RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)
R.V. Vidyaniketan Post, Mysore Road
Bengaluru – 560 059

Scheme and Syllabus of III & IV Semesters
(Autonomous System of 2018 Scheme)

Master of Technology (M.Tech)
in
COMMUNICATION SYSTEMS

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

ABBREVIATIONS

Sl. No.	Abbreviation	Meaning
1.	VTU	Visvesvaraya Technological University
2.	BS	Basic Sciences
3.	CIE	Continuous Internal Evaluation
4.	SEE	Semester End Examination
5.	CE	Professional Core Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	CV	Civil Engineering
9.	ME	Mechanical Engineering
10.	EE	Electrical & Electronics Engineering
11.	EC	Electronics & Communication Engineering
12.	IM	Industrial Engineering & Management
13.	EI	Electronics & Instrumentation Engineering
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	TE	Telecommunication Engineering
17.	IS	Information Science & Engineering
18.	BT	Biotechnology
19.	AS	Aerospace Engineering
20.	PHY	Physics
21.	CHY	Chemistry
22.	MAT	Mathematics
23.	MCS	Communication Systems
24.	MVE	VLSI Design & Embedded Systems

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

M.Tech in COMMUNICATION SYSTEMS

THIRD SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			
				L	**T**	**P**	**Total Credits**
1	18MCS31	Smart Antenna Signal Processing	EC	4	1	0	**5**
2	18MCS3EX	Elective -E	EC	4	0	0	**4**
3	18MCS33	Internship	EC	0	0	5	**5**
4	18MCS34	Dissertation Phase I	EC	0	0	5	**5**
Total number of Credits				**8**	**1**	**10**	**19**
Total Number of Hours / Week				**8**	**2**	**20**	**30**

FOURTH SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			
				L	**T**	**P**	**Total Credits**
1	18MCS41	Dissertation Phase II	EC	0	0	20	20
2	18MCS42	Technical Seminar	EC	0	0	2	2
Total number of Credits				**0**	**0**	**22**	**22**
Total Number of Hours / Week						**22**	**22**

III Semester		
GROUP E: CORE ELECTIVES		
Sl. No.	**Course Code**	**Course Title**
1.	18MCS3E1	Wireless Cellular and LTE 4G Broadband
2.	18MCS3E2	Wire line Broadband Communications
3.	18MCS3E3	Wireless Local Area Networks

Semester: III						
SMART ANTENNA SIGNAL PROCESSING (Theory)						
Course Code	**:**	18MCS31		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	4:1:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	50L+26T		**SEE Duration**	**:**	**03 Hours**

Unit-I — **10 Hrs**

Spectral Analysis of Deterministic Signals

Principles of Estimation Theory -Properties of Estimators, Estimation of Mean ,Estimation of Variance, Spectral Analysis of Deterministic Signals, Effect of Signal Sampling, Windowing, Periodic Extension, Effect of Spectrum Sampling, Estimation of the Autocorrelation of Stationary Random Signals, Estimation of the Power Spectrum of Stationary Random Signals,Power Spectrum Estimation Using the Periodogram, Power Spectrum Estimation by Smoothing a Single Periodogram, The Blackman-Tukey Method of Power Spectrum Estimation by Averaging Multiple Periodograms—The Welch Bartlett Method.

Unit – II — **10 Hrs**

Joint Signal Analysis

Estimation of Cross-Power Spectrum, Estimation of Frequency Response Functions, Multi-taper Power Spectrum Estimation, Estimation of Auto Power Spectrum, Estimation of Cross Power Spectrum. Signal Modelling and Parametric Spectral Estimation - The Modelling Process: Theory and Practice Minimum-Variance Spectrum Estimation

Unit –III — **10 Hrs**

Arrays

Introduction, Two-Element Array, N-Element Linear Array: Uniform Amplitude and Spacing, N-Element Linear Array: Directivity Design Procedure, N-Element Linear Array: Three-Dimensional Characteristics, Rectangular-to-Polar Graphical Solution, N-Element Linear Array: Uniform Spacing, Planar Array.

Narrowband Processing

Signal Model, Steering Vector Representation Eigenvalue Decomposition Conventional Beamformer Source in Look Direction Directional Interference Random Noise Environment Signal-to-Noise Ratio

Unit –IV — **10 Hrs**

Beam Forming

Conventional Spatial Beamforming - Spatial Matched Filter, Tapered Beamforming. Optimum Beamforming – Eigenanalysis of the Optimum Beamformer, Interference Cancelation Performance , Tapered Optimum Beamforming, The Generalized Sidelobe Canceler, Performance Considerations for Optimum Beamformer (In brief Effect of Signal Mismatch, Effect of Bandwidth)

Adaptive Beamforming - Sample Matrix Inversion , Diagonal Loading with the SMI Beamformer, Implementation of the SMI Beamformer, Sample-by- Sample Adaptive Methods – RLS and Steepest Descent methods. Other Adaptive Array Processing Methods - Linearly Constrained Minimum-Variance Beamformer

