B.
- Part A will have short answer questions (total of 15 marks).
- In Part A, all questions are compulsory and covers all the units.
- Part B will have long answer questions (total of 30 marks).
- In Part B option will be given, howerver questions will be from each unit.

ANTENNAS AND WAVE PROPAGATION

Semester	**:**	**VI**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UECTCC6003**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits : 03					

PREREQUSITES

Basic exposure to electromagnateic theory, linear algebra and finding solutions of double/triple integrations/differentiations.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Explain the concept of antenna parameters

CO2. Apply concept of broadband to design application oriented antennas

CO3. Compute returnloss bandwidth and radiation patterns of microstrip & CPW antennas

CO4. Examine the performance of antenna through its measurement.

UNIT-I

Basics of Antenna Theory: Introduction, radiation mechanism, Basic parameters of antennas: Input impdance, Reflection coeficient, Return loss, Bandwidth, Radiation patterns, beam width (HPBW & FNBW), Sidelobes, Backlobes, FBR, Directivity, Efficiency, Gain, Polarization, Axial ratio, AR bandwidth; Antenna classification, Friis transmission formula**.** **RBT Levels: L1, L2.** **(12Hours)**

UNIT-II

Broadband Antennas: Horn antenna, Yagi antenna, frequency independent antennas: Helical and Log periodic antennas, Dielectric Resonator Antennas, Parabolic Reflectror (Dish Antenna) Antennas. **RBT Levels: L1, L2, L3.** **(12Hours)**

UNIT-III

Microstrip & CPW Antennas: Radiation mechanism from patch; Excitation techniques; Rectangular patch, Circular patch, and Ring antenna – radiation analysis from transmission line model, cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Application of microstrip array antenna. CPW antennas & applications, Latest trends in MSAs & CPW antennas **RBT Levels: L1, L2, L3, L4.** **(12Hours)**

UNIT-IV

Antennas Measurement Techniques: Antenna measurement techniques: Network analyzer, Anechoic chamber; Returnloss, VSWR, Gain and Pattern measurements. **(12Hours)**

TEXT BOOKS

1. C. Balanis, Antenna Theory:Analysis and Design, John Wiley & Sons, 2005.
2. M. R. Garg, P. Bhartia, I. Bahl, and A. Ittipiboon, Microstrip Antenna Design Handbook, Artech House, Norwood, Mass, USA, 2001.

REFERENCE BOOKS

1. G. Kumar and K. P. Ray, Broadband Microstrip Antennas, Artech House, Norwood, Mass, USA, 2003.
2. J. D. Kraus, R. J. Marhefka and Ahmad S. Khan, Antennas and Wave Propagation, 5th Edition, Tata-McGraw Hill, 2017.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108/105/108105114/

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage.
- **Remaining 10 marks** will be given for two/four assignments.

B. **End Sem Examination** (Weightage **40 Marks**)

- There will be a total of FIVE FULL questions. Student has to answer any four.
- One full question carries 15 Marks. Full question may be divided further into sub questions.

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MACHINE LEARNING AND EXPERT SYSTEMS

Semester	**:**	**VI**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UECTCC6004**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits : 03					

PREREQUSITES

Knowledge of Statistics, Linear Algebra, Calculus, Probability and any Programming language.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the core concepts of Machine learning.
CO2. Acquire basic principles of working of Machine learning algorithms
CO3. Illustrate the working of ML Algorithms.
CO4. Apply effectively ML algorithms for appropriate applications.
CO5. Describe the Expert systems and analyze its development, discuss areas suitable for application of expert system.

UNIT-I

Introduction: What is ML? Types of ML, phases of ML, well posed learning problems, Designing a learning system, Perspective and Issues in Machine learning.

Concept Learning: Concept learning task, Concept learning as search, FIND-S, Version Spaces and the candidate elimination algorithm. **RBT Levels: L1, L2, L3.**

UNIT-II

Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm.

Artificial Neural Network: Introduction, NN representation, Appropriate problems, Perceptrons, Multilayer Networks and the Backpropagation algorithm. **RBT Levels: L1, L2, L3.**

UNIT-III

Bayesian Learning: Introduction, Bayes Theorem, Bayes Theorem and Concept Learning, Maximum Likelihood and Least-Squared Error Hypothesis, Naive Bayes Classifier, Bayesian Belief Networks. **RBT Levels: L1, L2, L3.**

UNIT-IV

Expert Systems: Definition and characteristics of Expert System, ES versus Traditional system, Applications of Expert Systems, Architecture of the Expert Systems, Expert system development life cycle phases, Expert system shell, MYCIN & DENDRAL examples of expert system, Benefits and limitations of ES. **RBT Levels: L1, L2, L3.**

TEXT BOOKS

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, (INDIAN EDITION), 2013.