Unit –V — **10 Hrs**

Direction-of-Arrival Estimation Methods

Spectral Estimation Methods**,** Bartlett Method**,** Minimum Variance Distortionless Response Estimator**,** Linear Prediction Method**,** Maximum Entropy Method**,** Maximum Likelihood Method**,** Eigenstructure Methods**,** MUSIC Algorithm, Minimum Norm Method, ESPRIT Method**,** Weighted Subspace

Course Outcomes: After completing the course, the students will be able to

CO1:	Explain the concept of spatial spectrum of a planar array antenna understand the estimation process for a spatially distributed statistical signal being received by the antenna.

CO2:	Analyze appropriate complex weighting technique for array elements that provide desirable spatial response and beam pattern.
CO3:	Analyze the spatially sampled spectrum by an array and verify the performance of known spatial estimation algorithms like Bartlett, MUSIC and MVDR.
CO4:	Evaluate and develop an array with spatial estimation algorithms that meet a specified spatial performance requirement including resolution and SNR.

Reference Books	
1	Dimitris G. Manolakis, Vinay K. Ingle, Stephen M. Kogon, 'Statistical and Adaptive Signal Processing', Artech House , 2005 ISBN 1-58053-610-7
2	Lal Chand Godara SMART ANTENNAS, CRC PRESS.-2004, ISBN 9780849312069
3	Don H. Johnson Dan E. Dugeon Array Signal Processing: Concepts and Techniques (Prentice-Hall Signal Processing Series)by, Prentice Hall Signal Processing Series. ISBN 0130485136
4	Constantine A. Balanis "Antenna Theory: Analysis and Design, 3rd edn. John Wiley & Sons, 2009,, ISBN 8126524227

Continuous Internal Evaluation (CIE): Total marks: 100

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

Total CIE is 20+50+30=100 Marks.

Semester End Evaluation (SEE): Total marks: 100

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Semester: III						
WIRELESS CELLULAR AND LTE 4G BROADBAND (Theory)						
Course Code	**:**	18MCS3E1		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	4:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	52L		**SEE Duration**	**:**	**03 Hours**

Unit-I	**12 Hrs**
LTE Standardization Phases, Evolution Beyond Release 8, LTE-Advanced for IMT-Advanced, LTE Specifications and 3GPP Structure. **System Architecture Based on 3GPP SAE** Basic System Architecture Configuration with only E-UTRAN Access Network ,System Architecture with E-UTRAN and Legacy 3GPP Access Networks,System Architecture with E-UTRAN and Non-3GPP Access Networks ,Architecture Configuration IMS Architecture PCC and QoS	
Unit – II	**11 Hrs**
OFDMA SC-FDMA and MIMO in LTE,LTE Multiple Access Background, OFDMA Basics SC-FDMA Basics MIMO Basics, Physical Layer- Transport Channels and their Mapping to the Physical Channels, Modulation Uplink User Data Transmission Downlink User Data Transmission, Uplink Physical Layer Signaling Transmission PRACH Structure, Downlink Physical Layer Signaling Transmission Physical Layer Procedures, UE Capability Classes and Supported Features Physical Layer Measurements, Physical Layer Parameter Configuration	
Unit –III	**10 Hrs**
LTE Radio Protocols Protocol Architecture, The Medium Access Control The Radio Link Control Layer, Packet Data Convergence Protocol, Radio Resource Control (RRC) X2 Interface Protocols Understanding the RRC ASN.1 Protocol Definition Early UE Handling in LTE	
Unit –IV	**09 Hrs**
Mobility Mobility Management in Idle State, Intra-LTE Handovers 190, Inter-system Handovers Differences in E-UTRAN and UTRAN Mobility	
Unit –V	**10 Hrs**
Radio Resource Management Overview of RRM Algorithms, Admission Control and QoS Parameters, Downlink Dynamic Scheduling and Link Adaptation, Uplink Dynamic Scheduling and Link Adaptation, Interference Management and Power Settings, Discontinuous Transmission and Reception (DTX/DRX), RRC Connection Maintenance, Performance- Layer 1 Peak Bit Rates, Terminal Categories Link Level Performance, Link Budgets Spectral Efficiency Latency, LTE Reframing to GSM Spectrum, Dimensioning, Capacity Management Examples from HSPA Networks	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the system architecture and the functional standard specified in LTE 4G.
CO2:	Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users.
CO3:	Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios.
CO4:	Test and Evaluate the Performance of resource management and packet data processing and transport algorithms.

Reference Books	
1	Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 'Fundamentals of LTE', Prentice Hall, Communications Engg and Emerging Technologies.