REFERENCE BOOKS

1. Ethem Alpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
3. AurelienGeron, Hands-on Machine Learning with Scikit-Learn &TensorFlow, O'Reilly, Shroff Publishers and Distributors pvt.Ltd 2019
4. E. Rich , K. Knight & S. B. Nair – Artificial Intelligence, 3/e, McGraw Hill. (Unit-4)
5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India. (Unit-4)

ONLINE RESOURCES

1. https://nptel.ac.in/courses/106/106/106106139/
2. https://nptel.ac.in/courses/106/105/106105152/

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage
- **Remaining 10 marks** will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

MICROELECTRONICS AND VLSI LAB

Semester	**:**	**VI**	**Internal Assessment**	**:**	**20**
Course Code	**:**	**UECPCC6005**	**End Sem. Exam**	**:**	**30**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**03**
Credits : 02					

PREREQUSITES

Basic exposure to analog and digital electronics circuits and applications.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Explain the concept of information and entropy

CO2. Apply Shannon's theorem to compute source codes.

CO3. Compute capacity of various information channels

CO4. Examine the performance of viterbi decoding technique.

LIST OF EXPERIMENTS

1. V-I characteristics of N channel/P-channel MOSFET. **RBT Level: L1 to L6**
2. Study of Common Source (CS) MOSFET amplifier. **RBT Level: L1 to L6**
3. Study of Basic Logic Gates using CMOS. **RBT Level: L1 to L6**
4. Study of design based on FPGA. **RBT Level: L1 to L6**
5. Design of Logic Gates using HDL and simulate the same using Xlink ISE simulator. **RBT Level: L1 to L4**
6. Design of half adder, full adder, half substractor, and full substratcors. **RBT Level: L1 to L4**
7. Write VHDL codes for 8:1 multiplexure and 1:8 Demultiplexure . **RBT Level: L1 to L4**
8. Layout design of PMOS and NMOS circuits. **RBT Level: L1 to L4**

TEXT BOOKS

1. Sundaram Natarajan, Microelectronics – Analysis and Design, Tata McGraw-Hill, 2007.
2. Behzad Razavi Fundamentals of Microelectronics, , John Wiley India Pvt. Ltd, 2008.
3. Douglas A. Pucknell & Kamran Eshraghian, Basic VLSI Design, PHI 3rd Edition.
4. Neil H.E. Weste, David Harris, Ayan Banerjee, CMOS VLSI Design- A Circuits and Systems Perspective-, 3rd Edition, Pearson Education.

REFERENCE BOOKS

1. Adel Sedra and K.C. Smith, Microelectronic Circuits, 6th Edition, Oxford University Press, International Version, 2009.

ONLINE RESOURCES

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage

B. **End Sem Examination** (Weightage **30 Marks**)

- An experiment will be allotted and the same has to be designed and performed by the student. For designing (theory part) 15 marks will be given and remaining 15 will be given for performing the experiment and showing the output.

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INTERNET OF THINGS (IoT) LAB

Semester	**:**	**VI**	**Internal Assessment**	**:**	**20**
Course Code	**:**	**UECPCC6006**	**End Sem. Exam**	**:**	**30**
Teaching Hours/Week (L:T:P)	**:**	**0:0:3**	**Exam Duration (Hours)**	**:**	**2.5**
Credits : 02					

PREREQUSITES

Fundamental concepts of sensors, actuators, Arduino/Raspberry Pi, and Python software.

COURSE OUTCOMES

On the completion of this laboratory course, the students will be able to:

CO1. Understand hardware and software design of Arduino/Raspberry Pi systems
CO2. Programming Arduino/Raspberry Pi using Python.
CO3. Interfacing and testing various interface various IO devices with Arduino platform.
CO4. Interfacing and testing various interface various IO devices with Raspberry Pi platform.

Harware and Software for IoT: RBT Levels: L1, L2, L3, L4.

1. Familiarization with concept of IoT, Arduino/ Raspberry Pi and perform software installation.
2. Study of different operating systems for Arduino/Raspberry-Pi.
3. Understanding the process of OS installation on Arduino/Raspberry-Pi

Working with AVR / Arduino: RBT Levels: L1, L2, L3, L4.

1. To implement an Arduino based simple digital I/O system
2. To implement analog output from the Arduino board in the form of Pulse Width Modulation.
3. Interface a SSD and LCD with Arduino board.
4. Interfacing Sensors with Arduino (Temperature, IR etc sensor)
5. Interfacing Motors with Arduino (Stepper or DC OR Servo)
6. Interface a heat sensor to the Arduino board and display its reading on an LCD.
7. Use the external interrupts of the Arduino board.

Working with Raspberry-Pi: RBT Levels: L1, L2, L3, L4.

1. Study of Connectivity and configuration of Raspberry-Pi board with basic peripherals, LEDS.
2. Understanding GPIO and its use in program.
3. Interfacing Sensors with Raspberry-Pi (Temperature, IR etc sensor)
4. Use the X-Bee module to understand the connectivity of Raspberry-Pi board with camera. Write an application to capture and store the image.
5. Interfacing Motors with Raspberry-Pi (Stepper or DC OR Servo)
6. Write a server application to be deployed on Raspberry-Pi board. Write client applications to get services from the server application.
7. Understsnding the Raspberry Pi with Cloud Interfacing

TEXT BOOKS

1. Arshdeep Bahga, and Vijay Madisetti, “Internet of Things (A Hands-on-Approach)”, 1 st Edition, VPT, 2014.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 st Edition, Apress Publications, 2013.
4. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

ONLINE RESOURCES

1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
2. https://nptel.ac.in/courses/108/108/108108098/

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage

B. **End Sem Examination** (Weightage **30 Marks**)

- An experiment will be allotted and the same has to be designed and performed by the student. For designing (theory part) 15 marks will be given and remaining 15 will be given for performing the experiment and showing the output.

REAL TIME OPERATING SYSTEMS

Semester :	**VI**	**Internal Assessment :**	**20**
Course Code :	**UECDSE6007**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours) :**	**02**
Credits : 02			

PREREQUSITES

Basic C programming and operating system.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Evaluate the requirements of real time systems and real time embedded systems.
CO2. Develop scheduling strategies in generic operating systems.
CO3. Analyze and develop software programs on open source FreeRTOS.
CO4. Develop comprehensive analysis on various open source RTOSs.

UNIT-I

General Purpose Operating System: Introduction, Architecture and Services.
Operating System Services: Inter Process Communication, Scheduling Algorithms.
RBT Levels: L1, L2, L3.

UNIT-III

Real Time Operating System: Introduction, definition and characteristics of RTOSs.
Real Time Scheduling: Rate monotonic and Earliest Deadline First.
RBT Levels: L1, L2 , L3.

UNIT-IV

FreeRTOS: Introduction and features of FreeRTOS. Architecture, Task creation and scheduling in FreeRTOS.
RBT Levels: L1, L2, L3, L4.

UNIT-IV

RTOS case study: Study on ARTe. Comparative study on any popular RTOS: RT Linux, MicroC/OS-II, VxWorks, Embedded Linux, Tiny OS, Android OS, Raspbian OS, FreeRTOS and RTuinOS.
RBT Levels: L1, L2.

TEXT BOOKS

1. Real-Time Embedded Systems, Design Principles and Engineering Practices- Xiaocong Fan, Elsevier, 2015
2. Embedded Microcomputer Systems, Real Time Interfacing– Jonathan W. Valvano– Brookes / Cole, 1999, Thomas Learning.
3. Embedded System Design- Frank Vahid, Tony Givargis, John Wiley.
4. Real Time Concepts for Embedded Systems– Qing Li, Elsevier, 2011

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108/102/108102045/

COURSE ASSESSMENT

A. **Internal Assessment** (Weightage **20 Marks**)

- One internal assessment will be conducted for 10 marks weightage
- Remaining 10 marks will be given for Assignments/Mini Project.

B. **End Sem Examination** (Weightage **30 Marks**)

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part be made zero.

MINI PROJECT

Semester	**:**	**VI**	**Internal Assessment**	**:**	**20**
Course Code	**:**	**UECRCC6008**	**End Sem. Exam**	**:**	**30**
Teaching Hours/Week (L:T:P)	**:**	**0:0:3**	**Exam Duration (Hours)**	**:**	**2.5**
Credits : 02					

PREREQUSITES

Working knowledge of Electronics and Communication areas including Computer Science.