2	'LTE for UMTS Evolution to LTE-Advanced' HarriHolma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.
3	'EVOLVED PACKET SYSTEM (EPS) ; THE LTE AND SAE EVOLUTION OF 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print ISBN:978-0-470-05976-0.
4	'LTE – The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, IssamToufik, and Matthew Baker, 2009 John Wiley & Sons Ltd, ISBN 978-0-470-69716-0.

Continuous Internal Evaluation (CIE): Total marks: 100

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

Total CIE is 20+50+30=100 Marks.

Semester End Evaluation (SEE): Total marks: 100

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Semester: III						
WIRELINE BROADBAND COMMUNICATIONS (Theory)						
Course Code	**:**	18MCS3E2		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	4:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	52L		**SEE Duration**	**:**	**03 Hours**

Unit-I	**10 Hrs**

Plain Old Telephone System (POTS)

The Network Structure, Network Demarcation Points, Customer Premise Wiring, Hybrid circuits, High speed Voice band Modems, ADSL and VDSL: Definition and Reference Model.

Copper Channel

Physical and Electrical Characteristics of Shielded Twisted pair, Models of DSL cables.

Unit – II	**11 Hrs**

Noise and Noise Modelling on Twisted Pair Channel

Cross Talk Models, Impulsive noise, Noise from faults, Engineering measures, Mathematical Modeling of Crosstalk NEXT and FEXT.

Twisted pair channels capacity

Transmission Rate and Channel Capacity in Presence of Additive Gaussian Noise, Theoretical Rate Computations for PAM, QAM, and DMT Systems. Ideal DMT Data Rate Calculations

Overview of DSL

Performance Requirements for ADSL , VDSL, Representative DSL Multicarrier system, ADSL Frame and Multiframe structure.

Unit –III	**11 Hrs**

Fundamentals of Multicarrier Modulation

Basics of MCM, DMT, Initialization, Timing and Performance – Initialization Methods, Adaptation of Receiver and Transmitter – Activation, Channel discovery (Gain Initialization, Clock Synchronization, First channel Identification(equalization, filter training), Channel analysis (Gain Estimation), Bit allocation for Target Noise margin and Target Rate, Secondary channel Identification, Parameter exchange.

Steady State Adaptation of Tx and Rx – Receiver Equalizer Update, Noise monitoring, Channel gain and response Update, FEQ adaptation. Dynamic Measurement of Performance - Bit swapping, Seamless rate adaptation, Power management state machine.

Unit –IV	**10 Hrs**

Error Control in DSL

Basic background of ECC, Reed Solomon Codes in DSL, Decoding of RS codes, Uncorrectable codes, Interleaving Methods (Tong's Method, Forney Interleaver), Erasures, Concatenated Coding, Coding Gain.Principles of Trellis Coded Modulation, Trellis coding and decoding

Unit –V	**10 Hrs**

DSL Channel Equalization

Basic background, Optimization Criteria, Equalizer Structures, Closed form equalizers, Adaptive equalizers, Training, Examples and Practical Design Issues.

DSL Synchronization: Overview, DMT synchronization, Timing Recovery Methods – Open loop Timing Recovery, Pilot based Timing Recovery, Decision directed Timing recovery, Frame Synchronization.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the technology issues and DSL Standards for broadband over wireline.
CO2:	Apply a variety of signal processing algorithms to DSL modem in a wireline channel environment to improve specific performance parameters.
CO3:	Test and validate performance parameters for DSL links for a variety of known channel topologies and channel noise profiles.

CO4:	Demonstrate by simulation or emulation, different functional blocks of DSL Modem to meet performance parameters for specified channel environment.

Reference Books	
1	Philip Golden Hervé Dedieu Krista Jacobsen. Fundamentals of DSL Technology. Auerbach Publications -Taylor & Francis Group. 2006.
2	T. Starr, J.M. Cioffi, and P.J. Silverman. Understanding Digital Subscriber Line Technology. Prentice-Hall, Upper Saddle River, NJ, 1999.
3	Philip Golden Hervé Dedieu Krista Jacobsen, ' Implementation and Application of DSL' Auerbach Publications -Taylor & Francis Group. 2008.
4	D. Rauschmayer. ADSL/VDSL Principles: A Practical and Precise Study of Asymmetric Digital Subscriber Lines and Very High Speed Digital Subscriber Lines. Macmillan Technical Publishing, 1998.
5	J.A.C. Bingham. ADSL, VDSL and Multi-Carrier Modulation. Wiley-Interscience, New York, NY, 2000.

Continuous Internal Evaluation (CIE): Total marks: 100

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

Total CIE is 20+50+30=100 Marks.

Semester End Evaluation (SEE): Total marks: 100

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Semester: III						
WIRELESS LOCAL AREA NETWORKS (Theory)						
Course Code	**:**	18MCS3E3		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	4:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	52L		**SEE Duration**	**:**	**03 Hours**

Unit-I	**10 Hrs**
Introduction – History of IEEE 802.11, IEEE802.11. **Physical Layer** – OFDM, MIMO, SDM basics; 802.11n propagation model, Linear Receiver Design, Maximum Likelihood estimation. Interoperability with 11a/g legacy OFDM devices- 11a packet structure review, Mixed format high throughput packet structure	
Unit – II	**11 Hrs**
802.11n High Throughput - 40 MHz channel, 20 MHz enhancements: Additional data subcarriers, MCS enhancements: Spatial streams and code rate, Greenfield (GF) preamble, Short guard interval. **Robust performance -** Receive diversity, Spatial expansion, Space-time block coding, Low density parity check codes	
Unit –III	**11 Hrs**
Medium access control: Protocol layering, Management functions, Distributed channel access, Data/ACK frame exchange, Hidden node problem, Enhanced distributed channel access, Block acknowledgement. **MAC throughput enhancements -** Reasons for change, Aggregation, Block acknowledgement, HT-immediate block ack..	
Unit –IV	**10 Hrs**
Advanced channel access techniques – PCF, HCCA, Reverse Direction Protocol, PSMP **Interoperability and coexistence** - Station and BSS capabilities, Controlling station behavior, 20 MHz and 20/40 MHz operation, A summary of fields controlling 40 MHz operation, Phased coexistence operation (PCO), Protection. **Transmit Beam Forming** - Eigenvalue analysis, Unequal MCS, Receiver design, Channel sounding, Channel state information feedback, Improved performance with transmit beamforming, Degradations, MAC considerations, Comparison between implicit and explicit, Fast link adaptation.	
Unit –V	**10 Hrs**
WiGiG – IEEE802.11ac and ad key features, 11ac and 11ad Physical Layer (Channels, Phy layer, Phy control, Single carrier Phy, Low Power SC Phy, OFDM Phy (Packet Structure, Modulation and coding) Beam forming and Beam form Training. D-Band measurement requirements for channel estimation and testing.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explain the use of OFDM, MIMO and SDM in WLAN 802.11n, ac & ad media access.
CO2:	Analyze Physical and MAC access layers for performance and throughput for typical Transmitters and Receivers using specified 802.11n channel models.
CO3:	Evaluate the performance and throughput using advanced channel access techniques as specified by 802.11ac and 802.11ad standards.
CO4:	Develop Evaluate schemes to ensure interoperability of 802.11 ac and ad with advanced access techniques with earlier 802.11a/b/g/n WLANs.

Reference Books	
1	Eldad Perahia and Robert Stacey, 'Next Generation Wireless LANs Throughput, robustness, and Reliability in 802.11n', Cambridge University Press 2008, ISBN-13 978-0-521-88584-

	3.
2	Jeff Smith, Jake Woodhams, Robert Marg, 'Controller-Based Wireless LAN Fundamentals', Cisco Press 2011, ISBN-13: 978-1-58705-825-7.
3	Matthew Gast, '802.11® Wireless Networks: The Definitive Guide', O'Reilly Publishers April 2002, ISBN: 0-596-00183-5.
4	Naresh Gupta, 'Inside Bluetooth Low Energy (Mobile Communications)' Artech House; 2nd edition (June 30, 2016) ISBN-13: 978-1630810894
5	Kevin Townsend and Carles Cufí, ' Getting Started with Bluetooth Low Energy: Tools and Techniques for Low-Power Networking', O'Reilly Media; 1 edition (May 22, 2014), ISBN-13: 978-1491949511.

Continuous Internal Evaluation (CIE): Total marks: 100

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

Total CIE is 20+50+30=100 Marks.

Semester End Evaluation (SEE): Total marks: 100

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

INTERNSHIP						
Course Code	**:**	**18MCS33**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P**	**0:0:5**	**SEE Marks**	**:**	**100**
Hours/week	**:**	**10Hrs**		**SEE Duration**	**:**	**3 Hrs**

GUIDELINES FOR INTERNSHIP

Course Learning Objectives (CLO):

The students shall be able to:

(1) Understand the process of applying engineering knowledge to produce product and provide services.

(2) Explain the importance of management and resource utilization

(3) Comprehend the importance of team work, protection of environment and sustainable solutions.

(4) Imbibe values, professional ethics for lifelong learning.

1) The duration of the internship shall be for a period of 8 weeks on full time basis between II semester final exams and beginning of III semester.
2) The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3) Internship must be related to the field of specialization or the M.Tech program in which the student has enrolled.
4) Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5) Students have to make a presentation on their internship activities in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the internship final report. However interim or periodic reports and reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
6) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
7) The broad format of the internship final report shall be as follows
    - Cover Page
    - Certificate from College
    - Certificate from Industry / Organization
    - Acknowledgement
    - Synopsis
    - Table of Contents
    - Chapter 1 - Profile of the Organization – Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
    - Chapter 2 - Activities of the Department -
    - Chapter 3 – Tasks Performed – summaries the tasks performed during 8 week period
    - Chapter 4 – Reflections – Highlight specific technical and soft skills that you acquired during internship
    - References & Annexure

Course Outcomes:

After going through the internship the student will be able to:

CO1: Apply engineering and management principles

CO2: Analyze real-time problems and suggest alternate solutions

CO3: Communicate effectively and work in teams
CO4: Imbibe the practice of professional ethics and need for lifelong learning.

1. Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of the Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

(1) Explanation of the application of engineering knowledge in industries 35%
(2) Ability to comprehend the functioning of the organization/ departments 20%
(3) Importance of resource management, environment and sustainability 25%
(4) Presentation Skills and Report 20%

Dissertation Phase 1						
Course Code	**:**	**18MCS34**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P**	**0:0:5**	**SEE Marks**	**:**	**100**
Hours	**:**	**10**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

The students shall be able to

1. Understand the method of applying engineering knowledge to solve specific problems.
2. Apply engineering and management principles while executing the project
3. Demonstrate good verbal presentation and technical report writing skills.
4. Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Major project will have to be carried out by only one student in his/her area of interest.
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
5. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.
6. It is mandatory for the student to present his/her work in one of the international conferences or publish the research finding in a reputed unpaid journal with impact factor.

Course Outcomes:

After going through this course the students will be able to

CO1: Conceptualize, design and implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports.
CO3: Apply project and resource managements skills, professional ethics, societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life-long learning

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.

Phase	Activity	Weightage
4th week	Topic approval along with Synopsis	20%
8th week	Literature survey with Problem Statement	20%
12th week	Motivation and Objectives	20%
15th week	Preliminary report for the approval of selected topic along with methodology.	40%

CIE Evaluation shall be done with marks distribution as follows:

- Selection of the topic 10%
- Literature review and framing of objectives 25%
- Defining the brief methodology along with the algorithm development/experimental setup 25%
- Presentation 20%
- Report writing 20%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

1. Brief write-up about the project 5%
2. Formulation of Project Objectives & Methodology 20%
3. Presentation 25%
4. Report 20%
5. Viva Voce 30%

Dissertation Phase II						
Course Code	**:**	**18MCS41**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P**	**0:0:20**	**SEE Marks**	**:**	**100**
Hours/Week	**:**	**40**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

The students shall be able to

1. Understand the method of applying engineering knowledge to solve specific problems.
2. Apply engineering and management principles while executing the project
3. Demonstrate good verbal presentation and technical report writing skills.
4. Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Major project will have to be done by only one student in his/her area of interest.
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
5. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.
6. It is mandatory for the student to present his/her work in one of the international conferences or publish the research finding in a reputed unpaid journal with impact factor.

Course Outcomes:

After going through this course the students will be able to

CO1: Conceptualize, design and implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports.
CO3: Apply project and resource managements skills, professional ethics, societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life long learning

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.

Phase II	Activity	Weightage
5th week	Review and refinement of Objectives and methodology.	20%
10th week	Mid-term progress review shall check the compliance with the objectives and methodology presented in Phase I, review the work performed.	40%
15th week	Oral presentation, demonstration and submission of project report. Outcome and publication	40%

CIE Evaluation shall be done with marks distribution as follows:

- Review of formulation of objectives and methodology 10%
- Design and simulation/ algorithm development/experimental setup 25%
- Conducting experiments / implementation / testing / analysis 25%
- Demonstration & Presentation 20%
- Report writing 20%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

1.	Brief write-up about the project	5%
2.	Formulation of Project Objectives & Methodology	20%
3.	Experiments / Analysis Performed; Results & Discussion	25%
4.	Report	20%
5.	Viva Voce	30%

TECHNICAL SEMINAR						
Course Code	**:**	**18MCS42**		**CIE Marks**	**:**	**50**
Credits	**:**	**L:T:P**	**0:0:2**	**SEE Marks**		**50**
Hours/Week	**:**	**4**		**SEE Duration**		**30 min**

Course Learning Objectives (CLO):

The students shall be able to:

(1) Understand the technological developments in their chosen field of interest
(2) Explain the scope of work and challenges in the domain area
(3) Analyze these engineering developments in the context of sustainability and societal concerns.
(4) Improve his/her presentation skills and technical report writing skills

GUIDELINES

1) The presentation will have to be done by individual students.
2) The topic of the seminar must be in one of the thrust areas with in-depth review and analysis on a current topic that is relevant to industry or on-going research.
3) The topic could be an extension or complementary to the project
4) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.
5) Each student must submit both hard and soft copies of the presentation.