COURSE OUTCOMES

After the completion of mini project, students should be able to:

CO1. Construct working models and explore field indipndently.
CO2. Develop practical exposure and upgrade to the present industrial standards.
CO3. Devise system integration skills
CO4. Demonstrate documentation skills
CO5. Develop Project management skills
CO6. Develop problem solving skills

GUIDELINES

There shall be an UG mini-project under the guidance of one of the department faculties of their specialization. Students will register for this immediately after V semester. The UG mini-project shall be submitted in a report form and presented before the committee in VI semester. The following points need be followed for UG Mini project

1. Student has to select a project either of their own interest or in consultation with faculty members of the department.
2. Students should carry out the mini project independently,
3. If student has his/her own idea for an individual Project, it is the student's responsibility to find a faculty member who both approves of the proposed programme of work and is willing to be the supervisor.
4. It is the responsibility of the student to update the progress of the work to the concerned supervisor regularly.
5. Students must submit the report with atleast 20 pages (printed on double side) at the end of the semester in the following format.

REPORT FORMAT

Following points may be noted regarding the format of a report:

- A4 size, 1.5 inches margin on left side and 1 inch margin on remaining three sides.
- Times New Roman fonts:
  -Title of the Project: 24, Bold
  -Main/Chapter Header (1, 2, etc..): 16, Bold

-Sub title: 14, Bold
-Running Text: 12, Regular
-Lines Spacing: 1.5 Lines
-Paragraph Beginning: 0pt (No Space)
-Paragraph Spacing: 6pt
-Figure Caption (Below Figure, Center Justified)): 10, Regular Times New Roman
-Table Caption (Above Table, Center Justified): 10, Regular Times New Roman
-References must be placed at the end of Report
-References must be cited in square brackets [1][2], [3-5], [6-9, 11, 14] etc.

- Report must be tested against Plagiarism and percentage of duplication must be less than 10% (As suggested by UGC)

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continues assement from internal supervisor.
- Mini project assessment will be carriedout twice in a semester usually after 5th and 10th weeks of the ongoing semester.

B. **End Sem Examination** (Weightage **30 Marks**)

- The evaluation shall be based on the report submitted and a viva-voce exam for 30 marks
- There shall be a committee comprising of the head of the department, project supervisor and department faculty members.

SUMMER INTERNSHIP

Semester :	**VI**	**Internal Assessment** :	**--**
Course Code :	**UECICC6009**	**End Sem. Exam** :	**--**
Teaching Hours/Week (L:T:P) :	**--**	**Exam Duration (Minutes)** :	**--**
Credits : Non Graded Compulsory Course			

PREREQUSITES

Working knowledge of Electronics and Communication areas including Computer Science.

COURSE OUTCOMES

After the completion of mini project, students should be able to:

CO1. Develop working models and explore field indipndently.
CO2. Develop practical exposure and upgrade to the present industrial standards.
CO3. Devise system integration skills
CO4. Develop documentation skills
CO5. Develop Project management skills
CO6. Develop problem solving skills

INSTRUCTIONS FOR SUMMER INTERNSHIP

There shall be Summer Internship of atleast four weeks duration, in collaboration with an Industry/ educational institute of national repute of their specialization. Students will register for this immediately after the completion of VI semester examinations. The UG summer internship shall be submitted in a report form and presented before the committee after the completion of summer internship or before the commencement of VII semester. The following points need be followed for UG summer internship

1. Student has to apply the summer internship in consultation with faculty advisor or coordinator/head of the department.
2. Approval from the department is mandatory for applying the summer internship.
3. Students must maintain all records while undergoing the internship like ideas, results, and analysis.
4. Some photographs need to be included in the report to support your internship work.

COURSE ASSESSMENT

The summer internship course is a non graded course. However, its completion is mandatory for the award of B. Tech. degree. At the end of summer internship course, department will organize a seminar. Students must deliver the seminar related to the work carriedout in the industry/institute of national importance. Internship certificate with a brief report (atleast 10 A4 Size double side printed pages) needs to be submitted to the department after the completion of seminar.

REPORT FORMAT

Following points may be noted regarding the format of a report:

- A4 size, 1.5 inches margin on left side and 1 inch margin on remaining three sides.
- Times New Roman fonts:
  -Title of the Project: 24, Bold
  -Main/Chapter Header (1, 2, etc..): 16, Bold
  -Sub title: 14, Bold
  -Running Text: 12, Regular
  -Lines Spacing: 1.5 Lines
  -Paragraph Beginning: 0pt (No Space)
  -Paragraph Spacing: 6pt
  -Figure Caption (Below Figure, Center Justified)): 10, Regular Times New Roman
  -Table Caption (Above Table, Center Justified): 10, Regular Times New Roman
  -References must be placed at the end of Report
  -References must be cited in square brackets [1][2], [3-5], [6-9, 11, 14] etc.
- Report must be tested against Plagiarism and percentage of duplication must be less than 10% (As suggested by UGC)