Course Outcomes:

After going through this course the student will be able to:
CO1: Identify topics that are relevant to the present context of the world
CO2: Perform survey and review relevant information to the field of study.
CO3: Enhance presentation skills and report writing skills.
CO4: Develop alternative solutions which are sustainable

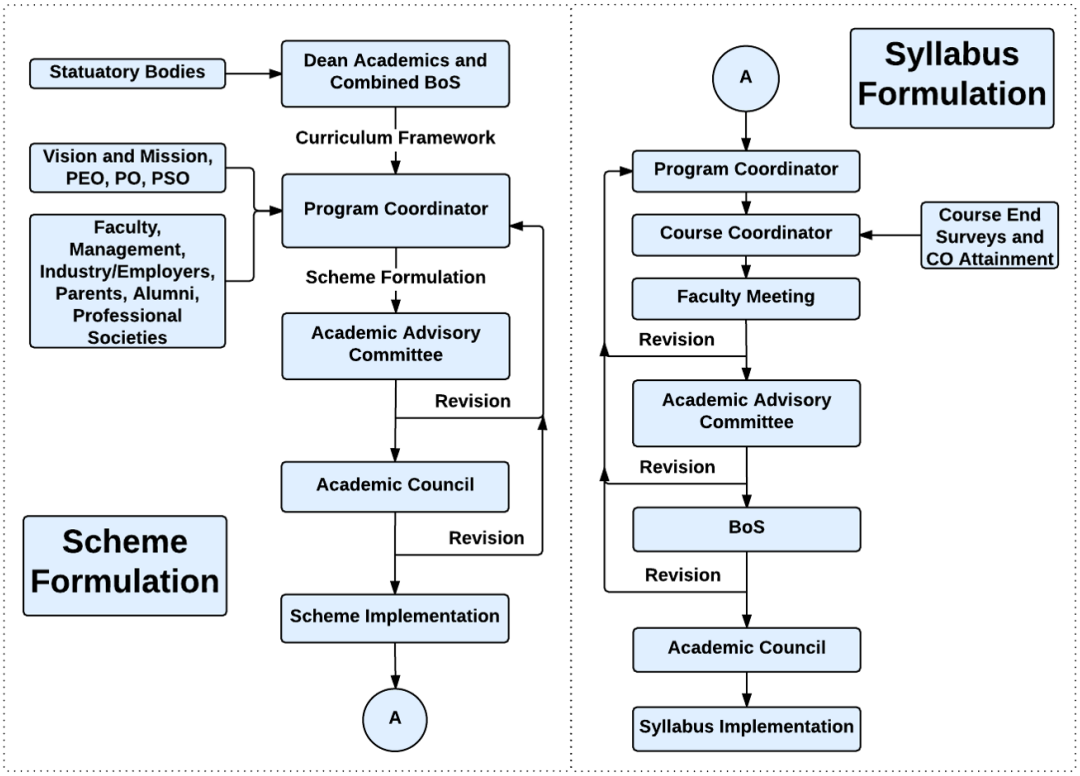
Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

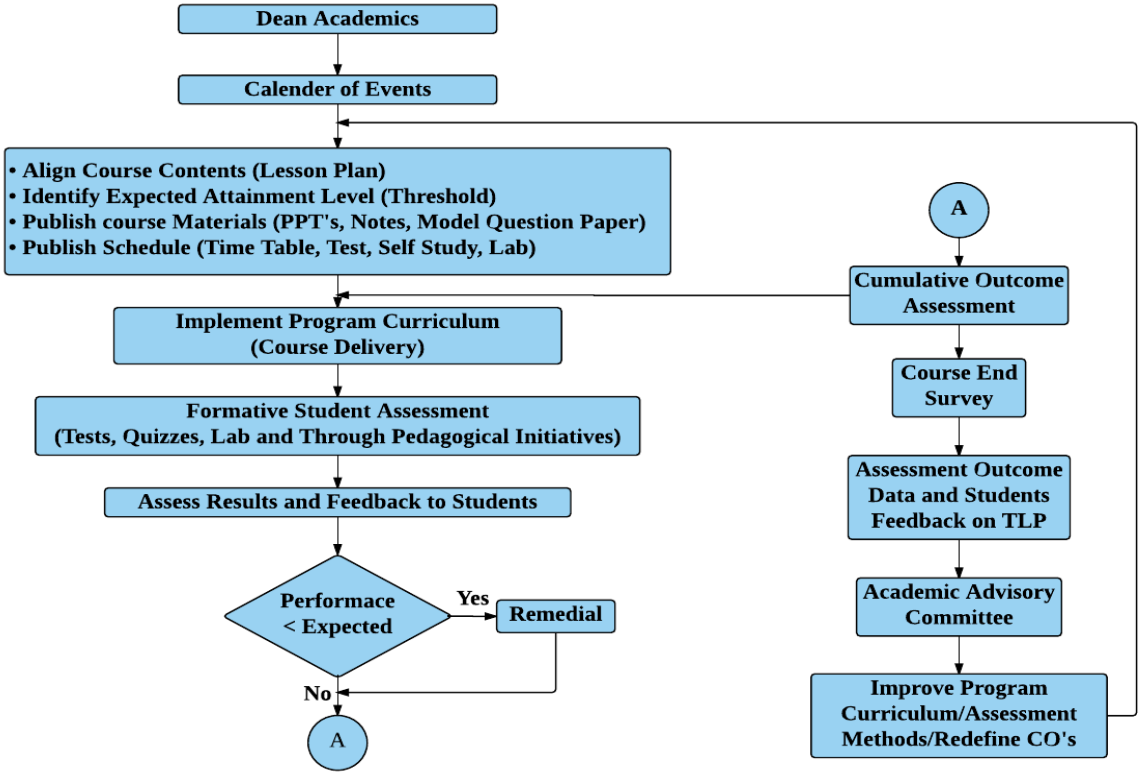
Rubrics for Evaluation:

1) Topic – Technical Relevance, Sustainability and Societal Concerns 15%
2) Review of literature 25%
3) Presentation Skills 35%
4) Report 25%

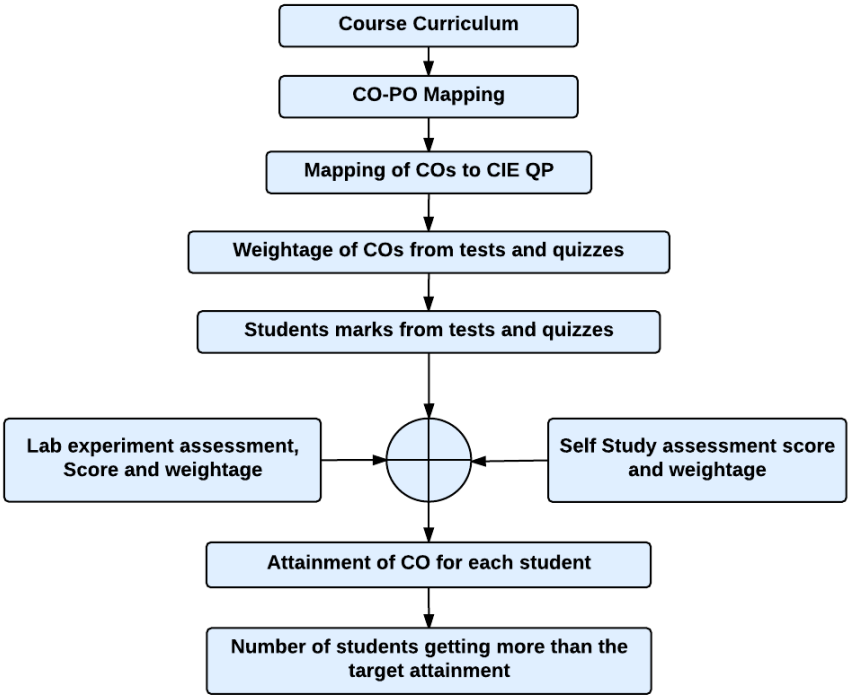
Curriculum Design Process



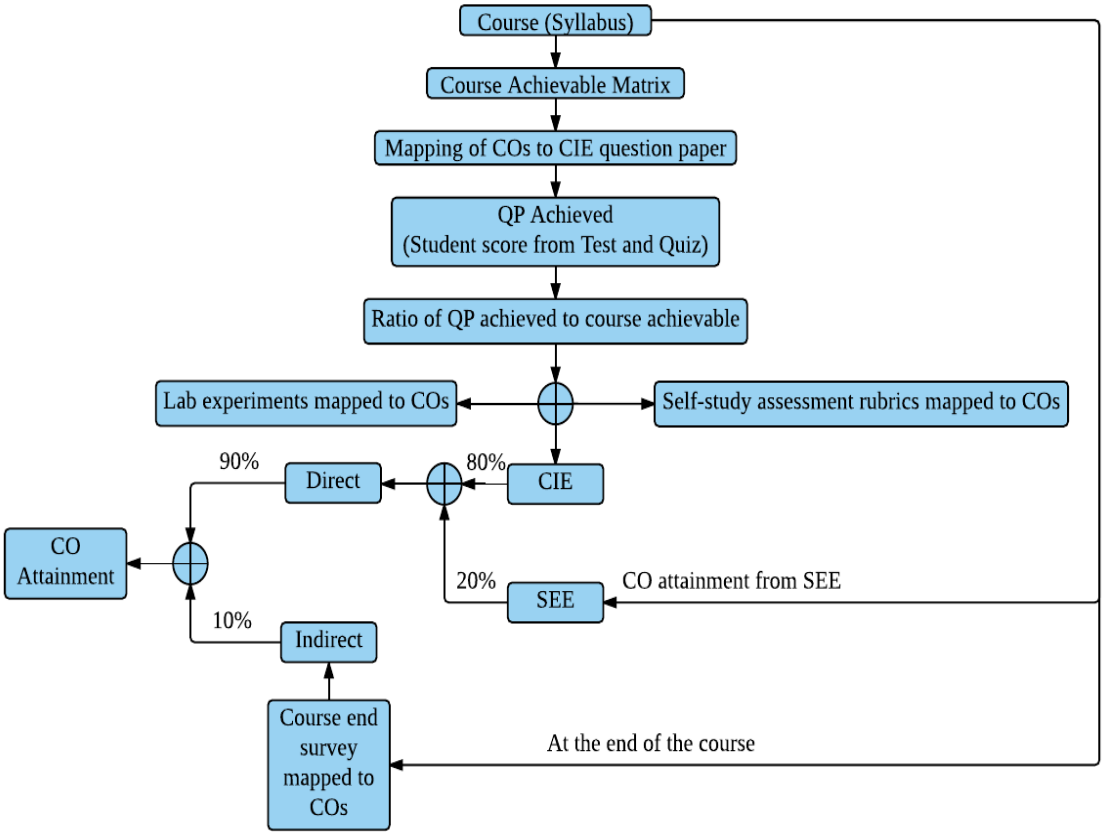
Academic Planning And Implementation



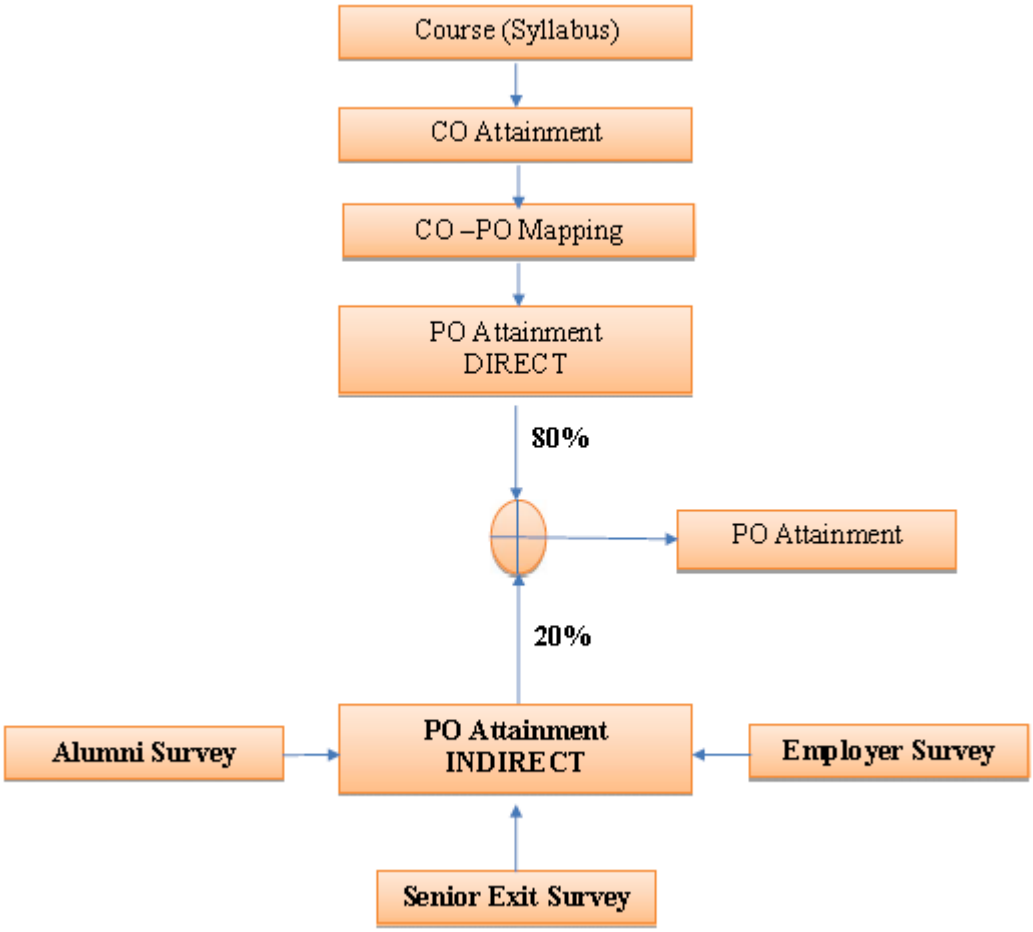
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



PROGRAM OUTCOMES (PO)

M. Tech. Communication Systems graduates will be able to:

PO1: Independently carry out research /investigation and development work to solve practical problems related to Communication Systems.

PO2: Write and present a substantial technical report/document in the field of Communication Systems

PO3: Demonstrate a degree of mastery over the area of Communication Systems. The mastery should be at a level higher than the requirements in the bachelor's in Electronics & Communication Engineering program

PO4: Design and develop communication system modules with good economics and business practices in order to meet the global challenges.

PO5: Abstract the requirements of an application to interface with communication modules.

PO6: Acquire professional and intellectual integrity, ethics of research and execute projects efficiently.